

FORENSIC PATHOLOGY/BIOLOGY

Proceedings 2002-2011



Forensic Pathology/ Biology



Forensic Pathology / Biology



AMERICAN ACADEMY OF FORENSIC SCIENCES
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Preface

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This further acknowledges the excellent work of Pathology/Biology authors worldwide who are willing to share their work for education.

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¹ The Executive Committee of The American Academy of Forensic Sciences has directed Laura Liptai, Ph.D. of the Engineering Sciences Section to prepare this volume for publication.

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<i>Evans, Richard J. MD*, Office of the Chief Medical Examiner, 720 Albany Street, Boston, MA; Ann Marie Mires, PhD, Office of the Chief Medical Examiner, 7416 Falmouth Street, Boston, MA; and Alexander Chirchov, MD, PhD, Faryl Sandler, MD, and William M. Zane, MD, Office of the Chief Medical Examiner, 720 Albany Street, Boston, MA</i>	Bioterrorism Response and Training: Building Upon Mass Disaster and Multiple Fatality Preparedness at the Office of the Chief Medical Examiner, Boston, MA	497
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PATHOLOGY/BIOLOGY

G1 Fatality Involving Complications of Bupivacaine Toxicity and Hypersensitivity Reaction: A Case Report

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After attending this presentation, attendees will understand the complications from use of bupivacaine local anesthesia when administered in the head and neck region, including CNS, cardiac sequelae, and death.

This presentation will impact the forensic science community in understanding the possible adverse effects of local nerve block anesthesia when administered in the head and neck region, the actions, pharmacokinetics, contraindications, and toxicity of bupivacaine are detailed. In addition a hypersensitivity reaction may result from bupivacaine as measured by postmortem tryptase. The importance of a complete forensic autopsy and forensic toxicological analysis to accurately certify the cause and manner of death is emphasized.

This case represents unusual findings of elevated bupivacaine and tryptase concentrations following local anesthetic, bupivacaine, administered as a scalene nerve block for elective rotator cuff repair surgery. The patient exhibited almost immediate seizure activity, bradycardia, and cardiac arrest following bupivacaine injection. Resuscitative efforts including cardiopulmonary bypass restored a cardiac rhythm. However, the clinical medical status of the decedent progressively declined and he died seven hours following administration of the local anesthetic. An autopsy was performed and various biological specimens were collected for toxicological analysis. Autopsy revealed several abnormalities of the heart including cardiomegaly, myocardial bridging, and lipomatous hypertrophy of the intra-atrial septum. The cardiac findings may have contributed to bradycardia and arrhythmia. Autopsy findings associated with hypersensitivity reactions such as urticaria or laryngeal edema were not observed at autopsy. The absence of these findings alone does not rule out a suspected case involving a hypersensitivity reaction.

Postmortem toxicology results revealed an elevated cardiac bupivacaine and tryptase concentration. An elevated concentration of bupivacaine in the blood taken seven hours post-injection is indicative of an intravascular injection. When taking into account that the patient was alive for seven hours post-injection of bupivacaine and the half-life of bupivacaine is about two hours, it was estimated that the subclavian blood concentration of bupivacaine was most likely much higher at the time of seizure activity than at the time of sample collection. However, the postmortem cardiac blood analyzed had a similar bupivacaine concentration at the time of seizure activity due to intraventricular blood stasis resulting from cardiopulmonary bypass for approximately five hours.

Patients receiving local scalene nerve block anesthesia that is in close proximity to the carotid artery may be at greater risk of CNS and cardiac toxicity due to a greater risk of inadvertent intravascular injection or an injection into a highly vascular tissue area. This would result in rapid absorption of the local anesthetic into the systemic circulation causing cardiac and CNS sequelae. Therefore, this type of

injection may increase the risk of adverse effects including seizures, bradycardia, and cardiac arrest as seen in this case.

Postmortem toxicology also included analysis of tryptase. This analysis revealed an elevated cardiac total tryptase concentration and a normal subclavian total tryptase concentration. The discrepancy between the cardiac and subclavian tryptase concentrations may also be due to intraventricular blood stasis resulting from cardiopulmonary bypass; whereas subclavian blood was actively circulating throughout intervention. Furthermore, tryptase peaks within 15 to 120 minutes post exposure to the allergen and follows first-order kinetics with a half life of 1.5 to 2.5 hours; therefore, approximately 3 half-lives had elapsed between symptomatic onset and blood collection. Thus, obtained subclavian serum tryptase concentrations are expected to be much lower than values at symptomatic onset if in fact an anaphylactic reaction occurred. The moderately elevated cardiac tryptase concentration in conjunction with the cardiac arrest and rapid onset of seizure activity post injection of bupivacaine indicates the possibility of an anaphylactic reaction. However, it is possible that the moderate increase in cardiac tryptase is due to lysis of mast cells in the tissue of the chest. At autopsy the chest had massive hemorrhages due to prolonged cardiopulmonary resuscitation.

In summary this unintentional death of a 37-year-old male during elective shoulder surgery was determined to be due to complications of bupivacaine. The moderately elevated cardiac tryptase concentration raises the possibility of anaphylaxis that may have contributed to the cause of death.

Forensic Pathology, Bupivacaine Toxicity, Postmortem Tryptase

G2 Undiagnosed, Untreated Natural Disease Mistaken for Lethal Child Neglect: Liability of the Family in Determining Child's Death

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After attending this presentation, attendees will understand that in cases in which there is a potential component of neglect or abuse, careful scene investigation, review of medical records, complete autopsy with skeletal survey, toxicology, chemical and metabolic testing should be requested.

This presentation will impact the forensic science community by emphasizing the fact that even if lethal neglect is a rare cause of death in industrialized countries, natural disease being mistaken for child abuse is rare too. As a matter of fact there are many potential organic diseases which may mimic neglect or abuse and an appropriate histological examination of all organs should be undertaken to assist in ruling out organic disease.

A case is presented of a 4-month-old infant who was found unresponsive at home and transported at a local hospital, where he expired in the Emergency Department. Physicians noted child's cachectic state; the mother stated he had fever, vomiting, and diarrhea for seven days but she was afraid to seek medical care because was fearful of legal action against her. Further investigations revealed a completely inappropriate and inadequate diet of meat, homogenized milk, and oatmeal from his birth. The infant was never breastfed.

Crime scene investigation showed the extremely poor living conditions of the apartment where the 22-year-old mother lived with her parents and her sons. The family was occasionally followed by social care workers. The infant had never been followed by a pediatrician.

The child weighed 4,000 g and was 62 cm long. His clothing and bedding were urine-soaked and vomit-covered. Whole body radiographic examination showed no fractures. At autopsy, there were clear signs of malnutrition and dehydration, like skin tenting and wrinkled loose skin, sunken fontanelles and ocular globes, depressed cranial sutures, focal alopecia, prominent ribs and bony planes, and dry serosal and mucous membranes. Partial lack of subcutaneous and deep fat deposits with a severe atrophy of skeletal muscles was found. Brownish material was found in gastrointestinal tract. There was a severe atrophy of skeletal muscles, heart, liver, spleen, and kidneys; the small intestinal wall appeared swollen, with reddish discolored mucosa.

Further histological examination showed a T-cell lymphoblastic massive infiltrate of the liver, kidneys, and other organs with multiple foci of bronchopneumonia in lungs, and sporadic evidence of aspiration. Immunocytochemical studies confirmed the diagnosis of acute lymphoblastic leukemia of childhood. Toxicological examination revealed no substances in blood or urine. The cause of death was attributed to an Acute Lymphoblastic Leukemia (ALL) – related cachexia, worsened by malnutrition and dehydration.

The ALL is rare under one year and the youngest infants (ages 0 to 6 months) have the worst outcome. At diagnosis of childhood ALL, anorexia-cachexia syndrome may occur, presenting with anorexia, weight loss, wasting of muscle and adipose tissue, hyperlipidemia, and other metabolic abnormalities.

In the case presented here, an early recognition with appropriate treatment of ALL would probably have given the child a chance of survival. In fact, despite the progressive improvements in outcomes achieved for the children treated on chemotherapy, the outcome is positive in less than 25% of cases.

Cases of suspected child abuse which ultimately are determined to result from natural diseases are extremely rare. Moreover, although it is important to suspect child abuse when the history and examination are consistent with the diagnosis, it is equally important to think of other potential diagnoses, considering legal medico-legal aspects related the liability of the parents in determining child's death.

Lethal Neglect, Acute Lymphoblastic Leukemia, Malnutrition

G3 Sudden Unexpected Cardiac Deaths: An Autopsy Based Study From Mangalore, South India

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After attending this presentation, attendees will be able to identify with the pattern and trend of sudden cardiac deaths in a coastal region of South India.

This presentation will impact the forensic science community by developing an understanding of the burden of sudden cardiac deaths in the coastal region. This presentation defines the problem status of sudden cardiac deaths in the region and emphasizes the importance of forensic pathologists in diagnosing the same at autopsy.

Forensic pathologists deal not only with unnatural deaths, but also with a wide range of natural deaths, especially, if the death occurs suddenly in apparently healthy individuals. Cardiovascular diseases are reportedly the most important cause of sudden natural deaths. Sudden cardiac death is defined as death due to cardiac causes, heralded by abrupt loss of consciousness within one hour of the onset of acute symptoms, in an individual who may have known preexisting heart disease but in whom the time and mode of death are unexpected. This

autopsy based retrospective research was conducted to determine the causes and the epidemiological aspects of sudden cardiac deaths in Mangalore, a coastal township in South India. The study was conducted at the Department of Forensic Medicine, Kasturba Medical College, Mangalore. All the cases recorded in the departmental file as sudden deaths from January 2005 to December 2007 were included in the study and autopsy case files of the same were studied in detail. The data was analyzed using statistical software.

During the study period a total of 1864 autopsies were conducted, of which 207 cases were classified as sudden unexplained deaths. Sudden cardiac deaths constituted of 39.6% of the total sudden deaths during the study period (n=82). Males were predominantly affected (91.5%). Age of victims varied from 19 to 80 years, mean age of the victims being 49.96 years. Majority of deaths were reported in the 5th and 6th decade of life. Mean BMI was 20.8 kg/m². The monthly distribution revealed that most of the sudden cardiac deaths were reported in May followed by February. Weight of heart varied from 210 to 560 grams (Mean=335.4 grams). Coronary artery diseases remained the most common cause of sudden cardiac deaths followed by cardiac hypertrophy, cardiomyopathy, myocarditis, and valvular diseases. More than 50% occlusion of the coronary arteries was evident in approximately half of the cases. Left anterior descending artery was the most commonly affected. Atherosclerotic changes were observed in the great vessels in most of the cases.

Cardiac causes are responsible for most of the sudden deaths in this region and coronary artery diseases are responsible for most of the cardiac deaths. Atherosclerotic changes were observed in the great vessels in most of the cases in our study. Atherosclerosis is responsible for significant cardiovascular morbidity and mortality worldwide. Medicolegal autopsies are an important source of epidemiological data that should effectively be used in planning the preventive strategies. Modifying the stressful life style and screening those at high risk are the measures to be emphasized to prevent such deaths.

Sudden Death, Cardiac Death, Coronary Artery Disease

G4 Periventricular Leukomalacia in a 2-Month-Old Infant Who Was Born With Cocaine Addiction: A Case Report

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After attending this presentation, attendees will be aware of the neuropathologic sequela in a 2-month-old infant born with addiction to cocaine. The prenatal history and the scenario surrounding the infant's death will be presented. Common outcomes of the effects of cocaine on the fetus and newborn are reviewed.

This presentation will impact the forensic science community by demonstrating that cystic periventricular leukomalacia is one of the irreversible neurological complications that directly or indirectly may occur in cocaine-exposed fetuses and the dilemma in considering the cause and manner of death of the similar cases will be discussed.

Case presentation: The decedent was a 2-month-old African American female who was born precipitously in an ambulance at 30 weeks gestational age to a 29-year-old mother who had a history of cocaine and marijuana abuse and used crack cocaine the day she gave birth. She had no prenatal care for this pregnancy. She had given birth to three live children, including the decedent, and all three were born addicted to cocaine. She also gave birth to one stillborn (female). This decedent's birth weight was 1,034 grams and length was 19 inches. She was diagnosed with cocaine addiction and respiratory failure, was on

mechanical ventilation for the first two days of her life, and stayed in hospital for 20 days before being discharged home. The discharge diagnosis includes bilateral periventricular leukomalacia. The infant was adopted by her biological mother's sister. The decedent's condition was stable and she was fed with formula. At 20:04 on the day of the incidence, when lying supine on the couch in the living room with her adoptive mother, the decedent suddenly exhaled and stopped breathing. The adoptive mother started to gently rub the decedent's chest and the decedent still did not get breath. 911 was called and the decedent was transported to a hospital by ambulance with an admission diagnosis of cardiac arrest. CT scans/X-rays revealed a large right pneumothorax and pneumoperitoneum. An emergency chest tube placement and exploratory laparotomy were performed in the operating room. The decedent was taken to the intensive care unit and her condition deteriorated. Pronouncement was made at 13:40 the next day after the incident.

Autopsy findings included a poorly developed 2-month-old black female with less than 5th percentile of body weight and length. No traumatic injuries were identified. The lungs exhibited atelectasis. The brain exhibited bilateral cystic periventricular leukomalacia and severe hypoxic/ischemic encephalopathy. Accessory tests were non-contributory.

Discussion: Effects of cocaine on the developing central nerve system of a fetus may cause different pathologic changes, such as germinal matrix hemorrhage or cystic changes, intraventricular hemorrhage, and periventricular leukomalacia. However, those changes are difficult to interpret as the sole consequence of the effects of cocaine because risk factors in cocaine abusing pregnant women tend to cluster together and interact, such as multiple drug use, poor maternal nutrition, lack of prenatal care, infectious disease, placental insufficiency, impaired fetal oxygenation, fetal intrauterine growth retardation, and premature birth. All the above CNS pathological changes can also be present in the premature newborn without intrauterine cocaine exposure. In addition, the premature infants with or without intrauterine cocaine-exposed tends similarly to be poorly grown, easily susceptible to infection and vulnerable for sudden infant death. *Cause of Death:* Although a definitive cause and effect relationship between these conditions and cocaine use is difficult to reach, the fact of intrauterine exposure of cocaine could not be ignored in this case. The cause of death was the complication of premature born with addiction to cocaine associated with cerebral cystic periventricular leukomalacia and severe hypoxic/ischemic encephalopathy. *Manner of Death:* Detailed history of the mother's cocaine abuse and the circumstances surrounding the decedent's addiction to cocaine at the time of birth were unclear, even though thorough investigation was performed and the death occurred two months after birth. In addition, constitutional issues may preclude criminal prosecution in many of these kinds of cases. The manner of death was classified as "Undetermined."

Cocaine, Fetus, Periventricular Leukomalacia

G5 A Man Without a Head: Postmortem Decapitation by German Shepherd Dogs

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After attending this presentation, attendees will understand that in cases of postmortem animal depredation of human corpses or remains, physicians and crime scene investigators not experienced in the field of forensic medicine are often unable to attribute the questioned injuries to their true origin.

This presentation will impact the forensic science community by emphasizing that postmortem injury by domestic animals is only rarely documented in the literature therefore lacking knowledge regarding morphologic features and the criteria for the differentiation of such postmortem soft tissue destruction may cause considerable complications in clarifying the cause of death. This is particularly true when postmortem animal depredation is caused by a domestic dog's activity.

A case of a 55-year-old man will be presented who was found putrefied in the bedroom of his apartment; head and neck of the body were missing. The rest of the body, in particular the hands, was intact. Also his well-feed two German shepherd dogs (8 and 1½ years old) were in the flat. The flat was locked with the windows closed. He had been seen for the last time one week before the incident. The public health service had been called one year earlier because the man and his two dogs had not left the dwelling for eight weeks. Policemen were called to the scene as the dogs had been barking for four days. In the hallway and the living room they remarked several remnants of small supposed human bone parts and crowned teeth in puddles of feces and vomitus. The flat was in messy condition with garbage, emptied alcohol bottles, and moldy food in every room. Lots of accessible dog food was also found. The dogs are brought to pet asylum, and an autopsy of the incomplete body is ordered. Autopsy showed a fatal gastrointestinal bleeding by rupture of esophageal varicose veins (while head and neck were still missing). Furthermore, signs of chronic alcoholism could be determined. Toxicological examinations led to no specific findings. At postmortem, animal depredation signs, canine-like bite traces and tissue defects were found surrounding the collar region. The right pleural cavity was opened by animal depredation; parts of the right pulmonary lobe were missing as well as the cervical vertebral bodies 1-6. The clavicles, the scapulae and 7th cervical vertebral body showed extensive gnawing traces. After autopsy, the apartment was searched again for head and neck of the man by forensic scientists and police; still the missing parts could not be found. From forensic point of view, it must be presumed that the dogs ate head and neck of the corpse completely.

Postmortem Injuries, German Shepherd Dogs, Animal Depredation

G6 Responses of Mast Cells in the Dura to Traumatic Brain Injury in an Animal Model

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After this presentation, attendees will understand the responses of mast cells in the *dura* to traumatic brain injury (TBI), the histamine-mediated brain damage after TBI, and the significance of histological examinations of the *dura* in cases of head trauma.

This presentation will impact the forensic science community by providing evidence for changes in the dural mast cells after TBI and the role of dural mast cells in the development of brain injuries. This presentation will also emphasize the need for histological examinations of the *dura* in autopsies of head trauma cases.

Mast cells secrete stored histamine in response to extrinsic stimuli. Histamine plays a role in the formation of brain edema and induces histamine receptor expression in the brain. Histamine receptors exert a protective effect against histamine neurotoxicity. Because the *dura* contains mast cells, it is hypothesized that blunt force to the head activates dural mast cells, leading to the release of their histamine and exacerbation of brain injury. Therefore, the time-dependent changes in dural mast cells and histamine receptor expression in the brain after TBI in a rat controlled cortical impact model was investigated.

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Male adult rats (7-10-weeks-old) weighing 200–310 g were used in this study. Under general anesthesia, a craniotomy of 6.0 mm in diameter was performed over the left parietal bone taking care not to penetrate the dura. A blunt force impact was applied to the craniotomy site using a pneumatic impact device and generated a cortical contusion on the left cerebral hemisphere. In sham-operated rats, the same surgical procedures were performed, but no impact was applied. Rats were perfused transcardially with phosphate-buffered saline under general anesthesia at 1, 4, 7, or 14 days after the surgery. Toluidine blue staining for mast cells and immunohistochemistry for histamine receptor H3 were performed on paraffin sections of the dura and cerebrum. Real-time PCR analysis of histamine receptor H3 mRNA expression was performed on total RNA extracts from the cerebrum.

The number of toluidine blue-stained dural mast cells at the site of impact was significantly decreased at one and four days after the trauma. The immunoreactivity and mRNA expression of histamine receptor H3 at the cortical contusion of the cerebrum were significantly increased at one and four days after the trauma. A previous report showed that activated mast cells release histamine-containing vesicles and appear unstained with toluidine blue. Therefore, the present results indicate that blunt force to the head causes dural mast cell degranulation and induces histamine receptor H3 expression in the cerebrum. The findings further indicate that a decreased number of toluidine blue-stained mast cells in the dura provide evidence of head trauma, suggesting that histological examinations of the dura may help to diagnose blunt force impacts to the head.

Forensic Neuropathology, Head Injury, Dura

G7 Plastic Bag Asphyxia: Suicide and Literature

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The goal of this presentation is to show: (1) the importance of a careful autopsy in cases of asphyxia; (2) the importance of the death scene traces; and, (3) the influence of the literature in some cases of suicide.

This presentation will impact the forensic science community by showing how the literature and media could influence and help someone to commit a suicide.

Asphyxial deaths using plastic bags are not common. Most frequently classified as suicide or accident (usually involving children, volatile inhalants, and autoerotic situations), they also can have a homicide origin. The death may be caused by mechanisms such obstruction of the external air passages, usually called smothering, and/or oxygen deprivation, included in the general group of mechanical asphyxia by suffocation.

The cases of suicide using plastic bags have increased with the publication, in March 1991, of the book *Final Exit: The Practicalities of Self-Deliverance and Assisted Suicide for the Dying* written by Derek Humphry. The book describes this method of suicide, in combination with drugs, as a painless way for those suffering from a terminal illness to end their lives. In New York City asphyxia deaths using plastic bags increased by more than 300% immediately following the publication of the book. However, these deaths have only been responsible for less than 5% of all suicides in the year after the book was released. In many other countries, like Portugal, this method of suicide is however rarely used.

The death scene investigation may be crucial to determine a suicidal aetiology. As a matter of fact, if the plastic bag has been removed, and as in such cases the external evidence of injury could be minimal, the death may be initially understood as a natural death.

A case of suicide using plastic bag is presented, in which the victim, a retired translator, left nearby the book *Final Exit* open to the chapter

Suicide Using Plastic Bag. Some pills were also found, as well as letters expressing his suicide intentions and last will.

The need, in such situations, of a high index of suspicion for the diagnosis of this entity is emphasized. When numerous petechiae are present, particularly in the conjunctivae, an attempt to identify their origin should be made to exclude other manner of the death, such strangulation. So, a full and careful autopsy, including toxicological analysis, combined with the investigation of the evidence at the death scene is mandatory in these cases.

Plastic Bag, Asphyxia, Suicide

G8 The Bone Collector: When Reality Overcomes Fantasy

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After attending this presentation, attendees will understand the importance of the application of a multidisciplinary approach in challenging cases of identification of human remains.

This presentation will impact the forensic science community by demonstrating that a case that may apparently seem simple may instead reveal great methodological and interpretative challenges, making it imperative to use a multidisciplinary approach with methods that require specific professional expertise in various specialties (e.g., pathology, genetics, anthropology, physics, chemistry).

All who work in the forensic field know that the more crucial the biological samples to be analyzed are (charred remains in an advanced state of decomposition, fragments of tissues, bones, etc.), the more complex personal identification is. In these challenging cases it is extremely important to apply a multidisciplinary approach for identification.

A case that came under their observation in July 2007 in Rome will be presented. A skeleton was discovered by firefighters after extinguishing a fire in a grassy field. The skeleton was almost complete and its right side was charred because of the flames. Beside the skeleton, a bag containing a bunch of keys and an identity card was found, fortunately not destroyed by the fire. These items belonged to an elderly man who disappeared in that area four years before.

Genetic tests were performed on a left femoral bone sample in order to confirm the presumed identity of the skeleton and instead provided a genetic profile that was not compatible with the sons of the missing man. Thus, other samples were taken from different bones and examined resulting in five different genetic profiles, corresponding to three women and two men, and none of them was compatible with the sons of the missing man.

Therefore the prosecutor asked for an anthropological expertise, who confirmed morphologically that the skeleton was composed by bones belonging to different individuals and could also give a range for the approximate age of these individuals at the time of death.

Thus, the prosecutor asked for the time-of-death estimation of these individuals and, at this request, specific investigations on the bone remains were carried out based on the measure of the isotopic ratio of ¹⁴C in lipids and collagen by Accelerator Mass Spectrometry (AMS), which can provide a dating for the remains in exam.

So far, five DNA profiles have been identified but not all the bones available have been genetically examined yet, so it is possible that the genetic profiles, and therefore the number of individuals involved in the case, may be more.

Identification, Multidisciplinary, Approach

G9 Cancer Patient mtDNA Forensic Identification: A Case Report

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After attending this presentation, attendees will understand how to manage a forensic identification case in a cancer patient, when only neoplastic tissue is available for the genetic analyses.

This presentation will impact the forensic science community by demonstrating that, because of the frequency of mutations in mtDNA is higher than in nuclear DNA in a variety of human cancers (as suggested from several studies), the mtDNA profiling should not be applied as the unique analysis in cases of forensic identification of cancer patients when only neoplastic tissue is available. Moreover, direct automated sequencing lacks adequate resolution to detect mtDNA heteroplasmy when, as in cancer cells, the somatic mutation tend to homoplasmcy.

Mitochondrial genome mutations are described in many kinds of human malignancies, including lung cancer. These mutations can be base substitutions, insertion, or deletions, and the 1.1 kb d-loop region has been recently identified as a mutational "hot spot" in the mitochondrial DNA (mtDNA) of neoplastic tissue. Cancer cells harbor homoplasmic rather than heteroplasmic mutations; therefore, somatic mutant mtDNA appears as a single copy among a majority of wild-type mtDNA molecules and becomes dominant in the cancer cell probably due to the growth/survival advantages that such mutation confers to the cell.

A case of forensic identification will be presented in which a widow claimed medical malpractice by the physicians that had taken care of her husband, who was affected by a malignant lung disease. The wife thought that he had been wrongly diagnosed with cancer and, therefore, he had undergone massive and inappropriate therapies that finally led him to death.

In this case, the prosecutor ordered the seizure of the neoplastic histological samples attributed to the deceased and the comparison of the genetic profile obtained from these samples with those of the relatives, in order to establish the presence or absence of genetic compatibility among the neoplastic tissue and the relatives of the deceased.

To this end, autosomal markers were analyzed and compared with those of the two daughters of the deceased, while Y-chromosome markers and mtDNA were analyzed and compared with those of his brother.

While both autosomal and Y-chromosome markers confirmed the correspondence of the histological samples to the deceased, in the case of mtDNA a difference at nucleotide 16093 of HVRI region has been highlighted: in fact the brother had a C while the lung tissue examined showed a transition from C to T. In order to ascertain the full genetic compatibility it was therefore necessary to study the nature of this nucleotide difference by cloning of PCR products.

Sequencing of PCR cloning products thus allowed highlighting a heteroplasmic site (tending to homoplasmcy) at nt.16093 in tumor cells with respectively 75% of mutated mtDNA and only 25% of germ-line mtDNA compatible with the brother reference sequence.

mtDNA Profiling, Heteroplasmy, Neoplastic Tissue

G10 Method of Concealment of Corpses in Mafia Related Homicides: Melting in Strong Acids

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After attending this presentation, attendees will learn about some awful methods of concealing corpses used by Mafia criminal organizations.

This presentation will impact the forensic science community by showing experimental data to help attendees better understand how strong acids and bases could melt a body; in particular, it will be shown using sulfuric acid activated with water, both soft tissues and bones could colligate in few days, in contrast with pure sulfuric acid.

The criminal organization called "Cosa Nostra" has implemented brutal approach to commit murders over the past years, with dramatic symbolic implications, in order to prolong the agony of the victims, extract useful information, and no only to cause death as quickly and bloody as possible, but also to facilitate the concealment and the disappearance of the corpse itself. In the mafia, ritual murder must be view beyond the event itself, even the meaning of such gestures, take value as a warning to strike terror. Regarding the concealment of the corpses, nothing was known until the "pentiti" (those Mafiosi who turned informant) began to tell the dramatic episodes of which they witnessed or participated in from time to time, shedding light on a particular aspect of the phenomenology in Mafia's homicides known as "lupara bianca" (literally "white shotgun"): the disappearance of a subject who was known to be dead, but without knowledge of where his corpse was.

To hide the bodies of the victims tortured and killed, criminals used various methods, like burial in land, immersion in seawater with weights tied to the victims to get them to the bottom, disposal of corpses in natural caves or wells, or burning of bodies in ovens or cars. But the most chilling and ingenious method was destruction by "melting" by using strong acids or bases. In particular, some pentiti spoke about a "death's chamber," property of the criminal clan of Brancaccio and his boss, Filippo Marchese, called "u milinciana" (the eggplant, because of his skin's color), where the police found some tanks full of acid, torture instruments, and human remains.

This report's goal, therefore, is to verify experimentally the use of strong acids (sulfuric acid) for the dissolution of biological tissues animals, and also observing the macroscopic changes that the soft tissues and bones undergo over the time, in order to verify the claims of the Mafia's "pentiti" in their statements. In particular, two different tests were conducted: in the first, dipping a pork knuckle weighing 160 grams in a glass bowl containing pure sulfuric acid of known concentration, highly caustic, water-soluble, and able to carbonize organic matter. In this case, after only 30 minutes, the piece of pork appeared to be "cooked," with brownish color, in two days the muscle structures were loose, while after only six days, the bone began to be eroded, although it remained essentially integrated. The second test was made by dipping the knuckle of pork into a bath of 700 cc of sulfuric acid activated with water. In this case, the muscle-cartilaginous component disappeared after only 12 hours and after two days the bone appeared dissolved in the liquid component.

These experimental test made have thus demonstrated that it appears unlikely that an entire body can be dissolved in few minutes (as reported by some "pentiti") using the normal commercially available sulfuric acid, but in any case it's likely that, in several days, a corpse could be colligated and made unrecognizable.

Mafia's Homicide, Concealment, Melting

G11 When Ribs Penetrate the Heart in Blunt Chest Wall Trauma

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After attending this presentation, attendees will be able to identify with the possible mechanism of penetrating trauma caused directly to the heart by the fractured ends of the ribs in run over traffic mishaps.

This presentation will impact the forensic science community by illustrating a type of injury that is well known but rare. The injury is reported for the first time in a run over traffic accident. Cardiac lacerations caused directly as a result of rib fractures although a rare phenomenon in blunt force trauma to the chest, its possibility should be explored so that prompt and early treatment saves the patient from a fatal outcome.

Cardiac damage in non-penetrating chest trauma is uncommon. Direct penetrating injuries to the heart are commonly observed in stab and gunshot wounds. The fractured ends of the ribs are very rarely reported to cause penetrating injuries to the heart. One such rare case where the sharp ends of fractured ribs has caused extensive damage to the heart in a run over vehicular accident is reported. The reported rare case illustrates the possible mechanism of direct cardiac injuries from broken sharp jagged fractured ends of ribs in blunt force trauma to the chest in run over traffic mishaps.

A 45-year-old male fell from a moving bus while trying to get off. By the time brakes were applied, the moving bus had run over the left side of his chest, neck, and head. The victim died instantly and the body was subjected to medicolegal autopsy. On external examination, the head and face of the victim was deformed. Underlying comminuted skull fractures were palpable. No external injuries were evident on the chest region. Avulsed lacerations were present on the lower limbs. Internal examination revealed multiple fractures of the cranial vault and base of the skull with diffuse subdural and subarachnoid hemorrhage, intraventricular bleeding, and extensive brain damage. Fractures of the 2nd to 6th ribs in anterior axillary line on the left side, and fracture of 1st and 2nd ribs in mid-clavicular line on the right side with corresponding chest wall muscle contusions were present. Pleura contained 300 and 400 ml of frank blood in the right and left sides respectively. Pericardium was torn and extensive damage to the left ventricle was evident. The heart weighed 280 grams. Transmural lacerations of the left ventricle were present, corresponding to the pointed fractured ends of the ribs on the left side. Peritoneal cavity contained 200 ml of blood. Multiple lacerations over the right liver lobe were present. All visceral organs were pale on cut section. Lungs escaped any major trauma in the reported case.

The rib cage acts as a protection for the thoracic organs and support for the vertebral column. Penetrating injuries to the heart in blunt chest trauma thus remain uncommon. Even when the ribs are fractured recoil of the intercostal muscles keeps the architecture of the rib cage intact preventing subsequent injuries to the thoracic organs. Fractured ribs at times may act as a weapon of offense causing damage to the underlying organs directly. In the present case of a run-over traffic mishap, no external injuries or deformity were apparent on the chest wall. On internal examination, intercostal muscle contusions were present but apparently the rib cage had retained its shape due to recoil of the intercostal muscles. It was only on further dissection that the major insult to the pericardium and the heart was observed. It is illustrated how the sharp jagged ends of the fractured ribs move medially on external pressure to cause penetrating injuries to the heart. It is proposed that as a consequence of the transient phenomenon of deformation of chest cavity under pressure in run over traffic mishaps, the projecting fractured ends of the ribs penetrate the underlying thoracic organs causing fatal injuries.

Ribs, Heart, Run Over Traffic Mishap

* Presenting Author

G12 Examination of Sexually Abused Children: Presentation of the First Danish Center for the Investigation and Care of Abused Children

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After attending this presentation, attendees will understand how the first Danish Child Protection Center was organized, and the importance of the participation of the forensic department and the forensic pathologist.

This presentation will impact the forensic science community by showing the importance of the involvement of the forensic pathologist in the investigation of child sexual abuse.

The prevalence of sexual abuse of children in the Nordic countries is unknown, but has been estimated to be around 5%. Very few cases of sexual abuse are reported to the police. The police may request a medical examination to document or verify the child's testimony.

Until now, the child and the child's family have had to go to the police station to give a videotaped interview to the police, go to a medical or a forensic doctor with examination rooms located elsewhere, followed by pediatric evaluation and treatment and psychosocial follow-up at yet another place.

In November 2007, the first Danish centre for the protection of abused children was established at Aarhus University Hospital, Skejby.

The Center, which receives all kinds of child abuse cases, is located in a building neighboring the Department of Forensic Medicine, Aarhus, and headed by a steering group with representatives from the Pediatric Department, the police, and the Department of Forensic Medicine; the Center is managed by a pediatric consultant.

Videotaped interviews by the police are performed at the centre as well as the forensic medical examination, pediatric and psychosocial evaluation and follow-up.

Experience and perspectives from the first Danish child protection centre for the forensic community will be presented.

Sexual Abuse, Child Protection Center, Forensic Pathology

G13 An Innovative Proteomic Approach for the Identification of Novel Plasma Biomarkers in Patients With Brugada Syndrome

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After attending this presentation, attendees will understand how plasma potentially carries important information whose knowledge

could help to improve early disease detection and prognosis in Brugada syndrome.

This presentation will impact the forensic science community by providing potential new tools for the correct diagnosis of “at risk” individuals with Brugada syndrome carrying specific gene mutations. The molecular signature obtained by the study of plasma proteome will complement genomic information therefore increasing the chance of disease detection in these individuals who are exposed to a dramatic risk of sudden cardiac death.

Brugada syndrome (BS) is a polygenic inherited cardiac disease characterized by life threatening arrhythmias and high incidence of sudden death. In the family enrolled in the present study, the disorder is caused by Q1118X-mutation in the SCN5A gene, encoding the cardiac sodium channel. 2D-PAGE was used to investigate specific changes in the plasma proteome of BS affected patients and family members sharing the same gene mutation, compared to healthy controls, with the goal to identify potentially specific disease biomarkers.

In order to reduce plasma sample complexity, the combinatorial hexapeptide ligand libraries were used.¹ The use of the beads prior 2D-PAGE enabled detection of many new protein spots and increased resolution and intensity of low abundance proteins.

Approximately 900 protein spots were detected in each gel. Proteins, whose expression was significantly different among the two groups, were excised, trypsin-digested and analyzed by LC-MS/MS.

Data showed that the levels of several proteins were significantly altered in BS patients compared with controls. In particular, Apolipoprotein E, Prothrombin, Vitronectin, Complement-factor H, Vitamin-D-binding protein, Voltage-dependent anion-selective channel protein 3, and Clusterin were considerably increased in plasma sample of BS patients, whereas Alpha-1-antitrypsin, Fibrinogen, and Angiotensinogen were considerably decreased; moreover, post-translational modification of Antithrombin-III was detected in all affected individuals.

In the light of these results, it is hypothesized that these proteins might be considered as potential markers for the identification of disease status in BS. Further analysis is being conducted in our laboratory in order to validate these findings in a larger number of cases and to elucidate the pathogenetic role of these proteins in this specific cardiac disease.

Reference:

1. Boschetti E, Righetti PG. The ProteoMiner in the proteomic arena: anion-depleting tool for discovering low-abundance species. *J Proteomics*. 2008 Aug 21;71(3):255-64. Epub 2008 Jun 20. Review

Brugada Syndrome, Plasma Biomarkers, Proteomics

G14 A Case of Lethal Peripartum Eosinophilic Myocarditis

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The goal of this presentation is to report an uncommon case of lethal peripartum cardiomyopathy in a young woman. A complete forensic approach was performed through autopsy, histological, and microbiological examinations and final results showed that the cause of death was due to an Eosinophilic Myocarditis (EM).

This presentation will impact the forensic science community showing that eosinophilic myocarditis is a rare, potentially fatal disease if left untreated.

Eosinophilic myocarditis is a histological diagnosis characterized by a mixed inflammatory cell infiltrate containing a variable amount of

eosinophils within the myocardium. This phenomenon may be associated with a variety of disease such as idiopathic hypereosinophilic syndrome (IHES), hypersensitivity myocarditis, giant cell myocarditis, toxic myocarditis, Churg-Strauss syndrome, or parasitic infection.

Clinical presentation includes a wide spectrum of nonspecific signs and symptoms: chest pain, fever, shortness of breath, chills, cough, but they are not always present at the same time and sometimes unusual symptoms, such as epigastric pain, can be the only indication of a pathological state. They can be also associated with peripheral eosinophilia and transient or persistent left ventricular dysfunction.

EM is considered, together with coronary heart dissection, one of the clinical presentations of peripartum cardiomyopathy that usually occurs one month before to six months following delivery. EM etiology and pathogenesis are unknown: eosinophils may be present and activated because of the systemic hormonal perturbation occurring during the period of uterine involution.

A major problem is that EM is rarely recognized clinically and is often first discovered only at postmortem examination.

A correct diagnostic approach in these patients should include an echocardiogram study (with evidence of low ejection fraction and decreased left ventricular systolic function) and an endomyocardial biopsy (confirming eosinophils as a major inflammatory cell component).

If successfully diagnosed, EM can be treated with beta-blockers and ACE inhibitors to support heart failure and corticosteroids to reduce the inflammatory process that is involving the myocardium. Prognosis is strictly linked to ventricular function recovery because those patients with severe myocarditis-induced heart failure have less survival chances if normal cardiac function is not restored.

Few EM cases are reported in literature and most of them are based only on autopsy diagnosis.

A case is reported of a 29-year-old woman who was admitted to critical care unit in respiratory and cardiac failure, three weeks after giving birth. Patient clinical history was non-existent for allergy or autoimmune diseases. The third day after birth, she complained of thoracic pain but echocardiogram was negative. During hospitalization physicians treated her with antacids and gastric inhibitors and then she was discharged with prescription of proton pump inhibitors with the suggestion of gastroenterology visit. The following three weeks were characterized by growing anterior and back thoracic pain associated with general discomfort, but neither specific symptoms nor peripheral eosinophils increase were present; only inflammatory indexes (velocity of erythrocyte sedimentation, VES, and creatine kinase, CK) were slightly increased. With progressive and worsening clinical symptoms, she was finally sent to emergency room in critical condition: dyspnea, confusion, fever, and tachycardia. Echocardiogram showed severe left ventricular systolic dysfunction and 25% of ejection fraction; chest radiograph and TC displayed pleural effusion with general edema. The young woman died after seven hours of cardio-respiratory failure and no medical approach was effective. External examination of the body was completely negative. Autopsy revealed bilateral pleural effusions, increased lung weights, and hepatomegaly. Heart was normal in size and shape, but myocardium and papillary muscles showed malacic areas. Histological examination pointed out massive eosinophilic infiltrates, more evident in cardiac samples. The cause of death was indeed attributed to peripartum eosinophilic myocarditis.

The role of “peripartum” in the etiopathogenesis of such cardiomyopathy as well as possible medical liability in lacking diagnosis and treatment of myocarditis will be discussed.

Eosinophilic Myocarditis, Peripartum, Heart Failure

G15 The Bodies of Two Missing Children in an Enclosed Underground Environment

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The goal of this presentation is to illustrate a little-known but noteworthy case concerning the wrongful conviction of a Southern Italy father whose two missing children were found dead in enclosed environment after approximately 1.5 years since their disappearance.

This presentation will impact the forensic science community by warning and improving search operation, methods of investigation, and indictment process, based on the autopsy findings and physical evidence collected on the scene and from the bodies.

Two young kids, 13- and 11-years-old respectively, originally from a small town in Southern Italy, were missing on June 5, 2006 (06:30 p.m.). Soon after their disappearance, a “missing child” search began. Broadcasters promptly aired a description of the missing children pushing the entire community to assist in the search and safe recovery of the child. But every effort was in vain for more than one year. During the search, the investigators collected enough evidence against the father who was arrested 17 months after the disappearance. He was indicted for kidnapping, homicide, and concealment of the two bodies. He never confessed the crimes and he claimed to be innocent.

Three months after the conviction, a fireman found the two corpses in a subterranean dry cistern next to a more than 20-meter-high well water. The bodies were well preserved, almost mummified with only few body-parts skeletonized. Based on dental records they were identified as those of the two children missing 1.5 years before. Signs of a very low insect activity were present, reasonably consistent with a rapid skin dehydration. The autopsy showed no signs of defense injuries or ligature consistent with strangulation or captivation except for fractures of the axial skeleton at a number of points consistent with a fall from a low-medium height. The body of the elder brother (CP) presented major injuries with signs of recent hemorrhages and gut content analysis consistent with the last meal which provided enough evidence to ascertain a very short survival time. The younger brother (TP) showed minor injuries, signs of old hemorrhage, gastric and intestine emptying time consistent with a longer survival time of approximately 3-4 days, spent alone in the dark and cold cistern. No evidence of body removal or corpse displacement following death was observed. A long postmortem interval (PMI) of approximately 20 months was estimated mainly from the pattern of insect succession. Based on such physical evidence, on March 4, 2008, four months after conviction and 40 days after the recovery of the two bodies, the father was released from prison and exonerated from previous indictment of homicide.

Missing Children, Wrongful Conviction, Postmortem Interval

G16 Diagnosis Of Drowning: The Contribution Of Microbiological Investigations

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After attending this presentation, attendees will gain knowledge of the effectiveness of marine bacteria and/or bacterial indicators of water fecal pollution as a new marker of drowning.

This presentation will impact the forensic science community by introducing an alternative test that could be useful in drowning diagnosis.

To investigate the effectiveness of marine bacteria and/or bacterial indicators of water fecal pollution as a new marker of drowning, an experimental protocol was performed to identify bacteria on samples of drowned victims recovered from umor vitreo (UV) and blood of different anatomic sites such as: right ventricular blood (RV), left ventricular blood (LV) and peripheral blood (P). The study, performed in 2008 and 2009, was performed on ten victims: six drowned victims (two cases in sea water, three in rivers or lake; one in rainwater collection tank) (study group), and four subjects who died from causes other than drowning (three cases of heart attack and one case of death by vehicle collision) (control group). From all groups at least 0.5 ml of each sample were obtained and the tests were calibrated by considering the water fecal pollution rates. Selective culture media were used to detect bacterial growth. Each samples of control or study groups (RV, LV, P and UV) or water samples (all 100 ml) were incubated in Tryptic soy broth (TSB) for 48 h at 37°C and 5% CO₂. After incubation, evaluation of bacterial growth was assessed by plating 100 ml of each sample onto: Todd Hewitt and Marine agars, selective for marine bacteria, m-FC agar, selective for fecal coliforms (FC) and KF Streptococcus agar, selective for fecal streptococci (FS). The plates were incubated for 24 h at 44°C and for 48 h at 37°C and 5% CO₂ to determine FC and FS growth, respectively. The presence of FC was indicated by the development of blue colonies, whereas the presence of FS was indicated by the development of red colonies. The absence of blue and red colonies indicated a negative result, i.e., no blood fecal pollution. The presence of marine bacteria was evaluated through the observation of their growth on selective culture media. Results showed that in the samples of drowned victims in sea water there is growth of marine bacteria, as evidenced by the presence of colonies on TH4% and MA culture media for LV and P blood samples, for the case 1, and for P and UV samples for the case 2. Moreover, the case 2 showed growth of FS and FC bacterial colonies. Regarding drowned victims in rivers or lake water, the analysis of case 4 showed the presence of marine bacteria from RV blood sample; on the other hand the case 5 resulted positive to marine bacteria and fecal streptococci. Surprisingly, case 3 was negative for marine bacteria and fecal streptococci. All anatomic sites of case 6, drowned victim in rainwater collection tank, resulted positive to all the bacterial species considered. Bacteriological analysis of RV, LV, P and UV samples of the control group evidenced a total absence of bacteria. This result showed the reliability of the microbiological test. All the water samples obtained from locations where corpses were found showed a bacterial presence according to samples obtained from the related victims. Applied method is sensitive since a very few bacteria aspirated at follow drowning can be evidenced. Positive results obtained for various anatomic sites (RV, LV, P, and UV) can be an internal control of the sampling procedure to avoid the possibility of bacterial contamination during blood and umor vitreo sampling. Notably, umor vitreo as a new sample for the microbiological test of drowning diagnosis was used.

Drowning Diagnosis, Microbiological Test, Umor Vitreo

G17 Butane Inhalation and Sudden Death: A Case Report

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After attending this presentation, attendees will have learned about a case of sudden death due to butane inhalation in a young inmate.

This presentation will impact the forensic science community by stressing the importance of combining autopsy data and the detection of volatile substances in blood and tissues in all cases of unclear death of young people.

This presentation will inform attendees of something they do not do correctly—the misdiagnosed problem of sudden death due to abuse of volatile substances, especially in adolescents and people living in remote communities. In the current practice, forensic pathologists don't often consider that volatile substances are very easily accessible, and lethal if abused. They should learn how to detect halogenated hydrocarbons, and when it is correct to analyze the concentrations of these volatile substances in blood and tissues. This kind of investigation should be performed in order to avoid mistakes, especially in cases of sudden death of young people with aspecific pathological findings or unremarkable histological examinations.

The deliberate inhalation of volatile substances has been reported from most parts of the world, mainly among adolescents, individuals living in remote communities, and those whose job gives easy access to these substances, with a higher incidence in Countries with large rural populations. Although it is less widespread than twenty years ago, inhalant use still remains a problem today ranging from 10% to 15% among U.S. teenagers and young people (M.R. Marsolek et al., 2010).

Solvents from contact adhesives, typewriter correction, dry cleaning fluids, cigarette lighter refills, petrol (gasoline), halogenated solvents, and aerosol propellants are commonly abused in this way, but cigarette lighter refills and butane-containing cans for portable cooking stoves are the most frequently abused ones. Although aliphatic hydrocarbons are considered safe as aerosol propellants, the acute inhalation of these substances, particularly n-butane, may potentially cause severe damage in healthy hearts (M. Ago et al., 2002).

Volatile substance abuse gives rise to dose-related effects similar to those of hypnotics. Small doses can rapidly lead to euphoria and other behavior disturbances similar to those caused by ethanol (alcohol), and may also induce delusions and hallucinations. Higher doses may produce life-threatening effects such as seizures, coma, and sudden death (R.J. Flanagan et al., 1994). The mechanism of sudden death directly related to volatile abuse includes cardiac arrhythmia, hypoxia, and respiratory depression.

Butane is a gaseous aliphatic hydrocarbon, also called n-butane, with the “n” designating it as normal butane. Its other isomer is isobutene, but the name butane is used collectively to denote both n-butane and isobutane (R.L. Myers, 2007). N-butane and isobutane have an anesthetic or narcotic effect on the central nervous system, and induce fatal arrhythmia at 0.5–15% concentrations in the air (H. Sugie et al., 2004). It has been reported that many n-butane or isobutane abusers experienced fatal ventricular fibrillation immediately after a sudden fright or intense muscular exercise such as running and sexual activity (C. Jackowski et al., 2005. H. Sugie et al, 2004). A few cases of suicide by propane-butane inhalation have been reported too (A. Gross et al., 2002).

A case of sudden death of a 22-year-old male inmate is described. He had a history of drug addiction, depression, and multiple self-inflicted superficial incised wounds. His cellmates reported that the body was found in the bathroom of the cell. The bathroom smelled of gas. The body was lying on the bidet, with his back leaning against the wall; a butane-containing can and a portable cooking stove were found on the floor adjacent to the body. A complete medicolegal autopsy was performed. The external examination showed marked livor mortis, nosebleed, and some parallel linear scars on the forearms; no signs of recent injuries or trauma were observed. The internal examination revealed marked lung congestion; the other organs showed no pathological findings, but evidence of congestion. Histological examinations were unremarkable. Blood samples were collected and analyzed for halogenated hydrocarbons and drugs, using gas chromatography. A concentration of about 0.5 µg/ml for n-butane, with traces of isobutane and butene was measured; drug screening revealed

therapeutic concentrations of benzodiazepines and 0.5 g/L of ethanol in blood samples. The cause of death was ascribed to n-butane poisoning inducing fatal cardiac arrhythmia.

In conclusion, abuse of volatile substances is a serious problem because it is not illegal and agents are easily available and cheap. Thus, the risk of sudden death due to abuse of volatile substances in an environment with no witnesses should be taken into consideration in all cases of unclear death of young people. It is recommended that medicolegal death investigators become familiar with the principles of detection of volatile substances in blood and tissues, especially in those cases with unspecific macroscopic and histological findings.

Volatile Substance Abuse, Butane, Sudden Death

G18 Case Report of a Fatal Intoxication by Nucynta®

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After attending this presentation, attendees will learn about a case, in which, Nucynta®, a newly released analgesic, a Schedule II controlled substance, comparable to tramadol, was fatally ingested.

This presentation will impact the forensic science community by raising the awareness of the toxicity of novel drugs, which is essential for medical examiners and forensic toxicologists.

Tapentadol (Nucynta®) is a centrally acting opioid analgesic prescribed for the treatment of moderate to severe acute pain. Its efficacy is believed to be due to mu-opioid receptor agonist activity and inhibition of norepinephrine reuptake resulting in increased norepinephrine concentrations. Metabolism of tapentadol is via glucuronidation to inactive metabolites. There are no cases in the literature relating to the toxicity of this agent or reports of fatalities. This report documents a case in which tapentadol was identified as the cause of death. The decedent was a 40-year-old obese male who was found at home by his girlfriend. He had been prescribed Nucynta® (tapentadol) for shoulder pain, Lexapro (citalopram), and amitriptyline. There appeared to be more tablets missing than expected. At autopsy, there were early decomposition changes and hepatomegaly with fatty change.

Routine volatile, therapeutic drug, and abused drug testing was performed on the heart blood in this case. This included: (1) methanol, ethanol, acetone, and isopropanol analysis by head space gas chromatography (GC); (2) acid/neutral drug screen by GC-nitrogen-phosphorus detection (NPD); (3) alkaline drug screen by GC-NPD; (4) acetaminophen and salicylate by color test; and, (5) morphine and benzodiazepines by enzyme-linked immunosorbent assay (ELISA). The blood ethanol concentration was 0.01 g/dL; the vitreous humor ethanol concentration was negative. The alkaline drug screen was positive for diphenhydramine (0.6 mg/L), amitriptyline (1.1 mg/L), nortriptyline (<0.1 mg/L), and citalopram (0.3 mg/L). All were confirmed by full scan electron ionization gas chromatography/mass spectrometry and quantified by GC-NPD.

Given the case history, the heart blood was sent to a reference laboratory for tapentadol analysis. Tapentadol was quantified by liquid chromatography – mass spectrometry/mass spectrometry (LC-MS/MS) using D5-tapentadol as internal standard. Extraction of tapentadol from blood involved addition of carbonate buffer followed by methyl-tert-butylether (MBTE). After taking the MTBE layer to dryness, methanol was added and then transferred to an autosampler vial for injection. The limit of detection (LOD) and limit of quantitation (LOQ) of the assay were 0.06 ng/mL and 0.5 ng/mL, respectively.

The therapeutic range for tapentadol is 5-300 ng/mL. The tapentadol concentration found in the heart blood submitted in this case was 6600 ng/mL; more than 20 times the upper limit of the therapeutic range. Possible mechanisms of death include respiratory depression, CNS depression, and serotonin syndrome.

Based on the scene investigation and autopsy findings in this case, the medical examiner determined that the cause of death was narcotic (Nucynta®) intoxication and the manner-of-death was undetermined.

Tapentadol, Nucynta®, Overdose

G19 Nasal Mucociliary Motility: New Forensic Tool for Estimating Time Since Death

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After attending this presentation, attendees will understand the potential contributions of postmortem investigation of nasal mucociliary motility in time of death estimation.

This presentation will impact the forensic science community by emphasizing the potential role of nasal scraping that could become a routine procedure in estimating time-since-death.

Postmortem interval (PMI) estimation is one of the most difficult issues in forensic medicine. Time-of-death is usually appreciated by recognizing early postmortem changes to the body prior to the onset of gross decomposition phenomena: algor mortis, rigor mortis, and livor mortis.

The study of these physical processes is strictly connected to the operator's subjectivity hence it can be source of confusion in estimating PMI. Moreover these body changes can be altered by several internal and external factors: body temperature at death time, subcutaneous fat, muscular mass, clothes, environmental temperature, humidity, and ventilation.

There have been many proposed innovative methods in attempts to avoid this trouble defining PMI objectively as possible. The goal of these new techniques is to find a link between PMI and objectively detectable values such as infrared tympanic thermography, skin fluorescence, electrolyte concentration in cerebro-spinal fluid, pericardial fluid or vitreous humor. All these samples, on the other hand, present practical difficulties in performing and require invasive methods and long time waiting.

Some studies have been published about nasal scraping role in clinical practice (ciliary dyskinesia, NARES, allergic rhinosinusitis), but no studies have never been performed in cadavers for PMI estimation.

A study concerning the examination of ciliary motility as residual life phenomenon, realizing a study on time of death evaluation using a new, rapidly available requiring substrate: nasal mucosa is presented.

Nasal mucosa is composed by numerous cell types (goblet cells, basal cells, ciliated and non-ciliated cells) and can be easily obtained by nasal scraping, a technique commonly used in otolaryngology; it consists of a curette crept on nasal mucosa and cells picked up in this way are then observed.

From June 2009 to June 2010, nasal scraping in 70 cadavers was performed. Age ranged from 24 to 95 years and the cause of death was most frequently due from ischemic cardiopathy, septic shock, and car accident. The only exclusion criteria of this study was nose bleeding.

A specimen of ciliated epithelium was obtained by scraping from the middle third of the inferior turbinate with a spoon-shaped nasal probe (Rhinoprobe). An *in vitro* evaluation of ciliary movement was performed. Ciliary beat frequency (CBF) was analyzed by phase-

contrast microscopy. Three different samples at different postmortem intervals were carried out: between 4 and 6 h (T1), between 10 and 12 h (T2) and after 24 h (T3). Then CBF (beat number/second) was classified in: present (3-4/sec), hypo-valid (1-2/sec) and absent.

Results demonstrated that, except for those cases which showed fungal or bacterial infections, at T1 motility was present in the majority of cases; at T2 motility was still present, but it was hypo-valid in a higher percentage. Ciliary activity was absent at T3. It is believed that all these findings can be explained with progressive metabolic reserves lowering: the more time passes after death, the more ciliated cells loose energetic substrates for ciliary motility.

In conclusion, mucociliary motility seems to be linked to PMI and thus nasal scraping can be considered as a new, easy, cheap, and efficient objective tool in detecting PMI; further studies are required.

Nasal Scraping, Mucociliary Motility, Time Since Death

G20 Fatal Spontaneous Non-Traumatic Subdural Hematoma and Terson Syndrome

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After attending this presentation, attendees will learn that a ruptured cerebral aneurysm can cause a compressive acute subdural hematoma without concomitant subarachnoid hemorrhage.

This presentation will impact the forensic science community by expanding the attendees knowledge base by increasing awareness of causes of non-traumatic subdural hematomas and retinal hemorrhages.

This presentation will inform attendees of something that they do not know. While most acute subdural hemorrhages are the result of trauma, forensic pathologists must be aware that a ruptured cerebral saccular aneurysm can cause a spontaneous non-traumatic subdural hemorrhage along with associated retinal hemorrhages (Terson syndrome).

Cerebral saccular aneurysms frequently rupture into the subarachnoid space, accounting for 70-80% of non-traumatic subarachnoid hemorrhages (SAH); however, aneurismal rupture also may result in concomitant intraparenchymal, intraventricular, or subdural hemorrhage. Most acute subdural hematomas (SDH) in adults are due to traumatic head injuries, although less common causes include coagulopathies, non-traumatic intracranial hemorrhage, intracranial hypotension, or post-surgical complications. A ruptured cerebral berry (saccular) aneurysm causing only an acute SDH is rare, representing < 0.5 - 2% of all ruptured aneurysms in several large case series. In 1881, Litten first described intra-retinal hemorrhage associated with SAH. However, Terson's description in 1900 of vitreous hemorrhage following SAH is now associated with this syndrome. Although originally defined by the presence of vitreous hemorrhage in association with SAH, Terson syndrome now encompasses any intraocular hemorrhage associated with intracranial hemorrhage and elevated intracranial pressures.

A case of 46-year-old woman who died suddenly and unexpectedly at her residence is presented. Found on the bathroom floor, she had no obvious injuries. According to investigations by the medical examiner and law enforcement, she had a vague past medical history significant for hypertension but did not consume alcoholic beverages or use illicit drugs. Subsequent toxicological analysis did not reveal any licit or illicit drugs.

At autopsy, she appeared well nourished and had a body weight, length, and body mass index of 49.1 kg, 160 cm, and 19.1, respectively. Postmortem monocular indirect ophthalmoscopy revealed bilateral retinal hemorrhages. The right and left fundi exhibited 25-35 and 15-20 flamed-shaped and dot retinal hemorrhages over the posterior poles, respectively.

A 1.5 cm subscalpular contusion was left of the vertex over the parietal area. No subgaleal extravasated blood or skull fractures were present. Diffuse liquid and clotted subdural blood covered the cerebral convexities ($R > L$) and weighed 67 gm. The calvarial dura had adherent non-organizing blood over the right and left frontoparietal regions. The leptomeninges were thin and translucent without any extravasated blood. Compression of the midbrain involved the inferomedial temporal lobes and $2 \times 1.5 \times 0.3$ cm dusky area of hemorrhage was in the inferomedial right temporal lobe (medial to the groove caused by transtentorial herniation). The arteries of the circle of Willis were in the usual anatomic configuration and patent. A $0.5 \times 0.2 \times 0.2$ cm ruptured saccular aneurysm projected from the callosal side of the bifurcation of the left pericallosal and callosal marginal arteries. The brainstem contained Duret hemorrhages in the pons and midbrain.

Ophthalmological examination revealed bilateral diffuse optic nerve sheath hemorrhages and extravasated blood within the perineural fat. The right and left fundi had 75-100 and 25-35 flame-shaped and dot retinal hemorrhages, respectively. These involved all four quadrants and extended past the equator but did not abut the ora serrata. The fundal hemorrhages were in all retinal layers and scant blood was in the vitreous of both globes.

A non-traumatic SDH can occur due to the rupture of cerebral saccular aneurysm. Most of these aneurysms are located on the internal carotid artery followed by the middle cerebral artery and anterior communicating artery, but only rarely arise from the distal anterior cerebral artery. Four mechanisms have been proposed by which blood from a ruptured cerebral aneurysm causes a SDH:

1. Successive small hemorrhages allow adhesions to develop and the final rupture dissects between the subarachnoid and subdural layers
2. The arachnoid membrane is breached by the rapidly accumulating blood from the rupturing aneurysm
3. A massive hemorrhage ruptures the cortex and breaches the arachnoid membrane
4. A carotid artery aneurysm located between the arachnoid layer and dura mater ruptures causing a SDH

Subarachnoid hemorrhage almost invariably develops following the rupture of a cerebral aneurysm and only extremely rarely does a SDH occur without an associated SAH. While most acute subdural hemorrhages are the result of trauma, forensic pathologists must be aware that a ruptured cerebral saccular aneurysm can cause a spontaneous non-traumatic SDH along with associated retinal hemorrhages (Terson syndrome).

Acute Non-Traumatic Subdural Hematoma, Cerebral Aneurysm, Retinal Hemorrhages

G21 A Fatal Complication of Vacuum-Assisted Vaginal Delivery

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After attending this presentation, attendees will learn of a fatal complication following vacuum-assisted vaginal delivery.

The presentation will impact the forensic science community by expanding the familiarity with a fatal complication of vacuum-assisted vaginal delivery, neonatal mortality, and conditions associated with retinal hemorrhages.

This presentation will inform attendees of something they do not know—that fatal neonatal subgaleal hemorrhage can result from birth assisted vacuum extraction and have associated extensive retinal hemorrhages.

An Edinburgh professor of obstetrics, James Young Simpson, first introduced a successful obstetric vacuum extractor in 1849. Technical difficulties limited its effectiveness and vacuum extraction (VE) fell from clinical interest until 1956 when the stainless steel cup vacuum device was introduced. While common in Europe, VE did not gain continued popularity in the United States until the 1980s. Early studies showed no significant traumatic complications attributed to VE when limited to 15 minutes and/or two “pop-offs” of the vacuum cap. The “pop-off” presumably served as a safety valve that would protect the neonate from excessive tractional forces. The development of the soft cup VE device with its implied safety caused VE to gain increasing popularity. Currently forceps and VE are used as delivery instruments, but over the past decade VE has replaced forceps as the main delivery instrument in assisted vaginal deliveries. However, controversy continues concerning which instrument is the best to use in specific clinical situations. VE remains popular because of its relative ease of use, lower maternal morbidity, and supposed safety. Nevertheless, severe neonatal complications can occur. The reported incidence of fetal death or severe fetal injury from VE ranges from 0.1-3 cases per 1,000 assisted deliveries. Three cases are presented of neonates who died from complications following vacuum-assisted vaginal delivery.

Case 1: Delivered by vacuum-assisted vaginal delivery, a 2.8 kg, 37-weeks-gestational age neonate had Apgar scores of 7 and 8 at 1 and 5 minutes, respectively. His initial hemoglobin (Hgb) was 17.4 gm/dL, but 5 hours later when he began grunting and developed hypothermia his Hgb was 6.8 gm/dL. He was transferred to a medical center with admitting diagnoses of subgaleal hemorrhage, anemia, hypotension, disseminated intravascular coagulopathy, and respiratory failure. After three weeks in the intensive care unit, the family withdrew care due to his increasingly poor prognosis. At autopsy, he had severe anasarca and hypoxic-ischemic/re-perfusion injury to his heart, liver, spleen, kidneys, and brain. An organizing subgaleal hematoma measured 15 cm and weighed 77 gm. No retinal hemorrhages (RHs) were identified by postmortem monocular indirect ophthalmoscopy (PMIO) and he had no documented clinical fundal examination.

Case 2: Born by vacuum-assisted vaginal delivery due to an arrested second stage of labor and shoulder dystocia, a 4.36 kg term neonate had Apgar scores of 0 at 1, 5, and 10 minutes and 2 at 15 minutes. She experienced immediate respiratory distress, hemodynamic instability, and presumed sepsis. Her initial Hgb was 14.9 gm/dL that later decreased to 10.7 gm/dL. An electroencephalogram demonstrated severe encephalopathy and her condition continued to decline until she died a day later. At autopsy, she had large subgaleal and subscalpular hematomas that were 20 cm in greatest dimension and weighed 54 gm. No skull fractures were present but she had bilateral subdural hematomas as well as subarachnoid hemorrhage. A clinical fundal examination was not done, but PMIO detected extensive bilateral multi-layered RHs.

Case 3: Delivered by cesarean section after a failed vacuum-assisted delivery, a 3.8 kg term neonate had Apgar scores of 3, 5, and 7 at 1, 6, and 10 minutes, respectively. He had respiratory distress, hemodynamic instability, and developed disseminated coagulopathy. The parents withdrew care the following day. At autopsy, extensive subgaleal and subscalpular extravasated blood was present measuring 35 cm in greatest dimension and weighing 140 gm. No skull fractures, epidural, or subdural hemorrhage was identified. PMIO revealed extensive RHs in the right globe and 1 RH in the left fundus; however, no clinical fundal examination was documented in the medical record.

The most common extracranial injuries associated with VE are superficial scalp abrasions, lacerations, and hemorrhage that can occur in 10% of neonates. Two major types of scalp injury are the common, but clinically unimportant, cephalohematomas and the relatively rare, but potentially life threatening, subgaleal (SG) hemorrhage where extravasated blood dissects between the periosteum of the skull and the galea aponeurotica. The mortality rate of SG hemorrhage following VE is estimated at 20%. Vacuum-assisted vaginal delivery is a relatively common procedure and most often benign. However, forensic

pathologists must be aware that a fatal SG hemorrhage can result from VE and have associated extensive RHs.

Vacuum-Assisted Vaginal Delivery, Subgaleal Hemorrhage, Retinal Hemorrhages

G22 The Relationship of Back Surgery to Overdose at Autopsy

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The goal of this presentation is to define the relationship between the presence of a scar in the midline of the back, indicating a history of laminectomy, with drug intoxication sufficient to cause death.

This presentation will impact the forensic science community by discussing how presence of a laminectomy scar is a powerful marker for a drug related death. In a practice where toxicology is not routinely performed on all cases, the presence of a laminectomy scar should lead to toxicological analysis for that case.

Rationale: Individuals who have died suddenly and unexpectedly in which examination reveals a scar in the midline of the back of the sort left by a lumbar or cervical laminectomy are regularly received. Because the cause of death in such individuals is frequently intoxication with some drug, it is hypothesized that death due to a drug overdose is more common in individuals with evidence of a previous laminectomy than in individuals with no prior laminectomy. Therefore, we tested the null hypothesis. There is no difference in the frequency of death from a drug overdose in a study group with a linear scar in the midline of the back when compared to the frequency of drug overdose in cases evaluated at the medical examiner office in which no scar is found on the midline of the back.

Methods: A retrospective case-control study of deaths in 2008 investigated by the Jefferson County Coroner/Medical Examiner Office, Alabama was conducted. The study group consisted of decedents 18 years of age or older who had a linear scar in the midline of the back; as determined by review of the autopsy protocol (body diagram or written report). The control group was chosen from all the decedents examined at the Jefferson County Coroner/Medical Examiner Office, Alabama in 2008. Controls were matched to the study cases by age, race, and sex. Race and sex were matched exactly. Age was matched to the same year in 21 cases, to within one year in five cases, and to within two years in three cases. When more than one control was available the control used was determined randomly the throw of a die. The charts of both the study group (back scar) and of the control group (no scar) were reviewed for the cause of death and evidence of intoxication. All toxicology results were noted in the decedents, including the presence of cocaine, any other drugs or medications, and ethanol. Bodies charred by fire (six cases) or recovered as skeletal remains (two cases) were excluded from the study. This project was approved by the medical Institutional Review Board of the University of Alabama at Birmingham.

Results: For all decedents 18 years of age or older in 2008, the likelihood of death being due to a drug overdose was 12.8%. The study group of decedents with a linear back scar consisted of 27 decedents, nine of whom died as a result of acute intoxication with some substance of abuse. In the matched control group one decedent died of acute intoxication with a substance of abuse. Decedents with a back scar were thirteen times (odds ratio 13.0; 95% confidence interval 1.9-85; p= 0.011) more likely to die of a drug overdose than the controls. In other words, a body with a laminectomy scar is 13 times more likely to die as a result of an overdose than is another body without a laminectomy scar. Given the small p-value, chance is an unlikely explanation for these

results. The confidence interval is large because of the few cases in the study; a larger study will narrow the confidence interval.

Conclusion: This study shows that, when found at postmortem examination, the presence of a linear scar in the midline of the back of the sort following laminectomy is a powerful marker for a drug related death. In a practice where toxicology is not routinely performed on all cases, the presence of a laminectomy scar should lead to toxicological analysis for that case.

Back Scar, Drug Overdose, Intoxication

G23 The Use of Raman Spectroscopic Imaging in Cases of Ethylene Glycol Toxicity

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After attending this presentation, attendees will have reviewed ethylene glycol toxicity, the pathophysiology and histology of ethylene glycol poisoning, and be introduced to the concept of Raman imaging and how it can be used to identify calcium oxalate crystals in tissues.

This presentation will impact the forensic science community by introducing a new method to identify crystalline deposits in the kidneys when ethylene glycol is suspected.

The American Association of Poison Control Centers reported 6,077 exposures to ethylene glycol in the United States, resulting in 40 deaths in 2002. The State of Maryland had 15 cases of ethylene glycol intoxication from 1996-2009. Ethylene glycol is a colorless, odorless liquid which is the principal component of antifreeze. The toxic dose varies but more than 0.1 ml/kg body weight is the reported toxic dose requiring medical treatment. The primary symptoms are CNS depression followed by a cardiopulmonary stage with eventual renal failure. The lethal dose is approximately 100 ml in an adult. It is metabolized to oxalic acid which binds the calcium in the body forming calcium oxalate crystals that eventually lead to the renal failure. In addition, it does not show up on toxicologic analysis in a routine volatile screen.

Forensic pathologists may be presented with a death without an obvious cause, but crystals may be seen in the kidneys that suggest ethylene glycol poisoning with initial negative toxicology. Four cases involving probable ethylene glycol ingestion and the use of Raman imaging to identify calcium oxalate crystals are presented. The cases presented include three cases of known ethylene glycol toxicity and one case of suspected ethylene glycol toxicity with negative ethylene glycol and glycolic acid blood analyses and crystals in the kidneys.

The case that prompted the use of Raman imaging was that of a 52-year-old black male found deceased with vomitus on a pillow next to him in his father's vacant home. The decedent had no known psychiatric or past medical history. At autopsy an anomalous right coronary artery and dull green stomach contents were found. Microscopic examination of the kidneys revealed multiple polarizable crystals consistent with calcium oxalate. This prompted additional police investigation revealing the subject was estranged from his family. No additional medical or social history was gained. Toxicologic analysis of blood for ethylene glycol and oxalic acid was negative. Raman imaging showed that the crystals were indeed calcium oxalate. The cause of death was anomalous right coronary artery complicated by oxalosis and the manner classified as Undetermined. Three other cases of known ethylene glycol toxicity underwent Raman imaging. In all cases, toxicologic analysis of the blood was positive for ethylene glycol, autopsy showed crystals in the kidneys, and the cause of death was ethylene glycol intoxication and manner was undetermined.

Raman molecular imaging is a method used to identify molecular structures. It is a physical phenomenon involving the interaction of light with molecules. This method is based on inelastic (Raman) scattering of monochromatic light from a source such as a visible laser, a near infrared laser, or near ultraviolet laser. The laser interacts with phonons in the system, resulting in the energy of the laser photons being shifted up or down. The shift in energy is then related as data concerning the phonons in the system being studied. The unstained aluminum slide is illuminated with a laser beam, light from this spot is collected with a lens, and then sent through a monochromator. Wavelengths similar to the laser are filtered out, and the rest of the light is collected into a detector. A given solid material has characteristic phonon modes that can help to identify it.

Raman molecular imaging was able to characterize the unknown crystals as calcium oxalate in all four cases of suspected ethylene glycol toxicity. The confirmation of the calcium oxalate crystals in the kidneys in the case with negative blood ethylene glycol and oxalic acid was helpful. In this case, the inability of investigation to establish clear social and medical history or the source of the oxalosis left the possibility of primary or secondary hyperoxaluria or an exogenous ingestion. Therefore, the manner was best certified as Undetermined.

This case series demonstrates the utility of Raman imaging to confirm the presence of calcium oxalate crystals in the kidneys. The correlation of these crystals to ethylene glycol intoxication requires complete toxicologic analysis and thorough investigation. Raman imaging could have many broad applications in the forensic pathology community and to the forensic community in general in the identification of unknown substances in tissues of all types.

Raman Imaging, Ethylene Glycol, Calcium Oxalate

G24 Death From Severe Anorectal Injury of a Jet Ski Passenger

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After attending the presentation, attendees will understand the basic principles of jet ski propulsion and the potential for hydrostatic injury to the perineum.

This presentation will impact the forensic science community by bringing awareness to an unusual mechanism of injury in jet ski accidents. Such knowledge would prevent initial confusion and unnecessary use of resources to investigate other causes. In addition, it would serve to promote better safety practices in the use of jet skis.

This presentation will highlight the unusual case of a young woman who sustained lethal anorectal trauma after falling from the back of a jet ski.

It is recognized that both the popularity of personal watercraft and injuries related to their use have been increasing. Non-lethal lacerations, contusions, sprains, and fractures make up the majority of these injuries. Rare, but more serious injuries include closed head injury and intra-abdominal injury involving high velocity and rapid deceleration. The latter types of injury are typically those which result in fatality involving personal watercraft.

In the case presented, the autopsy showed a midline laceration posterior to the vaginal introitus which passed through the anus. The laceration extended to involve the deep soft tissues and the distal rectum was seen to be transected and free in the pelvic cavity. The full extent of her injury became apparent when the laceration was seen to extend within the retroperitoneal space to a level above the kidneys.

Given the extensive injury, initial suspicion surrounded possible impalement by a solid object. Witnesses at the scene as well the operator of the jet ski reported that the decedent fell straight back into unobstructed water. A subsequent review of the accident site revealed no

fixed obstructions. The decedent was initially conscious in the water, but became unresponsive shortly after being pulled to shore. Bloody drainage was seen from her perineum, and her wound was extensively packed. Despite this, resuscitation was unsuccessful.

A review of her medical history revealed a recent c-section. Her obstetrician reported that her c-section had been uncomplicated. Autopsy supported this as her gynecologic organs were intact. No other injuries were identified. The combination of history, literature, and autopsy findings indicated that the cause of death in this case was due to severe anorectal trauma from the water thrust of a jet ski.

Risk factors for injury in this case included the fact that the decedent was a passenger and fell straight backward. When a passenger falls from a jet ski, the throttle does not shut off automatically as it would for a driver who fell. Further, the decedent was wearing a bathing suit at the time of the accident. A wetsuit may have provided more protection.

While occasional case reports of similar, non-fatal injuries from jet ski accidents have been documented in the surgical literature, such a case has never been reported in the forensic literature to our knowledge. In the surgical cases reported, patients who sustained vaginal and/or rectal lacerations underwent successful repair with recovery of normal function.

Anorectal, Trauma, Jet Ski

G25 Sudden Unexpected Infant Death: Peripheral Retinal Hemorrhages Associated With Accidental Positional Asphyxiation (Wedging)

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After attending this presentation, attendees will learn that peripheral retinal hemorrhages extending to the ora serrata are not specific for abusive head trauma (shaken baby syndrome) and can be associated with accidental positional asphyxia (wedging).

This presentation will impact the forensic science community by emphasizing the importance of routine retinal examinations (postmortem monocular indirect ophthalmoscopy) in infants dying suddenly and unexpectedly.

This presentation will inform attendees of something they do not know—multiple retinal hemorrhages, involving the peripheral retina and extending to the ora serrata in infants, are not specific for abusive head trauma (shaken baby syndrome).

Current data (1999 -2007) from the Centers for Disease Control lists accidental suffocation as the leading cause of unintentional death in infants. Of those deaths 65.7% were due to accidental asphyxiation in bed (all mechanisms). Accidental positional asphyxia from wedging often occurs when an infant becomes entrapped between the mattress and wall, headboard, or bed frame of an adult bed. Despite the number of unintentional wedging deaths in infants, to find published reports of retinal hemorrhages (RHs) associated with accidental positional asphyxia (wedging) were not found. A number of authors have asserted that multiple retinal hemorrhages (RHs) involving the peripheral retina and extending to the ora serrata occur only in abusive head trauma (AHT) or rarely with severe head injuries from motor vehicular

collisions or crush head injuries. This reports two infants who died suddenly and unexpectedly from wedging who had multiple RHs including peripheral RHs extending to the ora serrata.

Case 1: A father had been sleeping in an adult bed with his previously healthy 4-month-old infant son while the mother slept in another room with one of the infant's two older siblings. During the night the father heard the 3-year-old sibling wake up; he got up to check on her, but fell asleep her room. At 8:00 a.m., the mother found the infant unresponsive, wedged head down between the mattress and headboard of the bed. Paramedics pronounced him dead at the scene. At autopsy, he had parallel lines on his forehead corresponding to the mattress edging and ticking. Postmortem monocular indirect ophthalmoscopy (PMIO) revealed multiple RHs in the right fundus mainly over the equatorial region and two RHs in the left fundus at the mid-periphery. Microscopically, the right-sided RHs extended to the ora serrata and primarily involved the nerve fiber layer with focal involvement of the inner and outer nuclear layers. The left eye had one tiny retinal hemorrhage in the inner nuclear layer. No optic nerve sheath hemorrhages were identified grossly or microscopically. The *dura mater* had remote subdural membranes over the right and left frontal and left parietal regions. The brain had no ischemic or traumatic lesions. His postmortem radiographic skeletal survey revealed no acute or healing fractures.

Case 2: A previously healthy 6-month-old infant was sleeping in bed with her mother and was last seen alive at 2:00 a.m. Her mother found her wedged between the mattress and wall, face down on a stuffed animal, at about 6:00 a.m. She immediately drove her to the local emergency department where resuscitative efforts were unsuccessful. The infant was born at term by cesarean section without complication. At autopsy no scalp or subgaleal hemorrhages, skull fractures, cerebral edema, or epidural, subdural or subarachnoid hemorrhages were present. PMIO revealed bilateral RHs. Ocular examination disclosed 30-50 flame-shaped and dot hemorrhages circumferentially located from the mid equator to the ora serrata on the right side. The left eye displayed two posterior RHs measuring approximately $\frac{1}{4}$ disc diameter in size, located inferior and nasal to the fovea at the 3:00 position and 1 disc diameter from the optic nerve head at the 5:00 position, respectively. In addition, from the mid equator to the ora serrata were 40-60 pinpoint to flame-shaped or dot hemorrhages extending to, and focally abutting, the ora serrata in all 4 quadrants. No optic nerve sheath hemorrhages were observed grossly or microscopically. Intradural extravasated blood involved the falx cerebri and the right calvarial dura. The brain had age-appropriate development with no ischemic or traumatic lesions. Her postmortem radiographic skeletal survey revealed no acute or healing fractures.

These two cases with reliable histories of positional asphyxia demonstrate the importance of routine postmortem ocular examination of infants to better appreciate the spectrum of RHs seen in this age group. Multiple retinal hemorrhages in an infant, involving the peripheral retina and extending to the ora serrata, are not specific for AHT.

Sudden Unexpected Infant Death, Retinal Hemorrhages, Accidental Positional Asphyxia (Wedging)

G26 Antiepileptic Drug Intoxication: Report of One Case and a Forensic Pathologist's Approach

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After attending this presentation, attendees, will learn a better forensic approach in investigating fatal cases where there is suspicion of antiepileptic drug misuse.

This presentation will impact the forensic science community by showing a fatal case of intoxication with valproic acid. In addition, further discussion is made in order to clarify and systematize forensic approaches (crime scene investigation and autopsy procedure) in cases involving suspicion of antiepileptic drug misusage, fatal consequences of antiepileptic drug, particularly valproic acid, including its direct toxic effects, adverse reactions and interactions with other drugs, possible mechanisms, causes and manners of death in these type of cases, and promotion of prevention measures with physicians to avoid fatal cases in patients taking antiepileptic drugs.

Valproic acid is formally an antiepileptic drug but currently it has wider clinical uses, including treatment of some psychiatric disorders, such as bipolar and affective disorders. Since prescription of valproic acid has been growing, it is becoming an increasingly common agent to be used in intentional overdoses. Although considered a relatively safe drug, it is known to cause hepatotoxicity and pancreatitis, amongst other adverse reactions. In patients co-ingesting other medications, specifically, those acting as CNS depressants, side effects and toxicity can become more dangerous and even fatal for the patient.

This study presents a 45-year-old blind female, who was found dead by her husband inside their house. The forensic pathologist called to the scene, found five empty blisters-packs of valproic acid. Previous pathologic history included epilepsy, bipolar disorder, and chronic alcohol abuse with prior suicide threats. At autopsy, external and internal examination didn't reveal significant traumatic lesions. The organs showed generalized congestion, the liver was significantly enlarged, the pancreas showed no macroscopic abnormalities and a whitish substance was present in the stomach.

Histological ancillary investigation confirmed congestion in the lungs and kidneys, and also, mild hepatic steatosis. Toxicological results revealed high concentrations of valproic acid (556.0 μ g/mL); therapeutic concentrations of other psychiatric drugs (tiapride, mirtazapine, nordiazepam, and oxazepam) and blood ethyl alcohol concentration of 1.34 g/L.

After excluding death due to natural or traumatic causes, a direct toxic effect by valproic acid was considered. Taking into account the autopsy, histopathology and toxicological findings, along with the circumstantial evidence, the cause of death was attributed to suicide by intoxication with valproic acid in association with other CNS depressants.

In conclusion, this case illustrates that is crucial for forensic pathologists to: (1) participate or have detailed information from the crime scene, prior to autopsy; (2) know the deceased' complete medical history and prescribed medication; (3) do a careful postmortem examination to exclude natural and traumatic causes of death; (4) study target organs of valproic acid action by macroscopic and microscopic approach; and, (5) do toxicological studies and exclude other causes of death.

When prescribing multiple CNS depressant drugs to patients with alcohol abuse and suicidal ideation, physicians should always be

particularly aware of the risk of valproic acid toxicity, interactions with other drugs and possible adverse reactions, besides the potential accidental or intentional intoxication.

Forensic Pathology, Antiepileptic Drug Intoxication, Valproic Acid

G27 Are Peripapillary Intrascleral Hemorrhages Pathognomonic for Abusive Head Trauma?

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After attending this presentation, attendees will learn that peripapillary intrascleral hemorrhages are not diagnostically specific for abusive head trauma (shaken baby syndrome).

The presentation will impact the forensic science community by stressing the necessity for consistent postmortem ocular examinations of infants and young children to identify all conditions associated with certain ocular findings such as peripapillary intrascleral hemorrhages.

This presentation will inform attendees of something they do not know—that peripapillary intrascleral hemorrhages are not diagnostically specific for abusive head trauma (shaken baby syndrome) and exemplify the need for unbiased consistent ocular examinations, both clinically and at autopsy.

The American Academy of Pediatrics' Committee on Child Abuse and Neglect, Section on Ophthalmology, has acknowledged that searching for retinal hemorrhages (RHs) only in infants suspected of abuse creates a selection bias. However, they have also stated that postmortem eye removal might not be indicated "in children who have clearly died from witnessed severe accidental head trauma or otherwise readily diagnosed systemic medical conditions." Although infrequently described in the child abuse literature, peripapillary intrascleral hemorrhages have been considered "probably pathognomonic" for abusive head trauma (shaken baby syndrome) due to severe repetitive acceleration-deceleration forces with or without blunt head trauma.

Case 1: A 2-day-old male neonate had significant blunt force head trauma including bilateral subgaleal hemorrhages, right subscalpular hemorrhage, bilateral parietal skull fractures, diastatic separation of the sutures, subdural and subarachnoid hemorrhages, cerebral edema, and hypoxic ischemic brain injury. Indirect ophthalmoscopy revealed 30-50 flame-shaped and dot RHs involving all four quadrants of the left globe, extending anteriorly from the posterior pole past the equator to the ora serrata. Peripapillary intrascleral hemorrhages were in the left eye in addition to bilateral optic nerve sheath hemorrhages and bilateral periorbital soft tissue hemorrhage. The right globe had an artifactual papillomacular fold but no RHs. Neither eye exhibited papilledema. Hemothoraces and bilateral rib fractures were present. He had been delivered by cesarean section at 36-weeks estimated gestational age.

Case 2: A 3-day-old female neonate had severe blunt force head trauma. She had a small contusion on the right side of her forehead plus faint abrasions and ecchymoses overlying the right mastoid process. She had bilateral subgaleal hemorrhages, bilateral parietal skull fractures, and a diastatic fracture of the left lambdoid suture. Subdural and subarachnoid hemorrhages, cerebral cortical contusions, cerebral edema and diffuse hypoxic-ischemic brain injury were identified. Indirect ophthalmoscopy revealed multiple bilateral RHs. Subsequent examination of the orbital structures demonstrated bilateral preretinal, intraretinal, and subretinal hemorrhages, optic nerve sheath hemorrhages, peripapillary intrascleral hemorrhages and perineural extravasated blood. The right fundus had 15-20 flame-shaped RHs radiating from the optic nerve head for a distance of two to four disc

diameters. The largest of these measured approximately three disc diameters and was nearly confluent between the fovea and the superior temporal vascular arcade. No hemorrhages were evident past the equator on the right. On the left, the fundus had 10-15 flame-shaped RHs in all four quadrants, located mainly posteriorly, measuring approximately $\frac{1}{4}$ disc diameter in size. Two faint RHs at the 7:00 and 8:00 positions were flame-shaped and located 3-4 disc diameters from the ora serrata. Papilledema was not evident on either side. She had been delivered by cesarean section at 38-weeks estimated gestation age.

Both neonates had been delivered by emergency cesarean section following the involvement of their respective mothers in motor vehicle collisions. Both had Apgar scores of 0 at 1, 5, and 10 minutes and required prolonged resuscitation lasting 20 minutes and 14 minutes, respectively, before a heart rate was established. In the first case, the mother, a passenger in the vehicle, was ejected in a single vehicle rollover accident. She suffered only minor injuries. In the second case, the mother was the restrained driver of a van that crossed over the midline and hit an oncoming car. Extraction was prolonged and the mother suffered multiple pelvic fractures but no other serious injuries. In both cases the babies' heads were engaged in the pelvis at the time of the accidents. No uterine or placental injuries were found in either case and the mothers were not in labor at the time of the accidents. Neither neonate had a documented clinical fundal examination while hospitalized in the intensive care unit.

In-utero skull fractures with severe brain injury are uncommon but well documented. It is believed, RHs with peripapillary intrascleral hemorrhages have not been previously reported in neonates sustaining *in-utero* skull fractures and traumatic brain injuries. These cases demonstrate that peripapillary intrascleral hemorrhages are not diagnostically specific for abusive head trauma and exemplify the need for consistent, unbiased ocular examinations, both clinically and at autopsy.

Peripapillary Intrascleral Hemorrhages, Accident, Intrauterine Traumatic Brain Injury

G28 The Correlation of Serum Stress Hormone Levels With Cause and Circumstance of Death

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The goal of this presentation is to alert forensic professionals that biological markers have the potential to provide significant information concerning the psychological state and stress levels of someone just before death.

This presentation will impact the forensic science community by providing medical examiners and the courts a mechanism to understand the degree of stress someone was going through immediately prior to death.

Interleukin 6 (IL-6) is a major regulator of immune function, and has been shown to increase due to both physical and psychological stress. Knowledge of whether or not an individual was under psychological stress prior to death may be important in many cases. In this study, levels of IL-6 and its soluble receptor (sIL6-r) with an assumed level of psychological stress prior to death was correlated. Postmortem serum samples were obtained from the New Hampshire Medical Examiner's Office and analyzed using ELISA to determine concentration of both sIL6-r and IL-6. The raw data for the soluble receptor could be placed into four groups. However, these groupings were inconsistent with stress levels based on a study of the case histories of the decedents. The data for IL-6 however correlated well with the level of psychological and emotional stress an individual was under prior to death. This study shows that measurement of postmortem serum IL-

6 can be a potentially useful technique for determination of psychological and emotional stress prior to death.

Stress Hormones, Interleukin 6, Circumstance of Death

G29 Stippling Mimics — Differentiating Pseudostippling From Stippling: A Report of Four Cases

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After attending this presentation, attendees will be able to recognize factors from scene investigation, history, autopsy, and histology which may help in reliably differentiating stippling from stippling mimics, and understand the role of history and investigation as well as direct observation in differentiating stippling from stippling mimics.

This presentation will impact the forensic science community by assisting forensic pathologists in recognizing patterned injuries which may mimic stippling, and in utilizing history and scene investigation integrated with observation to draw valid conclusions about the origin of apparent stippling.

A valid outcome results from valid input. A forensic pathologist who relies only on observation, whether gross or microscopic, may draw invalid conclusions from what appear to be readily classifiable patterns of injury. Integrating history and scene findings into the decision-making process may allow the pathologist to come to reliable and valid conclusions about the source of a patterned injury that appears to be stippling.

A 20-year-old man died in a parking lot from a gunshot wound to the face, less than three weeks after sustaining nonfatal gunshot wound injury. Initial observation of the fatal gunshot wound, which entered the cranium through the tip of the nose, suggested a band or outline of stippling above the eyebrow, consistent with wearing a pair of glasses or sunglasses at the time he was shot. Multiple witnesses reported that the decedent was shot by an assailant from a car across the parking lot, far outside any possible stippling range. Scene re-investigation showed that the marks of pseudostippling matched the gravel in the parking lot. There were no glasses.

A 25-year-old male front-seat passenger in a vehicle, along with the driver was fatally shot by police during a chaotic incident that resulted from a confrontation following a police chase. The driver's body showed typical distant gunshot wounds, but the passenger, who was shot twice, had one distant gunshot wound, and one gunshot wound of the face surrounded by a dense 3" x 3" oval of apparent stippling. History and scene investigation suggested glass fragmentation injury from a bullet which passed through the passenger's window prior to striking him. A similar finding was noted in a homicide a year later when the driver of another vehicle was found dead in the front seat.

A 22-year-old woman was shot by her ex-boyfriend in a homicide-suicide event. The shooting was partially witnessed. The boyfriend shot the victim from a balcony of an outside staircase on which he stood two stories above her. He died immediately afterwards in the same location from a characteristic gunshot wound to the right temple. The decedent appeared to have stippling to the left axilla, and wounds suggestive of blunt to sharp force trauma across the neck, torso, and thigh. Extensive scene investigation was performed and co-ordinated with the autopsy findings to explain the apparent discrepancy between the locations of the shooter and the victim, and the victim's wounds.

These case reports are utilized, along with examples of true stippling for comparison, to demonstrate the dangers of invalid conclusions about patterned injuries when only observation is relied upon.

Stippling, Pseudostippling, Glass Fragmentation Patterns

G30 DNA Extraction From Paraffin Blocks: Organ Selection and Pre-Embedding Fixation Times – Practical Implications for Forensic Pathologists

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After attending this presentation, attendees will gain an understanding of which organs or tissues are optimal for paraffin archival for the purposes of subsequent DNA extraction; attendees will recognize the importance of the length of formalin fixation prior to paraffin embedding.

This presentation will impact the forensic science community by helping attendees to be able to direct histologic sampling to one or two tissue types (in decomposed and non-decomposed bodies) for the purposes of DNA sampling. Attendees will understand the critical time parameter for pre-embedding formalin fixation.

Synopsis: In recent years re-examination of old death investigation cases in the form of prosecutorial post-conviction review, defense review (prompted by the Innocence Project and others), law enforcement cold case initiatives (often with federal grant support), and ancestry inquiries is increasingly frequent. These reviews are aided and sometimes initiated by the existence of advanced DNA technology that may not have existed until after conclusion of the original investigation. Therefore the ability to obtain usable DNA evidence from items stored for extended periods is increasingly important. While standard forensic practices vary with regard to storage times for various pathology specimens (formalin fixed wet tissues in particular), forensic centers and hospital pathology services often retain paraffin embedded tissue blocks indefinitely; current National Association of Medical Examiners (NAME) accreditation guidelines require a retention time of at least 10 years. Consequently, paraffin blocks are an available resource for stored DNA evidence. However, forensic pathology practice varies regarding number of organs sampled for paraffin preservation, and even whether or not sections are taken in all types of cases; NAME accreditation guidelines allow discretion as to types of cases in which slides are produced but do recommend a one-year retention of paraffin embedded tissues when slides are not produced. To address the question of which tissue would be optimal for DNA recovery using modern methods, these experiments were designed to determine whether decomposition changes that answer, and whether the length of pre-embedding fixation is a critical variable.

Tissue obtained at autopsy was divided into three groups based on formalin fixation times of 1, 5, and 12 days prior to dehydration and paraffin embedding. Sections of each organ were deparaffinized with heat and DNA was purified from the residual tissue via organic extraction. Subsequent purification was accomplished by one of several different methods. Extracted DNA was quantified then amplified using a PCR amplification kit and separated by 3130x1 capillary electrophoresis. The electropherograms were analyzed for DNA profiles.

Tissues compared were heart muscle, skeletal muscle (psoas), liver, spleen, and brain. Cases included both non-decomposed and decomposed bodies. Preliminary results for quantitative DNA recovery indicate that spleen is superior to liver, heart or skeletal muscle. A striking loss of recoverable DNA is observed between pre-embedding fixation times of 5 to 12 days. The loss of DNA with increasing fixation times is maximum in spleen and skeletal muscle followed by liver and heart, but the differences between organs are small. Studies are ongoing, but preliminary data suggest that although quantitative DNA recovery is

greatest from spleen, the degree of degradation may also be greatest with spleen. Studies comparing brain to the other tissue types and the effects of decomposition are ongoing.

Impact: This project was undertaken to better define which tissue types are the best for extraction of DNA from paraffin blocks using modern DNA technology. With this knowledge forensic pathologists will be able to selectively sample organs in order to efficiently preserve DNA evidence while minimizing the expense of embedding multiple tissues and organs from all cases.

DNA Extraction, Paraffin, Formalin Fixation Time

G31 The Potential Value of Bone Marrow Analysis for Forensic Purposes: Evaluation of Needle Aspiration and Biopsy Taken From the Sternum

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After attending this presentation, attendees will understand the potential contributions of postmortem investigations of bone marrow (BM) taken from sternum in order to validate the diagnosis of some type of death.

This presentation will impact the forensic science community by emphasizing the potential contributions of postmortem BM evaluation that should become a routine procedure, especially if the forensic pathologist can not detect real cause of death during autopsy.

The importance of studying the bone marrow in clinical practice is well known and techniques such as marrow needle biopsies, smears from aspirate, and imprint preparations, allow the diagnosis of several blood disorders. On the other hand, many studies have explored the involvement of bone marrow also in systemic illnesses, including metastatic involvement with tumors, granulomatous diseases, AIDS, in staging of carcinomas, and for the follow-up evaluation of patients undergoing chemotherapy or transplantation. Other studies have strongly suggested that inflammatory cells originating from the BM contribute to sustain pathophysiological processes, e.g., allergy, sepsis, healing wounds. For example, in allergies, progenitor cells migrate to the site of allergic inflammation via blood, where they differentiate into tissue-dwelling and classic effector cells, such as mast cells and eosinophils. These modifications are probably secondary to the production of various cytokines which either block or stimulate the proliferation of hematopoietic stem cells (growth factors) and their differentiation.

A number of studies has been published in recent years about the use of BM specimens taken from iliac crest and rib as alternative tissue in forensic toxicology, concerning the detection of postmortem alcohol and drug content. Nevertheless, there is a lack of studies regarding an alternative role of the sternum aspiration and needle biopsy which can help to understand pathophysiological changes in response to stress, infection, or other external stimuli.

A study based on BM samples (needle aspiration and biopsy) taken from the sternum which were obtained from 70 autopsy cases performed in the Section of Legal Medicine, Bari University, from subjects died due to several causes (cardiovascular diseases, craniocerebral trauma, sepsis, etc) will be presented. The histopathological results will be discussed in

the light to underline the potential value of BM analysis for forensic purposes.

Assuming that by using sternum evaluation, the limit of poor samples possibly obtained by iliac aspiration, especially in postmortem work-up, might be avoided. Moreover, cytomorphological evaluation on sternum smears might offer more elements than those obtained by just histopathological examination, because of the less frequent postmortem alterations frequently described in bone marrow biopsy. In fact, BM is surrounded by solid cortical bone, which results in mechanical stability, this makes it more secure than other organs, e.g., against postmortem changes. Finally, sampling from sternum can easily be performed in larger amounts, easily accessible in routine autopsies, without changing the structure of the corpse in a relevant way.

The goal of this preliminary study is to demonstrate the presence of bone marrow postmortem activated cells in various causes of death as well as to analyze, for the first time in the literature, the sternum as the most important site for studying cells of such lymphoid organ in cadavers.

Bone Marrow, Postmortem, Immunology

G32 2009 H1N1 Fatalities: The New Mexico Experience

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After attending this presentation, attendees will be able to describe the clinical and epidemiologic features associated with H1N1 fatalities, recognize the spectrum of histologic features that can be seen in H1N1 fatalities gain a familiarity with laboratory diagnostic options in cases of suspected H1N1, and recognize the importance of the autopsy in tracking the epidemiology of infectious disease.

This presentation will impact the forensic science community by raising awareness of which subgroups have greater H1N1 influenza mortality risk, and therefore may benefit from early antiviral treatment. It will also illustrate that H1N1 fatalities with a relatively rapid disease course may have far subtler respiratory histologic findings than those of previously published studies.

Hypothesis: New Mexico is an ethnically and racially diverse state with a large Native American population, among others. It is hypothesized that this population heterogeneity may predict a similar diversity of clinical and pathologic findings in 2009 New Mexico H1N1 fatalities.

Methods: A retrospective review of hospital, laboratory, field investigative, and autopsy reports of all H1N1 positive influenza fatalities reported to the New Mexico Department of Health in 2009 was performed. In those cases in which autopsies were performed, all available microscopic slide sections were independently reviewed by a study pathologist. All respiratory sections were additionally reviewed by a study pathologist with pulmonary pathology expertise.

Results: There were 52 H1N1 deaths reported to the New Mexico Department of Health in 2009: of these, 14 were autopsied. In two autopsied cases, H1N1 infection was determined to not be the cause of death. These cases were excluded from further study. In 3 out of 12 autopsied cases, the diagnosis of H1N1 influenza was made via antemortem studies, while in 9 out of 12 cases it was made at autopsy via reverse-transcriptase PCR on nasopharyngeal specimens +/- viral

nasopharyngeal/lung cultures. The most common respiratory histologic findings were alveolar edema (75%), interstitial inflammation (100%), bronchitis/bronchiolitis (83.3%), tracheitis (87.5%), and bronchopneumonia (66.7%). Of the total autopsied and non-autopsied fatalities, race/ethnicity was 42% Hispanic, 36% Caucasian, and 22% Native American. Ages ranged from 2 months – 89 years, with peaks in the 40 (18%) and 50 (26%) year decades.

Conclusions: This study highlights the importance of the autopsy in tracking the epidemiology of infectious disease: in 9/12 (75%) cases, H1N1 influenza was not known to be the cause of death until after autopsy. Most other studies of H1N1 pulmonary histopathology report diffuse alveolar damage (DAD) in the majority of autopsied fatalities (74%-100%). In this series, only 2 out of 12 (16.7%) cases manifested DAD. Also, the majority had a relatively rapid disease course: time from onset of symptoms to death in autopsied cases ranged from 1-12 d (avg 3.5 d) vs. the other largest published series' range of 2-44 d (median 7 d). These findings may indicate that New Mexico H1N1 influenza fatalities generally did not survive long enough to develop the more classic pulmonary manifestations. Native Americans comprised 2 out of 12 (16.7%) of autopsied fatalities and 9 out of 38 (23.7%) of non-autopsied fatalities. As the overall New Mexico population is only 9.6% Native American, Native Americans are disproportionately represented among the 2009 NM H1N1 fatalities.

H1N1, Influenza, Autopsy

G33 The Potential Use of Aquatic Invertebrate for Postmortem Submersion Interval (PMSI) Determination

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After attending this presentation, attendees will understand that in cases in which a human body is found in aquatic environments, careful aquatic scenes investigation, review of medical records, complete autopsy with skeletal survey, marine biology, and taphonomy testing are required.

This presentation will impact the forensic science community by emphasizing the fact that although estimating postmortem interval in terrestrial environments are standardized and widely accepted in courts of law, estimating immersion interval in aquatic environments are largely unexplored. The Postmortem Submersion Interval (PMSI) in aqueous environments refers to the time period from when the body enters the water to the point of discovery, noting that the body may be totally submerged for all or part of the time period. Understanding the growth phases of aquatic plants and animals that attach themselves to submerged remains is particularly valuable information and can be used to estimate a minimum PMSI.

A case of an adult human body discovered on an Ionian coast (South Italy) in February 2009, whose soft parts were converted into adipocere with partial skeletonization and disarticulation and showed the presence of barnacle stratification on bone surfaces is presented.

Barnacles specimens collected from bone surface consisted of a body divided into two regions: (1) the peduncle (stalk); and, (2) the capitulum. The peduncle is fleshy, large, and long, and it attaches to the substrate using the first antennae. The body is compressed laterally, covered by two folds of mantle, where five thin calcareous plates are attached. The carina is a dorsal unpaired plate, which forms a central keel. Paired scuta are large, and are located at the anterior region of the body. Paired terga are short and are located at the posterior-most region

of the body. Six pairs of thoracic, biramous cirri bordered with chaetae are visible through an aperture present in the mantle cavity. In the mantle cavity, there is a short head, a thorax with six thoracic, biramous limbs, a mouth, and a long, setose penis. The length of pedunculated barnacles ranged between 0.7 and 2 cm.

These barnacles belong to the family of Lepadidae, genus *Lepas*, species *Lepas anatifera*, order pedunculate barnacles.

The *Lepas anatifera* live in tropical and subtropical waters, and after attachment to the substrate is increased by an average of 1mm/die in seabed with temperatures between 15°C and 30°C. The growth of the barnacle is blocked at temperatures below 15°C or above 30°C.

Therefore stratification found on the surface of long bones of the lower limbs of *Lepas anatifera*, require at least 20-30 days at water temperatures between 15 °C to 30° C for achieving the maximum size observed in this case (2 cm).

The average temperature estimated in the Ionian Sea in February 2009 was 10.7°C, so it can be assumed that seawater temperature along the Ionian coast drops below 15 degrees for November-March. Hence, in November 2008 the corpse was already skeletonized and already converted into adipocere since the colonization of barnacles was already present on skeletonized limbs. This data suggested the amount of time the body was in standing water was at least six months/one year prior to attachment barnacles (October 2008) and, as a consequence, the range of immersion was identified in a period between October and November 2007 and March/April 2008.

The use of aquatic invertebrate in this case suggests a new avenue of basic research that forensic investigators can apply to cases involving submersed and/or floating human remains. In fact, the study of biology of aquatic invertebrates along with a timeframe of decomposition in the aquatic environments, can provide important clues on the length of soak time, however influenced by a high number of variables can potentially influence this process (e.g., temperature, water depth, currents, tides, season, dissolved oxygen, debris, substrate type, salinity, acidity, interactions between chemical and physical processes, and micro and macrofauna activity).

Adipocere, Marine Biology, Barnacle

G34 Epidemic Outbreak of Meningococcal Meningitis in a Nursery: Two Fatal Cases of Waterhouse-Friderichsen Syndrome

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The goal of this presentation is to focus on two fatal cases of undiagnosed meningitis occurring simultaneously in two children from the same nursery. A forensic approach by means of autopsy, microscopic examination, and microbiological studies led to the conclusion that the cause of death in both infants was septic shock due to meningococcal meningitis in association with hemorrhagic adrenalitis.

This presentation will impact the forensic science community by demonstrating how important a thorough forensic investigation is to reach the correct postmortem diagnosis, as well as, by showing how rapidly children can develop a fatal meningococcal infection as well as explaining the importance of an early clinical diagnosis in order to avoid unexpected death and epidemic outbreaks.

Waterhouse-Friderichsen syndrome (WFS), first described in the early 1900s in England and Denmark, is the most severe form of meningococcal septicemia. The infection leads to massive hemorrhage in one or usually both adrenal glands. It is most commonly caused by *Neisseria meningitidis* (NM) but many other species of bacteria and also viruses are associated with WFS.

The onset of a meningococcal infection is non-specific with symptoms of fever, rigor, vomiting, and headache. Soon a rash appears; first macular, then rapidly becoming petechial and purpuric. In most cases the resulting hypotension rapidly leads to septic shock. In WFS, meningitis generally does not occur but if present, many clinical signs can be found such as hypoglycemia with hyponatraemia and hyperkalemia, thrombocytopenia and typical markers of diffuse intravascular coagulation.

Only microbiological studies can lead to the final diagnosis through culturing of blood or cerebrospinal fluid (CSF).

Fulminate meningococcemia is a medical emergency and needs to be treated with adequate antibiotics as fast as possible, also in order to prevent an epidemic outbreak. The administration of corticosteroids can sometimes reverse the adrenal shock.

Case 1: A 21-month-old child, previously in good health, developed high fever (40°C) on a Sunday morning. Paracetamol was administered twice during the day but both times with a low response. Few hours after the onset of the fever, the child began to vomit. In the evening the parents noticed a red\black “purpura” on the abdomen and the back. However, at the time, the child seemed to feel better, ate with a good appetite, and was afterward sleeping normally. Early the next morning the father found him lifeless in his bed.

Case 2: A healthy 19-month-old child, later discovered to be taken care of in the same nursery as the previous child, had a very similar clinical history. On the same Sunday afternoon, he developed high fever (39°C) and was treated with paracetamol but with a weak response. The next morning, after a normal night's sleep, he suddenly started to vomit and became cyanotic. The parents immediately called an ambulance but the baby died on the way to the hospital.

Complete postmortem autopsy of both children were performed 24 hours after death. Gross examinations revealed that they were age-accordingly developed. They were covered with purple petechial spots all over the body but no other remarkable external findings were observed.

Autopsies showed cerebral oedema and venous congestion, diffuse whitish and milky subpial exudation, adrenal glands with massive hemorrhagic infiltration of the parenchyma, and polyvisceral stasis. No other significant abnormalities were found.

The macroscopic appearance led to the suspicion of meningeal infection and hence, CSF, buccal, pharyngeal, and nasal swabs, as well as blood samples were taken for microbiological studies. These showed NM DNA positive for NM serotype B. Furthermore, all samples were culture positive after 72 hours of incubation. No other pathogenic agents were present.

The microscopic histological study, performed by using formalin-fixed paraffin embedded tissue sectioned at 4 µm and stained with haematoxylin-eosin, revealed subpial and cortical oedema, mild inflammatory infiltration along penetrating, deep brain vessels. The adrenal glands showed massive hemorrhagic infiltration, the lungs focal oedema, and there was polyvisceral stasis.

In conclusion, two infants died one shortly after the other 72 hours after they had last been in the same nursery and 24 hours after the onset of their symptoms. In both cases, a multidisciplinary approach revealed the cause of death to be septic shock due to acute meningococcal infection with hemorrhagic adrenalitis (Waterhouse-Friderichsen Syndrome).

Waterhouse-Friderichsen Syndrome, Epidemic Outbreak, Forensic Diagnosis

G35 Postmortem Animal Injuries: A Forensic Pathologist's Perspective

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After attending this presentation, attendees, will become aware of how traumatic injuries, especially those arising after suspicion of assault, could be instead, inflicted by local fauna where the body was found.

This presentation will impact the forensic science community by showing several cases involving postmortem traumatic lesions produced by different animals, which can lead to misdiagnosis, since they may resemble, inflicted and non-inflicted antemortem lesions. Therefore, postmortem animal injuries must always be taken in consideration by forensic pathologists, with the objective of avoiding mistakes in the initial investigation and further autopsy conclusions.

Postmortem animal predation on human death bodies is an important taphonomic phenomenon in forensic pathology, since animals, depending on their size and environment (land, water, or air), can produce a great variety of lesions. These type of animal injuries can be produced during early and/or late postmortem period creating some forensic implications and difficulties, including: (1) mimicking antemortem lesions, particularly when they are produced shortly after death; (2) modifying antemortem injuries, with loss of identifying features, which may lead to interpretation problems; and, (3) mistaken for signs of assault due to differential diagnostic problems.

This study presents several cases of postmortem injuries produced by animals from different environments, including ants, cats, dogs, sea and river fauna with the corpses being found indoors (home) or outdoors (forest, sea marine and river). The postmortem animal lesions didn't show any vital signs and the majority were located in unprotected body extremities, like face, upper and lower limbs. In these cases, autopsy findings allowed to identify both natural and violent causes of death, including two cases of asphyxia by drowning.

In conclusion, cases like those presented, illustrate that forensic pathologists need to have specific and especially attention when postmortem animal injuries may be present. Apart from the crime scene investigation and the autopsy procedure, it is essential that the pathologist: (1) have knowledge of local fauna, in particular from his own geographic area in order to better understand characteristic injury patterns produced by different animals; (2) always make a careful and detailed examination of the traumatic lesions, including morphological features and topographical distribution, so an accurate trauma etiology diagnosis can be done; and, (3) make a correct differential diagnosis which may clarify between antemortem and postmortem lesions.

Forensic Pathology, Postmortem Injuries, Animal Predation

G36 Neck Findings in Hanging and Strangulation Cases That Underwent Autopsy in Adana, Turkey

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The goal of this presentation is to demonstrate the neck findings in hanging and strangulation cases.

This presentation will impact the forensic science community by presenting macro-morphological findings in hanging and strangulation cases during the autopsy performance.

Deaths due to the mechanical forces applied to the neck area are frequently encountered in forensic medicine practices. Among these, hanging accounts for the majority of the forensic cases. It is seen in the majority of the studies performed in various regions of the world that hanging is the leading method of suicide. Strangulation cases are also seen though not common. The origin of the event is sometimes suspicious in the case where the crime scene has been altered, or in the case that the corpses had been pulled down or had fallen down because the string had broken.

In these cases, different problems may be in question and the direction of the inquest may change. Regarding the frequently encountered death cases due to the mechanical forces applied to the neck area caused by the above mentioned reasons, assessment and interpretation of the neck findings have important place for the forensic medicine. The consistency of these findings with the inquest and the information about the crime scene, as well as the method used and the presence, type, and characteristic of the traumatic findings in the neck area gain special importance. Fracture in the bone and cartilage tissues of this area and hemorrhage into the soft tissues are of great importance for the diagnosis as well as for the etiology to be exposed. These lesions are considered the indicators of a mechanical force applied to this area. Therefore, forensic medicine specialists carefully examine the neck during autopsies, remove the hyoid bone and thyroid cartilage, and completely evaluate. This present study was conducted in Adana province that is located in South Turkey, has a population of 2.5 million with high rate of unemployed subjects, and is exposed to high rate of internal migration because of extensive land available for agriculture. The records of the autopsies performed at the Group Presidency of Adana Institute of Forensic Medicine (IFM) between the years 2008 and 2009 were retrospectively reviewed. One-hundred and seventy cases (6.2%) that were assessed to have died due to a mechanical force (hanging or strangulation) were included in the study among 2,726 cases. Of the cases, 159 died of hanging and 11 died of strangulation. It was determined that 104 of the cases (61.2%) were male and 66 were female, hanging accounted for 93.5% and strangulation accounted for 6.5%, all of the hangings were suicidal, whereas the strangulations were murder. The age of the cases ranged between 4 and 86 years; the majority of the cases (n=37, 21.7%) were between 21 and 30 years of age, whereas 32 cases were between 11 and 20 years of age. It was determined that two girls between the ages 0 and 10 years died of strangulation. It was observed that 121 of the hanging cases were typical (the node was behind the neck), whereas 38 were atypical. Thyroid cartilage fracture was determined in 43 cases (25.3%) from hanging and strangulation, whereas hyoid bone fracture was determined in 25 cases (14.7%) and both thyroid cartilage fracture and hyoid bone fracture were determined in 11 cases (6.5%). Fracture or dislocation in cervical vertebra was observed in seven cases. A total of 86 cases (50.6%) had thyroid cartilage, hyoid bone, and cervical vertebra findings. It was determined that, 90 of the cases (52.9%) had hemorrhage into the soft tissues either with or without fracture and that 60 cases (35.3%) had no finding other than skin lesions. Both thyroid cartilage and hyoid bone fractures were observed in 2 cases (18.2%) died of strangulation, whereas only hyoid bone fracture was

observed in one case and hemorrhage into soft tissues was observed in five cases. It was determined that the neck findings were higher in hanging cases as compared to the strangulation cases. Toxicological analyses revealed that ethanol was present in 18 cases with a range 34mg/dl to 334mg/dl. This present study was performed to put forward the prevalence of neck findings in the hanging and strangulation cases that are frequently come across by the forensic medicine specialists, as well as to discuss the results with the information in the literature.

Hanging, Hyoid Fracture, Thyroid Fracture

G37 Evaluation of Cardiac Conduction System Pathologies in Sudden Deaths in Adana Region

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The goal of this presentation is to encourage the forensic pathologists in evaluating the cardiac conduction tissues in sudden death cases.

This presentation will impact the forensic science community by presenting the microscopical findings of the cardiac conduction tissues in sudden cardiac death cases.

A forensic pathologist is frequently asked to find the cause of death in cases of sudden unexpected deaths in adults. Approximately 50% of all medico-legal deaths are due to natural causes. Approximately 1-5% of all those cases remain as negative autopsies. Sudden cardiac death is usually defined as death from cardiac causes without apparent antecedent symptoms or within the first hour after onset of symptoms. Studies of morbidity and mortality related to cardiac disease estimate that there are between 300,000 and 400,000 sudden cardiac deaths annually in the United States. On the other hand, Turkey does not have a serial study of cardiac diseases as autopsy findings. Therefore, this preliminary study was planned. Examination of the cardiac conduction system is often looked upon as a last resort in the evaluation of a victim of sudden death. It is reasonable to conclude, then, that unfamiliarity with conduction system anatomy and pathology and lack of experience with the examination techniques are the true reasons for this reluctance, which is not surprising because many anatomic pathology and forensic medicine residents complete their training without learning about the cardiac conduction system. This lack of training is symptomatic of the ongoing decline of the autopsy as a teaching tool. Careful case selection for conduction system analysis, coupled with a sensible approach to dissection and histological sampling, will result in an increased yield of diagnostically specific, potentially lethal lesions with only a minimal increase in the expenditure of time or money.

Twenty-seven SUD and four known cause of death forensic cases had been chosen for this study. The autopsies held in the Morgue of the Adana Branch of the Turkish Forensic Medicine Council. The cardiac tissue and coronary artery samples were dissected as described by the CAP and the Cardiac Conduction System examined as already has been described by Cohle et al and Gulino Sam. Harris' H+E, Masson's Trichrome, Verhoeff's elastic Van Gieson and also for amiloidosis, Lieb's Crystal Violet stains had been used histochemicaly.

The 31 autopsy cases differed in age from age of 17 to 78 years with an average 41.7. Fifteen cases had serious atherosclerotic changes in the coronaries. In 13 cases there were infarctions. In this study cardiac conduction tissue pathologies in the 11 was revealed.

Serious fibrotic and remarkable adipose tissue changes in the SA and AV nodes were found. Many of the similar studies show parallel results with this study. The difference in between these serials can be explained by the difference of the countries, socio-cultural specifics, life conditions, environment, nutrition, and genetic variations. Hypoxic changes of the myocardial tissue may also cause conduction system pathologies. Myocardial infarctions were present in four of the SA nodes and two of the AV nodes of all cases. This is an important finding to understand and reveal the conduction system effects of the early and late myocardial infarctions. Amyloidosis was not found case in this serial. Any significant pathologic changes in any of the control cases was not noticed. In some of the SUD cases, the pathology is not morphological yet functional. Yet, still in some cardiac rhythm disturbances cases, some may find cardiac conduction tissue pathology histologically. The relationships between cardiac conduction tissue morphological pathologies and cardiac rhythm disturbances will only be demonstrated clearly by clinico-pathologic evaluations with in large serial studies.

Further study is needed of the cardiac conduction tissue on larger SUD serials, and to understand the pathologies and mechanisms of deaths in especially young SUD cases at our region and country. The findings in this model study are very important in demonstrating the young SUD cases and its relation with the conduction tissue pathologies. Therefore, examination of the cardiac conduction system can be a very useful adjunct to the examination of the heart in cases of sudden cardiac death especially in our region. Careful case selection, proper technique, and mindfulness of nonspecific findings or normal variants increase the likelihood of identifying abnormalities that may serve as the morphologic substrate for sudden cardiac death.

Sudden Cardiac Death, Conduction Tissue, Histochemistry

G38 A Peculiar Fatal Lightning Strike Inside a Cottage

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After attending this presentation, attendees will learn about a case of instantaneous death due to a peculiar form of lightning storm.

This presentation will impact the forensic science community by stressing the importance of crime scene investigation in order to assess real causes and means of death.

Lightning strike is a fascinating and unpredictable natural phenomenon with potentially devastating effects and represents one of the most common causes of deaths from environmental phenomena. The incidence of fatalities had been estimated in the United States to be around 150-300 cases/year (Duclos PJ et al, 1990), representing a third of all lightning strikes (Sheela SR et al, 2000).

Benjamin Franklin first demonstrated 200 years ago that lightning consists of a gigantic electrical discharge. The physical processes that take place in and around a thundercloud occur at the micro-particle level and at a much larger scale that involves the entire Earth as an electrical circuit. Lightning happens when the difference in voltage between a cloud and the ground or another object exceeds 2 million V/m. Afterwards, an arc occurs and there is the release of a great amount of electrical energy that can cause severe damage to organs, also resulting in high mortality (Copper MA et al, 2001).

The most vulnerable subjects for lightning strike are individuals who work in open fields such as farmers or swimmers; additionally, it is more rare for lightning to strike inside a building as in the case hereby presented.

The risk of being struck by lightning is also a function of population density and it comprises terrain features that may protect or not occupants of an area (Ritenour AE et al, 2008).

According to literature review, data appears to be significantly affected by underreporting when comparing Meteorological Offices to medical and death-certificate databases (Cherington M et al, 1999).

Five most common mechanism of injury were described: direct strike, ground current, flash discharge, contact strike, and blunt trauma.

A 53-year-old man started to renovate his own cottage after lunch. In the evening, receiving no answer from him, the family called the police. When they arrived, with the forensic pathologist, the scene investigation revealed the man lifeless lying on his right side between two metal sawhorses. The body was covered by burnt pieces of his working clothes. The man presented diffuse second, third, and fourth degree burns in several areas of the body but especially in the abdominal region, in the root of the thighs, and on his genitals.

There was complete carbonization of beard and hairs all over the body and the scalp. The surrounding environment showed no signs of burning. His working tools were scattered around and there was a generator that had been set up to perform the work. However, the firefighter technical assistant found no damage to the generator or electrical malfunction.

The Meteorological Office reported that in the same area, few hours before, there had been a thunderstorm. Moreover, another person had been simultaneously injured by a lightning strike while crossing a bridge in the same village.

The cottage presented a rudimentary system of walls containment with steel beams pointing from outside to the center of the premises through the roof. The beams might have played a decisive role in the conduction of an electrical atmospheric discharge. This was further facilitated in the room by the presence of metal working tools directed toward the ceiling.

All investigation data suggested that a lightning had entered into the cottage thorough the beams creating an arc in the point where the victim was working.

Necropsy and histological findings confirmed the suspicion of lightning strike.

In conclusion, a detailed analysis of crime scene investigation, environmental, and autopsy data led to the correct determination of the real nature of the suspicious death which could be related to other different causes which may also be not accidental.

Lightning Strike, Fatal Injury, Crime Scene Investigation

G39 Enterobacter Cloacae Peritonitis Secondary to Hemorrhagic Cystitis in a Long-Term Substance Abuser

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The goal of this presentation is to illustrate an unusual case of peritonitis caused by hemorrhagic cystitis.

This presentation will impact the forensic science community by illustrating the need for microbiological cultures and routine histology in cases of peritonitis where an obvious source or rupture site is not identified.

Introduction: The major causes of peritonitis are appendicitis, perforations associated with diverticulitis, peptic ulcers, gangrenous

gallbladder, gangrenous obstruction of the small bowel, incarcerated hernia, and volvulus. Peritonitis secondary to cystitis is a rare, life threatening condition due to the unique anatomic characteristics of the urinary tract. Predisposing factors include anatomic anomalies of the urinary tract, vascular impairment, previous surgery, irradiation and high virulence pathogens. Making a diagnosis of peritonitis due to cystitis is difficult and the prognosis is usually poor.

Materials and Methods: This case involves a 47-year-old African-American female with a long standing history of alcohol, heroin, and cocaine abuse, who was found dead in her secure apartment. According to witnesses, she experienced flu-like symptoms for the past few days. The examination of the scene revealed a cluttered and unkempt dwelling with numerous empty and full malt liquor cans. Dark colored stains were noted on the bed and the floor, and a bucket with vomitus was discovered near the deceased.

Results: Postmortem examination revealed a poorly nourished African-American female, weighing 102 pounds and measuring 65.5 inches (BMI – 16.5). Signs of prior drug abuse, i.e., multiple remote circular scars (“skin popping” sites), were noted on the upper and lower extremities. At autopsy, the abdominal cavity contained 500 cc of serous fluid. Fibrinous exudate was observed on the dusky red small and large intestines. The urinary bladder contained 20 cc of dark-brown blood and exhibited a markedly thickened, hemorrhagic mucosal surface. No gross perforation was identified.

Microscopic examination revealed severe full thickness acute and chronic inflammation, focal hemorrhage, and necrosis of the urinary bladder. Both kidneys displayed acute tubulointerstitial nephritis.

Peritoneal fluid and urine cultures grew *Enterobacter Cloacae*. Postmortem toxicology was positive for Ethanol (0.011% in the blood; 0.020% in the vitreous fluid).

No other pathologic abnormalities or trauma were identified during the autopsy.

Conclusion: Secondary peritonitis follows contamination of the peritoneum by organisms released from the infected organs or perforated viscera. Peritonitis due to acute cystitis is a rare occurrence with only a handful of reports published in the medical literature. Most of the cases involved gangrenous inflammation of the urinary bladder with or without perforation.

In this case, integrity of the bladder wall was preserved. The significant amount of blood in the bladder cavity and severe acute transmural inflammation with hemorrhage and focal necrosis supported the diagnoses of hemorrhagic cystitis.

Hemorrhagic cystitis results from damage of the transitional epithelium and blood vessels by infection (bacteria, viruses) and non-infection etiologies (drugs, toxins, radiation). In this case, *Enterobacter Cloacae* colonies were isolated from urine and peritoneal fluid. It is worth noting, that in adults *Enterobacter* affects individuals with underlying physical or structural anomalies, metabolic disorders or immunodeficiency causing complicated urinary tract infections. *Enterobacter* comprises 1.9% to 9.6% of all UTI pathogens.

The past history of the deceased played an important role in the evolution of what started as an innocent urinary tract infection (UTI) to a fatal condition. A number of studies have shown that drugs of abuse, including cocaine, opiates, and alcohol, alter not only neuropsychological and pathophysiological responses of individuals but also immune functions. This decedent's extensive history of polysubstance abuse and malnutrition (BMI of 16.5; normal 18-24) apparently caused severe debilitation of the immune system with rapidly progressive infection and the resultant grim outcome.

Peritonitis, Hemorrhagic Cystitis, Cocaine User

G40 Two Suicidal Deaths From Head Injuries Caused by Unusual Sharp Force Instruments and Review of the Literature

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After attending this presentation, attendees will become familiar with unusual penetrating sharp force wounds of the head, the external wounds and wound types produced, and internal wound trauma created.

This presentation will impact the forensic science community by reporting the first suicidal death by a meat thermometer to the head and by reviewing the literature of other sharp force penetrating suicidal wounds that have resulted in death.

Deaths due to sharp force penetrating wounds of the head are uncommon due to the thickness of the cranium and the difficulty of penetration to the brain. Even with brain penetration, individuals may survive with or without neurological deficits. These types of injuries are most often self-inflicted but homicide must be considered especially if the injury implementing instrument is no longer present in the wound.

Two unusual suicidal deaths due to penetrating head injuries will be presented. One case is that of a 44-year-old man who had previously served time in prison for second degree murder. He was at his residence when law enforcement officers arrived in order to arrest him on new molestation charges. They received no response after knocking at the door. Another resident arrived and entered the residence. The police remained outside of the dwelling. She found the man, unresponsive but still breathing, lying on the bed with a meat thermometer impaled into the right temple area of his head. Survival time was 26 hours but non-survivability was determined within the first few hours of the hospital stay following the CT scans. The thermometer was left in place until autopsy. Postmortem radiograph revealed the thermometer traversed the majority of the right side of the skull and brain. Autopsy revealed a 1/8" round puncture/stab wound on the right temple following removal of the thermometer. The right temporal lobe and basal forebrain were lacerated with massive hemorrhage of the basal forebrain with extension into the ventricular system. A laceration of a dural blood vessel, basilar subarachnoid hemorrhage, focal epidural hemorrhage, and cerebral edema at the entrance defect were also noted. Postmortem toxicology for ethanol and drugs was negative.

The second case was that of a 47-year-old man with a history of schizophrenia. He had been to many doctors in the past trying to “get the wires out of his head.” After a request was made by his parents for a welfare check, police found him in his secure residence in his bathtub filled halfway with water mixed with blood. The shower curtain was pulled from the wall and located partially beneath the decedent. On the sink was a plugged in electrical drill with an attached 1-1/2" hole saw drill bit with skin and hair in the teeth. On the top of the head was a roughly circular scalp defect and underlying 1-1/2" circular skull injury with central 1/4" drill hole. Blood spatter on the walls indicated the decedent likely stood in front of the mirror at the sink while inserting the drill into his head and prior to collapsing into the tub. Drug paraphernalia was present at the scene and postmortem toxicology was positive for morphine.

In addition to these cases, a review of the literature will evaluate other unusual cases of penetrating injury of the head with special focus on the regions of the brain and skull injured and the survivability of the injuries.

Heat Thermometer, Electric Drill, Suicide

G41 Iatrogenic Laceration of a Pulmonary Angiomatoid Lesion: Fatal Complication or Medical Error?

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After attending this presentation, attendees will understand the iatrogenic lesion.

This presentation will impact the forensic science community by stressing the importance of performing histological examination in any iatrogenic deaths to recognize underlying diseases and their eventual causal role in determining the fatality.

Percutaneous tube thoracostomy is a standard therapy for a number of pulmonary disorders. Even if it remains the most widely performed procedure to manage blunt or penetrating chest traumatism, and it is generally considered a simple procedure, this life-saving maneuver can be frequently associated with several complications, such as lung or heart perforations, arterial or venous injuries, neurological dysfunctions, injuries to the oesophagus, phrenic nerve and abdominal organs, bronchocutaneous fistula, and perforations of the mediastinal pleura with subsequent contralateral pneumothorax.

A case of a 76-year-old man, admitted to a peripheral hospital after a car accident, presenting bilateral flail chest, and subcutaneous emphysema is presented. Bilateral chest tubes were placed between the anterior and the mid-axillary lines. On the 3rd and 9th day of hospitalization the patient underwent surgical stabilization of bilateral flail chest with Kirshner wires and metal plates. The postoperative recovery was characterized by multiple recurrences of pneumothorax and subcutaneous emphysema with oxygen desaturation. For these reasons several bilateral drains were inserted with the trocar technique, the last one on the 25th day of hospitalization. A control CT scan showed that the tip of the chest tube, inserted between the anterior and the mid-axillary line, was located in the parenchyma of the left lung. Immediately after the withdrawal of the drainage tube the patient became unstable with low blood pressure and tachycardia, and was intubated with a double-lumen tracheal device. A fibrobronchoscopy performed through the tracheal tube revealed profuse hemorrhagic secretions. Because of the severe clinical conditions, the patient was transferred to our hospital where, despite multiple blood transfusions, he arrived pulseless and died after 60 minutes of cardiopulmonary resuscitation.

At autopsy the victim was found to be affected by an extensive hemotorax resulting from the laceration of a dilated vessel on the anterior surface of the inferior lobe of the left lung. Histology revealed that the vessel consisted of an "angiomatoid lesion," the distal component of a plexiform complex, the hallmark of plexogenic pulmonary arteriopathy, an idiopathic disease that may accompany primary pulmonary hypertension.

The risk of lung perforation during tube thoracostomy depends on several factors related to the patient (pulmonary contusion, pleural adhesion, adult respiratory distress syndrome, age above 60, mechanical ventilation) or to the method used for the insertion of the chest tube. Particularly, lung perforations have been reported more frequently with the trocar technique, where the insertion is determined by a metal rod projecting slightly from the tip of the tube, rather than the blunt dissection technique, where the penetration of the tube through the chest wall is prepared with a Kelley clamp.

In the reported case, even if the trocar insertion procedure was performed correctly, the penetration of the metal rod into the lung parenchyma produced a tear of a sub-pleural angiomatoid lesion. Initially the catheter blocked the blood flow through the iatrogenic

injury, but its removal generated a profuse and extensive bleeding into the pleural space.

The treatment of choice in such cases is an emergency resuscitative thoracotomy, defined as a thoracotomy performed immediately in the emergency room/department or in the operating room, because it enables a fast identification and suture of the vascular injury. However, when huge and dilated vessels are lacerated with subsequent extensive pleural hemorrhage (as in the reported case), the outcome is very poor. Thus, the most important thing is to prevent similar emergency conditions by choosing the blunt dissection technique instead of the more dangerous trocar insertion method, particularly in patients affected by adult respiratory distress syndrome or pulmonary hypertension that show an increased incidence of peripheral venous ectasias.

It is believed that the case could be of interest for the forensic community not only for the singularity of the reported lesion, but also for underlining once again the importance of performing histological examination in any iatrogenic deaths to recognize underlying diseases and their eventual causal role in determining the fatality.

Forensic Pathology, Angiomatoid Lesion, Iatrogenic Death

G42 Pedestrian Fatalities in Maryland: How Many, Who, When, Where, Why, How, and Ways to Prevent Them

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After attending this presentation, attendees will have a clear picture of the characteristics of pedestrian fatalities in Maryland. The presentation includes social, geographic, medical, and traffic related data from the previous five years.

This presentation will impact the forensic science community by discussing how understanding the nature and causes of a problem in its totality (in this case pedestrian deaths in an entire state), is the first step in correcting it. This presentation will suggest implementations for reducing the rate of fatal pedestrian accidents in the State.

How Many: In the last five years, a total of 400 pedestrian fatalities were studied at the State of Maryland Office of the Chief Medical Examiner (OCME). The majority of the cases had a complete postmortem examination (97.5 %), with toxicologic analysis (for the presence of volatiles in 99% and drugs screening performed in 92%).

Who: The majority of the victims were male (69.5%), aged 1 to 89 years (mean and standard deviation: 43.9 and 19.9 respectively). 179 individuals (44.8%) were African-American, 168 (42%) Caucasian, 36 (9%) Hispanic, 10 (2.5) Asian, and 7 (1.7%) belonged to other racial/ethnic groups. More than half of the victims (54.3%) were transported to the hospital before they were pronounced dead (data is skewed due to a few cases with long survival; median survival of 59 minutes, mean of 34.6 days), and 181 individuals (45.2%) were pronounced at the scene (15.6 minutes after the accident on average; median of 7 minutes). Another individual died at home three and a half days following the accident, and another at a nursing home, three months after the accident.

How: Most (more than 90%) events were witnessed and had a single vehicle involved. The impacting vehicle was recorded in 339 cases (85%), 181 (53.4%) were passenger cars, 62 (18.3%) SUVs, 28 (8.3%) pick-up trucks, 25 (7.4%) vans, 22 (6.5%) other trucks, 9 (2.6%) buses, 8 (2.4%) trains, 3 (0.8%) motorcycles and 1 (0.2%) was a bicycle. The manner of death in the majority of the death certificates were listed as accident (98.3%); there were 2 homicides, 3 suicides, and 2 deaths were undetermined. The cause of death was listed as: multiple injuries in 349 cases (87.3%), head or head and neck injuries only in 27 cases (6.8%), and complications of multiple injuries in 14 cases (4 %), with a variety of other causes listed in the remaining 10 cases. Ethanol in blood

was positive in 146 cases (36.7%) with a mean concentration of 0.16% (+/- 0.09; range: 0.01 to 0.39%). Toxicologic screening for drugs was positive in 107 cases; 28 individuals (7%) had narcotics in blood (12 morphine, 8 methadone, 5 tramadol, and 3 oxycodone), 21 (5.1%) cocaine or cocaine metabolites, and 6 (1.5%) had PCP.

When: In the five years studied, there was no clear change in the incidence rate. The highest incidence was found in December (12% of all cases), and November (11.75%), and the lowest in January (5.7%) and July (6.5%). Saturday (19.7%) and Friday (17%) had rates up to 1.8 times higher than Thursday (9.3%) or Tuesday. The majority of the accidents occurred at night (70.3%), 6.2% happened at dusk, 4.5% at dawn, and 19% during the day light.

Where: Graphical representation of the location of incidents throughout the State is provided. Location was also classified according to road type and presence or absence of traffic signals at intersections.

Why: Attempts to determine possible causes for the accident were made. Detailed examination of the incident description, police report, and in some cases complete accident reconstruction specified which was the party at fault (whether the pedestrian or the driver of the motor vehicle), weather conditions, light, etc.

Conclusion: Nearly 100 pedestrians die each year in Maryland. Possible ways to prevent or decrease the rate are provided based on the data collected in the prior five years.

Pedestrian Fatalities, Who, Prevention

G43 Sudden Cardiac Death in an Athlete: A Case Report

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After attending this presentation, attendees will learn of a case showing unusual cardiac cause of sudden death in an athlete, including arrhythmogenic right ventricular cardiomyopathy (ARVC), and coronary artery disease (CAD) after chronic cocaine use.

This presentation will impact the forensic science community by revealing various histological cardiac lesions observed after a sudden death in a retired doping athlete.

Cardiovascular diseases represent the most frequent causes of sudden death in athletes, including hypertrophic cardiomyopathy, anomalous coronary artery anatomy, arrhythmogenic right ventricular cardiomyopathy, and aortic aneurysm. Disorder of cardiac rhythm and stenosis of the coronary arteries are physiopathological mechanisms that can explain cardiac arrest.

This case involved a 36-year-old man who was a two-time world champion while he was cocaine-dependant. He participated in triathlons after his career as a recreational sport without taking cocaine. He had neither medical history nor cardiovascular risk factor except tobacco. He died suddenly during sleep. A complete postmortem examination was performed. The descendant was 172 cm tall and weighed 77 kg (BMI 26). The autopsy showed several cardiac lesions:

- A cardiomegaly (520g) with a symmetric left ventricular hypertrophy usually expected in elite athlete; there was no dilatation and no architectural disorganization.
- An epicardial coronary stenosis of the left anterior descending artery and the first diagonal branch (80-90%) with recent thrombosis on the surface of an atheromatous plaque; there is no acute myocardial infarction.
- Several areas of fibrosis in left ventricular, resulting from an ancient ischemia.

- Limited right ventricular hypertrophy with replacement of the myocardium by fibrofatty tissue in restricted expanse, which is a feature of ARVC.

Those findings allow the conclusion that rhythm disorder caused death. The association of ARVC and CAD in athlete is really unusual.

Arrhythmogenic right ventricular cardiomyopathy is a myocardial disease characterized by fibrofatty replacement and ventricular arrhythmias. ARVC is a hereditary disease with autosomal dominant transmission in at least 50% of cases. It occurs specifically in athletes and affects predominantly men. The prevalence in the general population varies between 1 in 1,000 to 1 in 5,000. Diagnosis rests on criteria including signs such as severe segmental dilatation of the right ventricle and fibrofatty replacement of myocardium on endomyocardial biopsy for example. This disease leads to sudden death by ventricular arrhythmias.

Atherosclerotic disease is primarily responsible for sudden death in athletes older than 35 years. Traditional markers of CAD are widely known, like hypertension, obesity, smoking, diabetes, and lipid abnormalities. Cardiac effects of cocaine chronic abuse also exist. It is associated with CAD by multiple pathogenic mechanisms: elevation in blood pressure, acceleration of atherosclerosis, increase of thrombosis risk by activating platelets, and vasoconstriction.

To conclude, this case report brings to light unusual arrhythmogenic factor leading to sudden death in athlete.

Sudden Death, Athlete, Arrhythmogenic Right Ventricular Cardiomyopathy

G44 Myocarditis With Giant Cells in an Infant: A Case Report and Review of the Literature

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After attending this presentation, attendees will be able to recognize the various entities associated with myocarditis with giant cells, most notably idiopathic giant cell myocarditis, and its clinico-pathologic features.

This presentation will impact the forensic science community by highlighting a case of an uncommon disease entity which is commonly fatal, and generally affects young, healthy adults, but can also affect the pediatric population.

The subject was a 26-day-old, Asian female infant born at 31 weeks gestation with no complications at birth. While under the care of her parents, she vomited once and then was reported to be feeding poorly. She was taken to her pediatrician's office where she was "sick appearing." In the clinician's office she became unresponsive, was subsequently admitted to the nearest hospital, and died within four hours. Family history included a "head cold" in an older sibling and her mother was believed to suffer from an autoimmune-type disease which was undiagnosed.

At autopsy, the subject's growth parameters were between the 10th to 90th percentiles when corrected for prematurity, her skin was free of rashes, and her abdomen was distended. Within the abdominal cavity, there was 60 cc of ascites. The lungs were congested and heavy with a combined weight of 53 grams. The heart weighed 16 grams; it was normally formed, and had a probe patent ductus arteriosus. Externally, the epicardium of the heart was mottled pale tan to erythematous. Cut sections of the myocardium were equally mottled. The other major organs were appropriate weights and unremarkable for an infant of her age. No lymphadenopathy was identified. Blood cultures obtained from the hospital and at autopsy were negative. Toxicology and vitreous electrolytes were unremarkable.

Histological sections of the heart revealed patchy myocyte necrosis with mononuclear cells, a prominent collection of eosinophils, and scattered multinucleate giant cells. No granulomas were identified. The

intramyocardial vessels and epicardial fat were free of inflammation. Histological sections of the other organs were free of granulomatous inflammation, viral cytopathic effect, or vasculitis.

Myocarditis with giant cells is seen in association with many recognized entities including tuberculosis, fungal infections, rheumatic myocarditis, measles, syphilis, foreign body reaction, Wegener's granulomatosis, hypersensitivity reaction, and sarcoidosis. Idiopathic giant cell myocarditis is as the name implies a myocarditis with giant cells, but of unknown etiology. It is a rare, but commonly fatal form of myocarditis which has been recognized since the beginning of the 20th century. This disease generally affects previously healthy, young adults (mean age 42 years); however, approximately 16 cases have been reported in the pediatric population. The youngest to date was 6-weeks-of-age; however, the majority of reported pediatric patients are teenagers. Symptoms generally are due to congestive heart failure, although numerous other symptoms have been reported including sudden death and palpitations. Diagnosis has classically been made at autopsy, although, the disease is being diagnosed by endomyocardial biopsy and following cardiac transplant. Gross identification of the disease ranges from "normal" to serpiginous areas of myocardial necrosis. Histology demonstrates myocyte necrosis, with lymphoplasmacytic inflammation with eosinophils and multinucleate giant cells. While the disease generally affects previously healthy people, approximately 20% of patients have immunologic disorders including inflammatory bowel disease, optic myocytis, thyroid disorders, systemic lupus erythematosus, Takayasu's arteritis, myasthenia gravis as well as others. The most successful treatment consists of cardiac transplantation with immunosuppression. Giant cell myocarditis has, however, been known to recur post-cardiac transplant at a rate of 20-25%. Without treatment, the average survival time from diagnosis to either death or cardiac transplantation is 5.5 months.

Based on the history including no known exposure to any drugs, maternal history of an autoimmune disease, and following review of the histology and other studies, the cause of death of this infant is due to idiopathic giant cell myocarditis. Based on the literature review, this is the youngest reported patient with the disease.

Myocarditis, Heart Failure, Sudden Death in Infants

G45 Massive Systemic Fat Embolism Detected by Postmortem Imaging and Biopsy

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After attending this presentation the participants will learn about systemic fat embolism and the characteristic image features of systemic fat embolism on pre-autopsy computed tomography compared to autopsy and histopathological findings.

This presentation will impact the forensic science community by raising awareness of the feasibility to detect systemic fat embolism on postmortem computed tomography prior to autopsy. Finding on computed tomography were significant and serve as quality improvement to forensic procedures.

Purpose: The purpose of our case study is to describe the findings of lethal systemic fat embolism (FE) on postmortem unenhanced computed tomography (PMCT), PMCT-Angiography (PMCTA), and image-guided lung biopsy, with correlation to conventional autopsy and histopathology.

Materials and methods: An 89-year-old woman with traumatic femoral neck fracture died due to cardiac arrest during implantation of a cemented total hip prosthesis. The patient was under long-term anticoagulation for atrial arrhythmia. In the course of the hip trauma, anticoagulation had to be stopped and antidote (vitamine K) was

administered. No disorder of lipid metabolism or transport or renal failure was known. The body underwent whole-body PMCT (Somatom Emotion 6, Siemens, Erlangen, Germany) with subsequent cannulation via an unilateral inguinal incision and contrast application by a modified heart-lung machine. PMCTA was then performed with an arterial and venous injection. The body was moved from the supine to prone position to improve filling of nondependant vessels. After PMCT and PMCTA, image-guided biopsy of the lung was obtained. The harvested specimens were stained to detect fat embolism.

Results: Unenhanced PMCT revealed a distinct fat level on top of sedimented layers of corporcular blood particles and serum in the systemic arterial system and the pulmonary trunk. This finding was measured (Hounsfield Unit) and compared to possible small position-dependent air embolism and evaluated as negative. PMCTA showed no clotting suggesting pulmonary thrombembolism. The triple layered intravascular finding was reproducible after PMCTA and after turning of the corpse. Autopsy showed no evidence of patency of the foramen ovale that would account for paradoxical embolism. In addition, there were no autopsy findings other than fatal fat embolism that were relevant to the cause of death. There were no petechial rash or kidney changes visible. There was no evidence for cholesterol embolism, e.g. triggered by anticoagulation. Both image-guided biopsy and histopathological specimens confirmed the findings of PMCT/PMCTA demonstrating severe FE (Grade IV).

Conclusion: PMCT/PMCTA established the cause of death as systemic fatal FE. It is believed that this is the first description of these unusual systemic imaging findings in the postmortem setting. Autopsy and histopathological specimens validated imaging and biopsy findings.

Fat Embolism, Postmortem Computed Tomography, CT

G46 Radiocarbon and Stable Isotope Results of Fingernails of Breastfed Mother-Infant Pairs to Investigate Deviation of Year-of-Birth Determinations Due to Diet

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The goal of this presentation is to find a possible explanation to justify outliers in ¹⁴C results from a recent pilot experiment measuring human tissues to determine the year-of-birth of deceased individuals of known birth records.

This presentation will impact the forensic science community by exploring new methods and techniques to aid in human identification.

Researchers have investigated the possibility of acquiring the year-of-birth and year-of-death dates by using radiocarbon (¹⁴C) measurements from a broad range of human tissues. This is possible due to high concentration of radiocarbon in the earth's atmosphere during the thermonuclear bomb testing carried out between 1953 and 1963, and its propagation into the food chain through photosynthesis. Measuring the magnitude of this ¹⁴C concentration allows year-of-birth determinations for individuals that were born in this period. Recently, Hodgins (2009)¹ studied human tissues of 36 deceased individuals of known birth dates. To estimate the year-of-birth, Hodgins measured ¹⁴C of tooth enamel. More than 50% of his results were consistent with the true birth dates, and uncertainties for most were as good as 1.5 years. However, a significant percentage of the measurements yielded estimated birth dates off as much as 4 years. Since diet life histories of individuals were unknown, Hodgins speculated that a ¹⁴C depleted marine diet may have played a role in explaining some of these date deviations. Since some human non-turnover tissue, such as eye lens crystalline and tooth

enamel, start forming while *in utero* and stop at approximately age of 3 and 17 years, respectively, this notion raises the question of how much an individual's childhood diet can affect the age determinations. To examine this possibility isotopes d13C, d15N, and ¹⁴C in fingernails collected from breast milk fed infants and their mothers from before birth through the weaning period were measured. In this study, the mother-infant pairs were from the same region in the United States and their protein diet was recorded during the course of sampling. Samples that would most likely show some differences from one another since they were from individuals with different protein dietary preferences were chose, but in this preliminary investigation no significant variability was observed. This may be attributable in part to the fact that the individuals sampled were from the same region, and so a more diverse population would possibly produce more variability. To further investigate the outliers that were observed by Hodgins, and to determine the magnitude of any dietary biases on ¹⁴C measurements to estimate the year-of-birth, future research should be done directly on non-turnover tissue of individuals of varied recorded diets from different locations.

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Isotopes, Diet, Fingernails

G47 The Effect of Cultural Cranial Deformation on Neurological Development: A Beneficial or Disadvantageous Practice?

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After attending this presentation, attendees will gain an appreciation of the different methods of cultural cranial deformation and the existing medical conditions that cranial deformation simulates. There are clear similarities between cranial development in individuals with culturally-induced cranial deformation and individuals with different forms of the congenital condition craniosynostosis. Attendees will understand the implications of cranial deformation for the neurological development of the individual, and these will be compared with those with craniosynostosis. Ethnographic material written through participant observation amongst societies that practice cranial deformation, and medical reports of function in craniosynostotic individuals will be examined to determine whether the practice has a beneficial or disadvantageous affect on individuals' neurological function.

This presentation will impact the forensic science community by detailing the effect of artificial or culturally-induced cranial deformation on the neurological function of the individuals. This is of significance to forensic anthropologists as it is a method of body modification that has implications for the survival of the participants. Neurological conditions are known to affect bone morphology, for example bone atrophy due to paralysis. It also allows an appreciation of cranial growth processes and the interrelationships between the cranial vault, base, and face, as well as the foramina that conduct the cranial nerves. An analysis of the morphological changes to the nerve foramina, coupled with an examination of ethnographic accounts of the physical symptoms exhibited by the individuals has not been attempted before, and constitutes a novel contribution to our understanding of cranial deformation in past and existing societies. The modern condition of craniosynostosis can inhibit neurological development, and can offer the forensic anthropologist insight into the physiological consequences of the social practice. This has implications for investigations of human rights violations and the recognition of how social and cultural practices can dramatically affect human physiology.

This project builds on previous research conducted by Dingwall,¹ Schijmane,² and Cheverud *et al.*,³ among others, to determine whether or

not artificial cranial deformation practiced by past and extant peoples has an effect on neurological function. It aims to refute or support the hypothesis that cranial deformation must have an effect on the development of the brain and the skull and therefore affect neurological function in an observable way.

Intentional artificial cranial deformation, practiced for a variety of cultural reasons, is of great interest to anthropologists due to its value for reconstructing aspects of past and contemporary social systems, as well as understanding modern medical conditions. Deformations have been carried out for many social and aesthetic purposes, ranging from increasing perceived beauty to encouraging obedience in infants. It is associated with instilling ethnic identity and social stratification. This paper addresses the question of whether artificial cranial deformation of infant skulls, as practiced with boards, pads, stones, or bandages, had any adverse or beneficial consequences for neurological development, and whether these were ignored or embraced by the societies practicing the tradition.

Previous research has not made links between cranial modification and ethnographic evidence of abnormal neurological function (whether impaired or improved); however, papers written comparing the skull morphology of modern pathological specimens and ethnographic examples of artificially deformed specimens have shown that some features appear different to un-modified skulls, for example, the patterns of venous sinuses and meningeal vessels, which may affect neurological function.⁴ The resulting consequences of possible neurological change have not been compared to ethnographic data. The paucity of such research may have implications for wider anthropology, as cultural or social phenomena such as tribal demise or proliferation, or shared spiritual experience may be attributed to neurological modification as a result of artificially-induced cranial deformation. Some traits and idiosyncrasies peculiar to distinct peoples may have a neurological foundation.

A study was conducted using two types of artificially deformed crania from the Natural History Museum, London, to examine whether changes in cranial foramina morphology could explain some of the symptoms observed in ethnographic accounts. Cephalic indices and ethnographic accounts of observed effects of artificial cranial deformation were collated, and compared to measurements and documented symptoms and CT scans of individuals exhibiting the medical condition craniosynostosis which appears to express similar morphological changes to the skull. The cephalic indices of artificially deformed skulls were found to be similar to those of skulls with craniosynostosis, which is known to cause an increase in intracranial pressure and precipitate conditions such as strokes and 3rd, 4th, and 6th cranial nerve palsies. This supports the hypothesis that the symptoms exhibited by individuals with artificial cranial deformation would be similar to those with craniosynostosis, and the explanations for the observed symptoms of cranial deformation substantiate the theory that brain function is affected.

This study represents original research that has not been undertaken elsewhere, and constitutes a valuable contribution to anthropological knowledge. It will further the understanding of the nature of cranial deformation, neurological development and pathology, with significant implications for socio-cultural anthropology, forensic anthropology, and medicine.

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3. Cheverud J. Kohn L. Konigsberg L. and Leigh S. (1992) Effects of fronto-occipital artificial vault modification on the cranial base and face. *American Journal of Physical Anthropology*, 88:323-345.
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Cranial Deformation, Neurological Function, Craniosynostosis

G48 Morphological Identification of Right Ventricular Ischemia Determining Right Heart Failure in Cases of Fatal Pulmonary Thromboembolism

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After attending this presentation, attendees will be aware of the possibility of detecting right ventricular failure due to ischemia in cases of pulmonary thromboembolism

This presentation will impact the forensic science community by making the public aware about the possibility of detecting morphological signs of right ventricular failure due to right heart ischemia.

Pulmonary thromboembolism is a medical emergency that may potentially determine right ventricular failure. Even if the pathophysiology of this phenomenon has been widely investigated, no morphological demonstration of right ventricular ischemic damage determining right ventricular failure in cases of fatal pulmonary embolism has been reported till now.

An immunohistochemical investigation was performed with the antibodies against Fibronectin and C5b-9 in 26 cases of fatal pulmonary thromboembolism (16 ♀, 10 ♂, mean age 56.4 years) as well as in 25 cases of acute myocardial infarction (16 ♀, 9 ♂, mean age 60.8 years) and 20 cases of hanging (3 ♀, 17 ♂, mean age 40.8 years). In each case at least one tissue slide from both cardiac ventricles (wall of the right ventricle, anterior and/or posterior wall of the left ventricle) was available. The reactions were semi-quantitatively classified and the expressions in the groups were compared. In cases of pulmonary thromboembolism the occurrence of positive reactions at the right ventricle was significantly higher than in cases of myocardial infarction and global hypoxia due to hanging. This may indicate the primary ischemic involvement of the right ventricle and be interpreted as morphological sign of right ventricular failure.

Right Ventricular Failure, Acute Pulmonary Hypertension, Immunohistochemistry

G49 Autopsy Performance in Transfusion Recipient Fatalities Reported to the United States Food and Drug Administration (FDA) During Fiscal Year 2008

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After attending this presentation, attendees will learn recent updates regarding the classification of fatal transfusion reactions, review recent transfusion-recipient fatality data relevant to forensic practice, especially regarding autopsy performance and medical errors, consider approaches to the investigation of deaths potentially related to transfusion of blood products, and learn how to contribute to the national investigation of transfusion-associated fatalities through the FDA transfusion fatality program.

This presentation will impact the forensic science community by sharing how findings suggest that ME/C systems can provide important contributions to the investigation of transfusion-related fatalities through increased awareness, vigilance, autopsy performance, and reporting.

This presentation will inform attendees of something they do not know: (1) classification of fatal transfusion reactions; and, (2) recent

transfusion-recipient fatality data relevant to forensic practice, especially regarding autopsy performance and medical errors. This presentation will inform attendees of something they do not know/do: (1) how to approach the investigation of deaths potentially related to transfusion of blood products; and, (2) how to contribute to the national investigation of transfusion-associated fatalities by the FDA transfusion fatality program through increased awareness, vigilance, autopsy performance, and reporting.

Background: Many deaths investigated by medical examiner/coroner (ME/C) systems are associated with a blood transfusion shortly before death. Complications of transfusion may occur and are occasionally fatal. The transfusion service is required to report fatal complications of transfusions to the FDA Center for Biologics Evaluation and Research (CBER). A CBER Medical Officer (CMO) reviews submitted information and determines to what extent, if any, the transfusion may have contributed to death. CBER publishes an annual summary of the reported fatalities. As part of its investigation, FDA requests the reporting facility to provide information on whether or not an autopsy was performed, but autopsy data have never been published in the annual summary.

Hypotheses: (1) Transfusion-associated fatalities reported to the FDA are under-reported to ME/C systems, despite the fact that several of these deaths are due to medical errors and therefore likely be certified as Accidental in manner of death; (2) a significant number of these cases would also otherwise typically fall under ME/C jurisdiction, such as cases involving transfusion for traumatic injuries; (3) there is a very low autopsy rate in these cases; and, (4) for the group of fatalities in which the FDA could not rule out transfusion as contributing to the death, a higher autopsy rate could have potentially helped to determine the cause of death with a higher degree of certainty and therefore allowed more definitive classification of some of these cases as either transfusion-related or not.

Methods: After review of the 2008 U.S. FDA Annual Summary report of fatalities following transfusion, the most recent year for which data had been published at the initiation of the project, a Freedom of Information Act request was submitted to CBER for the "Table of Final Conclusions" prepared by a CMO for each of the 72 reported transfusion-recipient deaths. Sixty-nine individual reports with some data redacted were received, as three cases had been withdrawn prior to CMO review. Available documents were mined for data that would address the hypotheses and potentially be of interest to participants of death investigation systems.

Results: Of the transfusion-recipient deaths reported (N=69), there were 35 males (51%), 33 females (48%), and 1 sex unspecified. Age ranged from 6 weeks to 97 years (median=66 years). The overall reported autopsy rate was 26% (18/69). Performance of an autopsy was reported in 24% (11/46) of cases in which transfusion was determined by the CMO to have contributed to the death and in 43% (6/14) of cases in which transfusion was determined to be unrelated to the death, but in only 11% (1/9) of cases in which transfusion could not be ruled out or confirmed as contributing to the death. Human errors in pre-transfusion specimen collection, compatibility testing or blood administration accounted for 30% (14/46) of transfusion-related deaths; all of these were due to hemolytic transfusion reactions (HTRs). Ninety percent (90%, 9/10) of the deaths due to ABO incompatibility (ABO HTRs) occurred when Type A donor red blood cells were erroneously transfused to non-A recipients, 89% (8/9) of whom were Type O. Of the deaths due to incompatibility of non-ABO red blood cell antigens (non-ABO HTRs), 71% (5/7) were due to errors that occurred in the blood bank during compatibility testing. Autopsy performance was reported in only 14% (2/14) of the deaths due to human error. Trauma patients accounted for 6% (four cases) of all reported deaths, and for each of these a transfusion complication was determined to contribute to the death (three cases) or could not be ruled out (one case). For five of the eight deaths without an autopsy in which transfusion could not be ruled out or confirmed as a contributing factor, the CMO listed a differential

diagnosis that suggested autopsy findings may have helped with further classification.

Conclusions: In this study, a significant number of reported transfusion-related deaths were due to human error. Transfusion complications may cause or contribute to death in cases that would typically otherwise fall under ME/C jurisdiction, including trauma cases. Lack of autopsy findings may impede the determination of whether or not a transfusion contributed to death and thereby prevent definitive classification.

Transfusion, Fatal, Autopsy

G50 A Case of Atypical Chronic Subdural Hematoma: A Spontaneous Rupture of Dural Lymphoma Nodule?

Renaud Clement, MD*, 1 Rue Gaston Veil, Nantes, FRANCE

After attending this presentation, attendees will understand the call for creating an entity of spontaneous chronic subdural hematoma.

This presentation will impact the forensic scientist community by presenting a case report about chronic subdural hematoma (SDH) and the different causes of bleeding beneath the *dura*.

Introduction: SDH is usually associated with brain injury following trauma. Hemorrhage resulted from the rupture of the cerebral bridge veins of the meninges, from a tear of superficial cortical arteries or from a focus of intraparenchymal hemorrhage associated with an overlying contusion such as in temporal lobe which ruptures through the contused cortical area. Acute SDH is due to direct impact trauma or sudden acceleration-deceleration of the head without injury of the head. Chronic SDH may be traumatic or may rise spontaneously.

Case Report: A 40-year-old Caucasian woman traveled to an African country. Her medical history included local radiation therapy, several years beforehand, for the treatment of breast cancer. She had been in complete remission for more than a couple of years. This woman's status of health presented no constitutional or acquired hemostasis disorders. She was completely free of medicine. She had no known addictive tendencies. Several days after her arrival, she presented paroxysmal hyperthermia, accompanied a few hours later by photophobia, difficulty in walking and confusion. Neurological state worsened with the appearance of coma (Glasgow score of 6). She was hospitalized and resuscitation measures did not prevent the patient's death. Following cold storage, the victim's body was repatriated to France, where an autopsy was performed to determine the primary cause of death because liability could be assigned against insurance (transfer with delay time between neurological deterioration and hospitalization). On opening the cranial space, a subdural hematoma forming a right hemispheric biconvex lens was discovered. It weighed 90 grams, was wine red in color and consisted of an encased fluid mass. No traumatic lesion was found during external or internal examination of the skull. Histological investigations then uncovered a multi-organ generalized lymphoid infiltration. Examination of the cerebral cortex showed these lymphoid infiltrations as well. A small-cell lymphoid nodule, disrupted by erythrocytes was found in the falx cerebri of the meninges. Following these additional investigations the main cause of death was a chronic right circumferential SDH. This hematoma could originate with the "spontaneous" hemorrhagic rupture of a nodule of lymphoid infiltrate in the meninges of the falx cerebri. This nodule was a dural metastasis of a multi-organ lymphoma.

Discussion: Chronic SDH is well known as incidental finding during forensic autopsy. In forensic medicine, the formation of chronic SDH is always linked to trauma. The entity of spontaneous SDH doesn't exist in forensic medicine. Chronic subdural hematomas occur more frequently in men, in the elderly, and in patients using anticoagulant or platelet aggregation inhibiting drugs. The consumption of alcohol is also

a predisposing factor. In these circumstances, the development of a SDH involves necessary the intervention of trauma. It can be minimal such as some encountering in the impacts of everyday life. In the medical literature, several cases of atypical chronic SDH characterized by the presence of pre-existing pathological dural lesions, especially cancerous ones, have been described. These tumors of the dura mater can result from primitive neoplasias of the central nervous system in the meninges or from dural metastases of cancers. In the present case history, several forensic medical elements contributed to the atypical nature of this chronic SDH: no major or minor traumas were identified in this young woman of forty years; she was non-menopausal; and she was not a chronic or acute consumer of alcohol and/or medications that could interfere with hemostasis or coagulation. In some previous published cases, the hypothesis of trauma, even if minimal, leading to displacement of the brain within the cranial space was suggested and could not be excluded. And spontaneous chronic SDH have been described. This presentation will review the possible mechanisms which rupture the lesion and will discuss the fact that if trauma could not be completely excluded, the entity of spontaneous chronic SDH could be created in forensic medicine.

Subdural Hemorrhage, Forensic Medicine, Spontaneous

G51 A Comparison of Trauma Associated With Manual and Automated Cardiopulmonary Resuscitation

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After attending this presentation, attendees will be able to associate certain injury distribution patterns with the type of CPR administered.

This presentation will impact the forensic science community by assisting medical examiners in identifying fracture distribution patterns associated with automated CPR specifically ZOLL AutoPulse® Noninvasive Cardiac Support Pump use. Posterior fractures such as those observed with AutoPulse® CPR are generally noticed in cases of inflicted trauma. By understanding the fracture pattern associated with AutoPulse® CPR, a potentially erroneous interpretation of therapeutic injuries as inflicted can be avoided.

This presentation will detail the results of a retrospective study of the effects of therapeutic intervention with manual cardiopulmonary resuscitation (CPR) compared to the effects of automated mechanical CPR device use. After this presentation, attendees will be able to associate certain injury distribution patterns with the type of CPR administered.

In 2007, Houston TX was selected as a test site for the ZOLL AutoPulse® Noninvasive Cardiac Support Pump. According to ZOLL, the benefits of this device include continuous CPR without fatigue, relief for EMS personnel who are then free to perform other life-saving tasks, and improved blood flow for patients with cardiac distress. The purpose of this study was to identify the trauma associated with AutoPulse® use, particularly how it compares to standard manual CPR. Expanding on previous research that found upper body skin abrasions associated with AutoPulse® use, this study also included the occurrence of hard tissue trauma between the two forms of CPR. It is well established that manual CPR can result in rib and sternal fractures. A comparison of the distribution and frequency of manual CPR fractures to AutoPulse® fractures as well as abrasion occurrence can potentially help rule out erroneous interpretations of inflicted trauma.

Autopsy records from 137 decedents brought to the Harris County Institute of Forensic Science, Houston TX, between the years 2006 to

2009 were analyzed. According to the sample records, manual CPR was performed on 49 individuals (24 males, 25 females) and AutoPulse® CPR was used on 88 individuals (52 males, 36 females). The median age for the manual CPR group was 48 years and the AutoPulse® CPR group was 54 years. The distribution of rib fractures from the anterior, lateral, and posterior compartments as well as sternal fractures and skin abrasions were recorded. Kruskal-Wallis ANOVA comparisons between fractures from the manual CPR group and the AutoPulse® CPR group demonstrated a statistically significant difference ($p<0.05$) between the number of anterior fractures, lateral fractures, posterior fractures, sternal fractures, and skin abrasions. In manual CPR, anterior fractures had the highest frequency followed by lateral fractures. Posterior fractures were only found in one case, secondary to body placement during manual CPR. In AutoPulse® CPR, anterior fractures had the highest frequency followed by posterior fractures and lastly, lateral fractures. Sternal fractures were found at a higher frequency in the manual CPR group than the AutoPulse® group. Skin abrasions were more common in the AutoPulse® CPR group, located primarily along the anterior chest, lateral chest, and shoulder. In the few cases that abrasions were observed in the manual CPR group, they were located along the sternum.

The results of this study identify the distribution patterns of fractures associated with manual and automated CPR. When rib fractures are found in the anterior or lateral rib cage in association with sternal fractures, they are consistent with manual CPR. When rib fractures are found in the anterior and posterior compartments with chest skin abrasions, they are consistent with automated CPR resulting from AutoPulse® use (and not other types of devices, which were not included in this study). It should be noted that it is mandatory for Houston EMS personnel to initially administer manual CPR before AutoPulse® use and this combination may account for the anterior rib fractures observed in the AutoPulse® CPR group. During manual CPR, chest compressions are administered for an extended period of time, thus causing sternal fractures. The small number of sternal fractures seen in AutoPulse® CPR is likely due to the short duration of manual CPR. The significance of this study to the forensic community is in the importance of identifying fracture distribution patterns associated with AutoPulse® use. Posterior fractures such as those observed with AutoPulse® CPR are generally noticed in cases of inflicted trauma. By understanding the fracture pattern associated with AutoPulse® CPR, medical examiners can avoid a potentially erroneous interpretation of therapeutic injuries as inflicted.

Trauma, Cardiopulmonary Resuscitation, Fractures

G52 Sudden Unexpected Death Associated With Undiagnosed Lymphocytic Thyroiditis: Report of a Case and Literature Review

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After attending this presentation, attendees will have a better understanding of the significance of pathological changes in the thyroid gland in determining the cause of death, since in many patients thyroid dysfunction remains undetected during life, due to the lack of clinical signs and symptoms characterizing some nosographic entities, such as silent (painless) thyroiditis, or the Hashimoto disease.

This presentation will impact the forensic science community by emphasizing the importance of taking all natural diseases into proper account when investigating sudden deaths, even if clinical records are not indicative or when the anamnesis is poor.

In this perspective a careful gross examination and an adequate sampling of the thyroid gland are mandatory. Findings obtained by histology and updated tissue analyses should be always interpreted in relation to complex data coming from a multidisciplinary approach, finally leading *per exclusionem* to the diagnosis of sudden death due to an episode of transient thyrotoxicosis. Silent (painless) thyroiditis is regarded as follicular destruction-induced hyperthyroidism resulting in the release of stored thyroid hormones in the circulation. The above mentioned disease is characterized by a transient hyperthyroidism with spontaneous resolution in two to five months, even though cases of relapse can occur quite often. The thyrotoxic phase of this syndrome is short and requires no, or only symptomatic therapy, but it is assumed that untreated thyrotoxicosis might lead to sudden death by several mechanisms (cardiac arrhythmia, hyperpyrexia, electrolyte disturbances, and epileptic seizures). Macroscopically the thyroid glands are normal sized and non tender; histologically, focal, or diffuse lymphocytic thyroiditis is present. In some cases anti-thyroid antibodies can be detected, indicating an autoimmune pathogenesis and postmortem dosage of thyroid hormones, when interpreted in relation to the histological findings, can provide further information about the functional status during life.

In the present case a previously healthy 18-years-old woman was found dead prone near the entrance of her house, where she was living alone. The crime scene investigation did not offer any significant finding, and external examination of the body showed a single contusion at the forehead, consistent with an accidental fall from the standing position. Clinical history was unremarkable, but information regarding a possible family history of thyroid disease was not available.

Full autopsy was carried out including a detailed macroscopic/microscopic cardiac examination, tissue molecular analyses for viral detection, chemical analyses, and toxicology. At the autopsy all internal organs were unremarkable and the thyroid gland was macroscopically normal. The one relevant pathological finding was a prominent lymphocytic infiltration with follicular disruptions, rare oxyphilic changes and low grade fibrosis. Since the histological picture was consistent with lymphocytic thyroiditis, immunophenotype characterization and lymphocyte clonality analyses were performed in order to rule out the diagnosis of hematologic malignant neoplasm.

In this case the lymphocytic thyroiditis could by exclusion offer a reasonable explanation of the sudden unexpected death occurred during an episode of transient thyrotoxicosis, cardiac arrhythmia being the most likely mechanism of death.

In consideration of the autopsied findings, further investigation into the medical history was carried out, revealing that the deceased a few days before death complained chest pain to the general practitioner; moreover, three months before she required the prescription for psychoactive drugs, due to the recent onset of insomnia and unexplained anxiety; contemporaneously, she was noticed loosing weight.

Since the young woman had one sister and one brother, at the end of the medico-legal investigation a clinical diagnostic protocol on the relatives was recommended to the general practitioner.

In conclusion: the presented case highlights to forensic pathologists the importance of sampling and careful studying the thyroid gland to evaluate the possible role of a thyrotoxic episode related to a silent thyroid disease, as a cause of sudden death in otherwise unexplained fatalities. Review of the literature reported only a few cases of lymphocytic thyroiditis as a possible cause of death, but in such cases a full multidisciplinary approach (with special regard to biomolecular and chemical analyses) was not carried out.

Furthermore, the present case investigation, first aiming to the solution of forensic concerns, also represented the start up for diagnostic protocol on the relatives, at that time still asymptomatic, with final possible positive outcome on their health care.

Silent Thyroiditis, Sudden Death, Thyrotoxicosis

G53 The Pattern of Immunoreactivity for von Willebrand Factor in a Variety of Thrombotic States

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After attending this presentation, attendees will understand the role of von Willebrand Factor (vWF) in thrombotic thrombocytopenic purpura (TTP) and recognize variations in patterns of immunohistochemical staining against von Willebrand Factor antigen in thromboemboli from thrombotic thrombocytopenic purpura, hemolytic uremic syndrome, disseminated intravascular coagulation, non-bacterial thrombotic endocarditis, renal allograft vascular rejection, and stasis thrombosis.

This presentation will impact the forensic science community in cases of precipitous deaths with little or no antemortem workup that are characterized by a thrombotic state. Although previous reports have discussed the value of immunohistochemical staining against von Willebrand Factor antigen in deaths where thrombotic thrombocytopenic purpura is suspected, this is the first case report to provide images that demonstrate the staining patterns of several other entities within the differential diagnosis.

Although previous reports have detailed the value of this stain in deaths where TTP is suspected, this is the first case report to provide images that demonstrate the staining patterns of several other entities within the differential diagnosis. The variations appear to reflect the etiology of the thromboemboli and their relative content of vWF. The visual references included here will be especially helpful to the medical examiner in cases of precipitous death when there has been little or no antemortem workup.

TTP is a thrombotic microangiopathy, historically requiring a pentad of symptoms for clinical diagnosis: microangiopathic hemolytic anemia; thrombocytopenia with or without purpura; acute renal insufficiency; fever; and neurologic abnormalities. It is now understood that few patients present with all features; however, the presence of neurologic abnormalities is often helpful in distinguishing TTP from hemolytic uremic syndrome (HUS).

The case of an adult male is presented with microangiopathic hemolytic anemia, thrombocytopenia, and an episode of hematuria two days prior to hospital admission. The patient did not report diarrhea or fever, and did not exhibit neurologic symptoms. Pulseless electrical activity and renal failure were present at the time of admission. The patient had a rapid clinical decline and died before a diagnosis could be made. Autopsy did not reveal significant gross pathology. Histologic sections contained myocardial necrosis with relatively widespread microthrombi in small cardiac vessels and, less frequently, microthrombi within glomeruli and renal arterioles. Vascular lesions also included intimal thickening and disruption, and fragmented red cells.

TTP is currently thought to be driven by a deficiency in ADAMTS-13, a metalloprotease that cleaves vWF to render it ineffective in its role in intravascular platelet aggregation. Deficiencies may be inherited or acquired, and may lead to unchecked formation of vWF-rich thrombi in those vessels subject to shear stress (including arterioles and capillaries). Because vWF is produced in arterial endothelial cells and megakaryocytes, thrombotic lesions in TTP, non-bacterial thrombotic endocarditis (NBTE) and allograft vascular rejection will demonstrate immunoreactivity to vWF antigen. The characteristically fibrin-rich thromboemboli formed in states that are not mediated by vWF will exhibit minimal-to-no immunoreactivity.

Tissue controls in the current report included a single example of each aforementioned disease entity, including a mixed immune-TTP

control case, internal positive controls (arterial endothelium), and internal negative controls (hepatic veins and sinusoids). In TTP, there was dense, relatively homogeneous staining of the entire vWF-rich thrombus. In NBTE, there was variably dense, granular staining of characteristically platelet-rich bland vegetations (both on valves and in embolized material). In renal allograft rejection, there was heterogeneous staining, most dense in areas of vascular damage, with only minimal peripheral staining of the thrombi.

In HUS, there was minimal peripheral staining of thrombi. In disseminated intravascular coagulation (DIC), and in stasis thrombosis (the latter secondary to a myocardial infarct), there was focal dense staining only within the more cellular "layered" regions of organizing thrombi, where platelets may become entrapped.

Tissue from the presented case demonstrated vWF-rich thrombi in cardiac and renal vessels as well as in rare small cerebellar vessels, and looked most similar to the mixed immune-TTP control tissue, supporting myocardial necrosis secondary to TTP as the cause of death.

Overall, this case with its corresponding array of tissue controls represents a spectrum of patterns that correlates well with the pathophysiology of each specific pathologic entity. In conclusion, when interpreted in combination with anatomic findings at autopsy, vWF staining provides support for a diagnosis of TTP even when the clinical history is limited or atypical.

TPP, von Willebrand, Hemolysis

G54 Giant Cell Myocarditis as a Cause of Sudden or Unexpected Death: A Report of Two Cases and a Review of the Literature

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After attending this presentation, attendees will have an awareness of giant cell myocarditis as a cause of sudden or unexpected death and its diagnosis.

This presentation will impact the forensic science community by increasing knowledge and awareness of an uncommon cause of sudden or unexpected death with two case presentations.

Giant cell myocarditis (GCM), formerly known as Fiedler's myocarditis, is an inflammatory process of unknown etiology restricted to the heart, typically occurring in young and middle-aged adults. There is no clear gender predilection, but the prevalence of GCM is higher in Caucasians than in other races. Because of its isolation to the heart and fulminant clinical course resulting in sudden or unexpected death, GCM is usually diagnosed at autopsy, and therefore may be encountered in a forensic setting. Gross findings at autopsy are variable. Microscopically, there is myocyte necrosis associated with an infiltrate composed of histiocytic giant cells, lymphocytes, and scattered eosinophils. The differential diagnoses of GCM include other forms of granulomatous myocarditis, such as sarcoidosis and infectious etiologies. In contrast with sarcoidosis, GCM is typically localized to the heart and has a fulminant clinical course. Infectious etiologies can be excluded with the use of special stains. GCM is a rare cause of sudden or unexpected death with a very low prevalence as reported by other studies.

A search of the records of the Cook County Medical Examiner's Office identified 72 cases in which myocarditis was the principle or contributing factor to death in adults aged 18 and older. The search covered the period from January 1, 2000 through July 15, 2010. Of these 72 cases, only two were cases of giant cell myocarditis. The remaining 70 cases consisted of neutrophilic, lymphocytic, or mixed inflammatory infiltrates.

The first case is a 39-year-old African-American female with a history of hypertension and obesity, who presented to the emergency

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room with shortness of breath and sinus tachycardia. Two days prior to this event, she was seen in the emergency room with fever, malaise, and an elevated white blood cell count, and was discharged. Soon after presentation to the emergency room, she developed pulseless ventricular tachycardia despite pharmacologic therapy. Following synchronized cardioversion and a brief period of asystole, she developed sinus bradycardia. Transcutaneous pacing was attempted, but she progressed to ventricular fibrillation, then asystole. She died within two hours of admission. At autopsy, the heart was enlarged, weighing 487 grams. Grossly, there was concentric left ventricular hypertrophy and the myocardium was uniformly red/brown with the exception of the papillary muscles of the left ventricle, which were pale yellow/gray. Microscopic examination of the heart revealed foci of myocyte loss, fibrosis, and chronic inflammation with scattered giant cells predominantly in the papillary muscle. Other findings at autopsy included cerebral edema, splenomegaly, and chronic passive congestion of the liver. Toxicologic studies were negative for ethanol, opiates, or cocaine.

The second case is a 33-year-old African-American female with no prior medical history, who collapsed suddenly at a nightclub. At autopsy, her heart was enlarged, weighing 426 grams. Grossly, there were geographic areas of pallor from base to apex involving the myocardium of the anterior, lateral, and septal walls of the left ventricle. Microscopically, there was extensive fibrosis and inflammation with numerous giant cells and only small islands of preserved myocardium. Other findings at autopsy included pulmonary congestion and an incidental ovarian teratoma. Toxicologic studies were negative for opiates or cocaine.

These cases are reported to demonstrate the variation in clinical presentation and autopsy findings of GCM, as well as to illustrate that GCM remains a rare cause of sudden or unexpected death even in a busy, urban medical examiner's office.

Myocarditis, Sudden or Unexpected Death, Heart Disease

G55 Death Due to Atrial Septum Defect Repaired by Transcatheter Closure: Who Failed?

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After attending this presentation, attendees will learn about the role of the forensic pathologist in transcatheter procedures and professional liability.

This presentation will impact the forensic science community by showing a case report regarding a bronchial lesion following transcatheter procedure.

A 13-year-old Caucasian male, with past medical history of ostium secundum atrial septal defect previously treated using septal occlusion device with no success.

After a period of time, a new surgical access procedure was performed on the young man using transcatheter closure procedure. The device should be placed in the atrial septum via catheter introduced into femoral vein. The access was monitored with transesophageal echocardiography. The medical record states that twenty minutes after the start of surgery, a sudden decrease of oxygen saturation, and contemporaneous sub-cutaneous emphysema occurred. In spite of cardio-pulmonary resuscitation maneuvers and following placement of the trocar and thoracic drainage system, the young man died, because of a contemporaneous ventricular fibrillation.

External examination revealed a drainage located in left hemithorax in the first intercostal space; another one in the right hemithorax in the fifth intercostal space, two needle marks in the left third intercostal space and in the right second intercostal space; cyanosis of finger nails of both hands was present.

Internal examination revealed emphysema in subcutaneous soft tissue of the thoracic and abdominal regions, in greater omentum and in the visceral adipose tissue. Also observed marked mediastinal emphysema, bilateral pneumothorax and reduced volume of the lungs.

The macroscopic examination of the heart showed collapse of the fossa ovalis, redundant, with diameter of 2.5 centimeters and with two perforations: the first one with maximum diameter of 1 centimeter and the second one of 0.5 centimeter, divided by fibro-muscular biceps. The right ventricle was dilated with thin walls (0.3 centimeter maximum thickness), left ventricle slightly dilated with a free wall of 1.5 centimeters.

The observation of air breath showed in the right intermediate bronchus an "S"-shaped laceration with frayed margins slightly that involved, in the point of the bifurcation with medium lobe, in the extraparenchymal intrapleural tract, half circumference of the bronchus.

The dissection of the lungs revealed congestion and hemorrhagic edema. There was hypoxic ischemic multiorgan damage.

Histologic assays showed massive right endo-bronchial bleeding and the site of the bronchial lesion was characterized by incomplete breakup of a cartilaginous ring in correspondence of one of the extremities; the adjacent pulmonary vein with massive blood infiltration of the nearest soft tissues. The borders of the vascular breakup were irregularly dissected and infiltrated by blood cells; in the context of the vascular wall other breaches were observed with partial tonaca media's dissection. Hemorrhagic edema was found in pulmonary parenchyma with red cells infiltration of the nearest soft tissues and sub-pleural tissues, in association with emphysematous blebs.

On the macro-microscopic evidences the cause of the death has been attributed to an acute respiratory insufficiency by severe pneumothorax following bronchial breakup; the typology of death is attributable to "therapeutic complication."

Along with the histological assays, the authors have verified the iatrogenic nature of the breakup; besides, using the classic forensic criteria the pathologists have attributed the professional liability to one of the professional figures (echocardiographist, hemodynamist, anesthetist) involved in the management of the young patient.

Transcatheter Closure, Atrial Septum Defect, Bronchial Lesion

G56 Dissecting Intramural Hematoma of the Esophagus: A Rare Case of Sudden Death

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After attending this presentation, attendees will learn that dissecting intramural hematoma of the esophagus is a rare condition with excellent prognosis when treated conservatively. Spontaneous ruptures of hematoma are rarely described as well as sudden death due to DIHO.

This presentation will impact the forensic science community by presenting the rarity of the fatal events due to DIHO and the autopsy technique performed in visualizing rupture, preserving anatomical relationship between cervic-thoracic organs.

Dissecting intramural hematoma of the oesophagus (DIHO) is a rare condition in which intramural hemorrhage leads to submucosal

dissection of the oesophageal wall. It is usually associated with a rapid increase in intraoesophageal pressure, trauma or a coagulation disorder. The clinical presentation is with chest pain, hematemesis and dysphagia/odynophagia and an accurate history is vital to help distinguish it from other causes of acute chest pain, such as myocardial infarction, aortic dissection or oesophageal perforation. The three different types of acute oesophageal injury are a mucosal tear (Mallory–Weiss syndrome), full-thickness rupture (Boerhaave's syndrome) and dissecting intramural hematoma. Neither the Mallory–Weiss nor the Boerhaave lesions are associated with submucosal hematomas or dissections. In some cases the first event may be hemorrhage into the submucosa with secondary rupture into the lumen. The differential diagnosis includes other causes of central chest pain and it is vital to obtain an accurate history of both gastrointestinal and cardiovascular symptoms. Analysis of the precipitating factors suggests that there are three main subgroups. Firstly, a sudden pressure change in the oesophagus (e.g., swallowing, vomiting) perhaps associated with a temporary disruption in the normal co-ordinated opening mechanism of the upper and lower oesophageal sphincters. Secondly, direct injury following an endoscopic therapeutic intervention (e.g., oesophageal dilatation). Thirdly, about one fifth of patients appear to have a truly spontaneous origin although this may be associated with an underlying predisposition to abnormal pressure changes within the oesophagus (e.g., achalasia) or a bleeding disorder (e.g., due to anti-platelets, anti-coagulants or thrombolytics). The pathophysiology is characterized by submucosal hemorrhage that dissects the submucosa and classically occurs in the distal oesophagus because this region is least supported by adjacent structures such as the trachea or heart.

A rare case is presented of sudden death due to spontaneous rupture of DIHO occurred in a 42-year-old woman presented at local emergency department with a 24 hour history of sudden onset severe central chest and interscapular pain associated with dysphagia and odynophagia. There was no history of vomiting, hematemesis or trauma. There was little previous medical history of note and he was not taking any regular medication. On examination, vital signs were: blood pressure, 104/49 mmHg with no differential between arms; pulse, 125 beats/min; respiratory rate, 24 breaths/min; body temperature was normal. There was no abdominal tenderness and no maelena. EKG was unremarkable as well as cardiac enzymes. Clinical conditions suddenly got worse; the woman collapsed and resuscitation maneuvers were unsuccessful. Autopsy was performed the day after death. Massive hemothorax was recorded. Thoracic and abdominal organs were removed en masse according to Letulle technique and fixed in 10% buffered formalin for a detailed macroscopic examination. All other organs examination was unremarkable except for cerebral oedema. Vessels were poor of blood. Lungs were increased in volume and size, with few subpleural hemorrhagic spots. Mild white foam on the main bronchi was also detected. Heart was normal in size and volume, with conical shape. Coronaries examination was unremarkable. A large bluish/red intramural haematoma of the posterior wall of the oesofagus extending from just below the cricopharyngeous to the gastro-oesophageal junction was recorded with a complete rupture of the oesophagus wall in the proximal third. Mild cerebral oedema and focal pulmonary oedema were observed at histological examination with standard H&E staining. Histological examination of heart was unremarkable except for few foci of contraction band necrosis. Sample of oesophagus dissection was collected excluding recognizable abnormality in the muscle layers, except for rupture. A complete immunohistochemical panel has been performed on esophagus samples. Genetic investigations had been performed also.

DIHO, Spontaneous rupture, Sudden Death

G57 Anaphylactic Shock and Postmortem Exam – A Systematic Approach

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After attending this presentation, attendees will have an insight about the efforts being made by the Portuguese National Institute of Legal Medicine in order to harmonize the methodology of forensic autopsies, since not all the medical forensic experts have the specialty of legal medicine.

This presentation will impact the forensic science community by informing attendees of the attempt to establish specific rules concerning the approach of fatal cases of suspect anaphylactic reactions.

The anaphylactic shock is classified as a type I of hypersensitivity reaction that occurs due to the release of biologically active agents, among them, histamine. It is due to exposure to allergens of different types, like drugs, food, animal sting, animal fur. If not promptly reversed, the outcome can be fatal.

The relevance of available circumstantial information, namely context and symptoms prior to death, previous medical history and possible life support procedures applied will be discussed.

The need for a thorough external examination of the corpse is also addressed, in order to search, for instance, for possible sting marks or hives-like lesions that may help to support the diagnostic.

Overall, postmortem findings, either in the external and internal examination, are usually nonexistent or nonspecific, the forensic expert should collect all body samples that may be needed later on to reach a more accurate diagnosis.

Therefore, besides the routine histology (heart, lungs, liver and kidneys), the collection of samples from other organs with known increased mastocyte cells population is recommended. Toxicological exams should contemplate drugs, abuse drugs and/or pesticides, according to the specificity of the case.

Also highlighted is the relevance of collecting peripheral blood for IgE and tryptase concentration levels and that this task should be undertaken as soon as possible after the judiciary's authorization for the autopsy.

Because of the lack of relevant findings, death by anaphylactic shock is considered a diagnosis of exclusion, that is achieved through the evaluation of the available circumstantial information, the findings (or their nonexistence) in the external and internal examination and results of ancillary investigation, namely, histology, in some cases complemented by immunohistochemical techniques (anti-tryptase and anti-CD117), toxicology and serology (IgE and tryptase).

Based on the most recent scientific knowledge, a comprehensive protocol was designed with the purpose of being applied to this situation and serve as a guideline to forensic autopsies.

Forensic Autopsy, Anaphylaxis, Protocol

G58 Spontaneous Pulmonary Arterial Dissection: A Case Report

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The goal of this presentation is to present a fatal case of spontaneous pulmonary arterial dissection with a wide immunohistochemical study about alteration of pulmonary wall.

This presentation will impact the forensic science community for the rarity of the deaths due a spontaneous dissection of the pulmonary trunk.

Unlike dissection in systemic arteries, pulmonary artery or main pulmonary branche dissection, is usually lethal. So the diagnosis of this condition is very rarely made during life and most commonly diagnosed at autopsy in cases of sudden and unexpected death. Hemorrhagic pericardial effusion and cardiac tamponade usually follow the outward rupture of the proximal main pulmonary artery.

With regard to pathogenesis, pulmonary artery dissection is strongly associated with primary and much more frequently, secondary pulmonary hypertension. Secondary pulmonary hypertension most often results from congenital cardiac lesions, above all with various forms of left-to-right shunting, most commonly patent ductus arteriosus, or congenital ventricular septal defect. These cardiac conditions predispose individuals to the development of pulmonary artery aneurysm by generating sustained high pulmonary flow rates and pulmonary artery pressure. However, other possible causes are Marfan syndrome and other connective tissue diseases, infectious processes and inflammatory conditions, such as Behcet disease. Anyway pulmonary artery dissection is exceedingly rare in the absence of pulmonary hypertension or other pathologic conditions.

The clinical presentation of pulmonary artery dissection is highly variable and the symptoms are nonspecific, most frequently chest pain, dyspnea, cyanosis, and hemodynamic compromise. Diagnostic instruments for this condition are noninvasive imaging techniques, including echocardiography, CT, and magnetic resonance imaging (MRI).

The vascular histopathologic changes associated with the majority of pulmonary artery dissections involve medial degeneration, with fragmentation of elastic fibers. These changes may represent an intrinsic weakness in the vessel wall which is compounded by the increased hemodynamic shear stresses of pulmonary hypertension, thereby predisposing an intimal tear. The pathogenetic mechanism of dissection in absence of histopathologic alterations remains substantially unclear.

The case presented concerns sudden death due to spontaneous pulmonary artery dissection.

A 72-year-old woman was admitted to the Emergency Department for chest pain, spread to mandible, dyspnea, and jugular tightness, and she referred these symptoms after bleach inhalation during housecleaning.

Physical examination, ECG and CT were unremarkable. Cardiac ultrasonography showed concentric ventricular hypertrophy and ascending thoracic aorta ectasia (50 mm). Laboratory blood values demonstrated neutrophilia, lymphopenia, moncytosis and increased erythro sedimentation rate. Two days later she died.

A postmortem examination was performed and revealed a large hemorrhagic area in left posterior mediastinum and pericardial sac containing approximately 150 ml of blood and 250 g of clotted blood. The source of hemorrhage was readily identified as a 2 cm tear in the wall of the pulmonary trunk and so dissection and rupture of the artery.

Microscopic sections of the pulmonary artery revealed regular morphology of the wall layers. The medial layer showed fragmentation of elastic fibers, marked fibrosis and copious erythrocytes. In a section the intimal tear was identified as initial site of dissection.

The immunohistochemical investigation of the pulmonary artery samples in whole artery wall and in laminar dissection was performed with antibodies anti TGF-beta-1, TGFBR1 (ALK-5) e TGFBR2, ALK-1, fibrillin and endoglin. Fibrillin showed a massive and diffuse positive reaction of the whole pulmonary artery near the dissection, but it showed negative reaction in laminar dissection; Endoglin showed a weak positive reaction in the whole artery and a negative reaction in the laminar dissection; TGF-beta1 revealed a weak positive reaction in the whole pulmonary artery and a strong reaction in the laminar dissection; TGFBR1 and ALK-1 showed a moderate positive reaction in the whole pulmonary artery wall and a massive positive reaction in laminar dissection; TGFBR2 revealed a massive positive reaction of the whole pulmonary artery, but it showed moderate reaction in laminar dissection.

A fatal hemopericardium caused by spontaneous pulmonary artery dissection was recorded as the cause of death. The histological investigation of the pulmonary artery samples revealed the absence of hypertensive arterial changes and the immunohistochemical showed the absence of any connective tissue disease of the pulmonary trunk. So the presented case illustrates a very rare cause of sudden death in a spontaneous dissection of a normal pulmonary trunk.

Spontaneous Pulmonary Dissection, Sudden Death, Immunohistochemistry

G59 Inherited Cardiac Diseases and Molecular Autopsy: Perspectives and Limitations

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After attending this presentation, attendees will understand the importance of postmortem genetic testing, as well its limitations for the diagnosis of sudden cardiac death in young adult or in sudden infant death syndrome (SIDS) cases.

This presentation will impact the forensic science community by presenting the practical approach to a new diagnostic tool in cases of sudden death in the forensic context.

Cardiac diseases of genetic origin are often the cause of sudden death, especially in young individuals. Postmortem genetic testing, also known as molecular autopsy, is recommended in cases of sudden cardiac death with a negative autopsy. These deaths are currently considered to be due to sudden arrhythmic death syndrome, and are reported in up to 40% of sudden cardiac deaths of young adults. The studies performed on cases of sudden infant death syndrome (SIDS) indicate that approximately 5–10% of SIDS is due to defective cardiac ion channels.

Rhythm disturbances observed in genetically determined cardiac diseases are not always lethal, but can have dramatic consequences if the individual is driving or swimming, for example.

Several cases of sudden death resulting from different genetically determined cardiac pathologies will be presented. In some cases, a morphological substrate, such as arrhythmogenic right ventricular dysplasia cardiomyopathy (ARVD/C) or hypertrophic cardiomyopathy (HCM) was observed at autopsy and confirmed by histological examination. In others cases without any pathology observed during standard autopsy procedures, and after a negative toxicological analysis, mutations in the three genes most frequently implicated in inherited arrhythmias SCN5A, KCNQ1, and KCNH2 were found. In the remaining cases even the molecular autopsy was negative.

The first case is a 33-year-old man who died after losing control of his vehicle. ARVD/C was found at autopsy. No traumatic lesions were observed and it was determined to be a natural death. The second case is an 18-year-old man who died after a football match. The only significant finding at autopsy was the ARVD/C. In this case, an electrocardiogram recorded a few weeks before his death showed pathological patterns pathognomonic for the ARVD/C. In one SIDS case, the molecular autopsy showed mutations in the KCNH2 gene and in another SIDS case a genetic variant in the SCN5A gene. Both have been described in long QT-cases. In the last presented SIDS case, molecular autopsy was negative but a positional asphyxia was evoked after scene investigation and a cartilaginous meta-hyperplasia of the cardiac conduction system was observed.

The major limitations of the molecular autopsy in forensic practice are the cost of the analyses, the accessibility of a competent laboratory and the legal aspects of postmortem genetic testing. The interpretation

of the results and their transmission to the families can also prove to be problematic. Due to the heritability of genetically determined cardiac disease, the autopsy diagnosis is very important for any living relatives. Collaboration with cardiologists and geneticists allows proposing multidisciplinary consultations to them.

In conclusion, the molecular diagnosis of cardiac arrhythmias represents a very useful and attractive tool in cases of sudden death. However, even if the case is presumed to be related to a hereditary cardiac disease the classical guidelines of autopsy practice should be respected (scene investigation, histological examination, toxicological analyses etc.) to avoid the over interpretation of the results of the molecular autopsy. Moreover, due to the heritability of genetically determined cardiac disease, the potential implications for living relatives must be taken into consideration and genetic counseling should be proposed to the family.

Molecular Autopsy, Sudden Cardiac Death, Channelopathies

G60 Sudden, Unexpected Death Due to Glioblastoma: Three Fatal Cases

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The goal of this presentation is to present three cases of sudden, unexpected death due to glioblastoma, with different brain localization and expression.

This presentation will impact the forensic science community by discussing how a complete methodological forensic approach by means of autopsy, histological and immunohistochemical examinations let us to conclude for an acute central dysregulation caused by glioblastoma and relative complication with rapid increase of intracranial pressure as cause of death.

Glioblastoma is the most common malignant primary brain neoplasm, representing about 12-20% of all intracranial tumors and accounting for about 50-60% of all astrocytic gliomas. In the most European and North American countries, the incidence is approximately 2-3 new cases per 100,000 people per year. The incidence of sudden death due to undiagnosed primary intracranial tumor is low in forensic autopsy and is an uncommon event. In fact only 12% of all cases of sudden unexpected death due to primary intracranial tumors are due to glioblastomas.

Three cases of sudden unexpected death due to glioblastoma according to WHO grade IV are reported.

Case 1: a 43-year-old Polish man was found dead in a slope near the track of the railway. Death scene investigation was unremarkable. A complete autopsy was performed 48 hours after death. The external examination revealed only same abrasions and bruises on the face, and the upper and lower limbs. The internal examination revealed polyvisceral stasis, heavy lungs and reddish colored foam on trachea and the main bronchi. The skull was entire. The examination of the brain (cm 21x16x6, g 1630) after fixation in buffered formalin revealed a cerebral edema and an increase in volume of the left frontal lobe. On coronal sections, the cerebral hemispheres were asymmetrical with deviation of midline structures from left toward right. In the left frontal lobe a spherical mass (cm 3.5x3x1.5), with variegated appearance and contained regions of necrosis and hemorrhage was found. The blood alcohol concentration was 0.8 g/l.

Case 2: a 79-year-old Caucasian man, with a history of ischemic heart disease and hypertension, was brought to the hospital in the neurological unit for symptoms such as confusion, slackening, sleepiness, and tremor of the upper limbs start few days before. The brain CT scanner examination shows a large hypodense mass in the left

temporal lobe with massive oedema and compression phenomena on occipital and temporal lobe and midline shift. The patient was then referred for neurosurgical consultation, but the day before surgery he suddenly died. General autopsy performed 48 hours after death was unremarkable. The brain weighed 1600 g and measured (cm 22x16x6.5) showed diffusely swollen cerebral hemispheres and an increase in volume of the left temporal lobe. There was no herniation of the temporal lobe uncus or cerebellar tonsils. On coronal section, after fixation, the left temporal lobe showed a large mass lesion, which measured 3x2.5x2.2, hemorrhagic and surrounded by necrotic and oedematous tissue.

Case 3: a 71-year-old-Caucasian man, with a past history of hypostenia of the right arm, cervical spine surgery, chronic kidney disease, and hepatic steatosis. During his detention, showed headache, confusional state, and difficulty in walking therefore he was transferred to the local hospital. The neurological examination revealed poor general condition, marked weight loss, ataxia and ideomotor slowing, depressive syndrome, apathy, fatigue, and lack of initiative. The laboratory examination of blood and liquor was negative for infection-inflammatory disease. To diagnose a multi-infarct dementia the patient was scheduled for TC and magnetic resonance imaging of the brain and the entire spine, but suddenly died prior to the imaging. At autopsy a moderate pulmonary edema and polyvisceral stasis were observed. The brain weighed 1550 g and showed massive edema. A spherical gelatinous solid mass, measuring 1 cm in diameter was attached in the right medulla. On coronal sections, the right temporal lobe showed a reddish-rusty mass lesion, measuring 1x2 cm and the third ventricle was compressed and dislocated.

The etiopathogenetic definition was outlined by histological examinations performed on brain tissue samples using haematoxylin-eosin (H&E) and Perl's and revealed the presence of diffuse and marked cytotoxic and vasogenic brain edema, and in samples taken from left frontal lobe (case I), left temporal lobe (case II), right medulla and temporal lobe (case III) foci of central necrosis surrounded by neoplastic cells with nuclear pleomorphism, pseudopalisading, multinucleated cells ("giant cells glioblastomas") and vascular proliferation. Areas of extensive haemorrhage near tumor cells were also observed.

The immunohistochemical examination of the brain specimens revealed a positive reaction for antibodies anti-GFAP (glial fibrillary acidic protein), CD68, vimentin and S-100; NSE (neuron-specific enolase), smooth muscle actin, CD34, cytokeratins MNF 116, EMA (epithelial membrane antigen), synaptophysin, HMB45 (Human Melanoma Black) were negative. The positive reaction for GFAP was confirmed by Western blotting. The other organs showed signs of central dysregulation (pulmonary oedema).

The death was attributed in the first and second case to brain edema and massive hemorrhage into the glioblastoma from arrosion of vessels, with an increase in intracranial pressure and compression of cerebrospinal fluid circulation, whereas in the third case death can be explained by distortion and compression of the medulla by the tumor with consequent acute central dysregulation due to glioblastoma corresponding to WHO grade IV.

Glioblastoma, Sudden Death, Immunohistochemistry Stains and Western Blotting

G61 Postmortem Tryptase Levels of Anaphylactic and Non-Anaphylactic Deaths

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After attending this presentation, attendees will understand the importance and some limitations of the analysis of serum tryptase in the postmortem diagnosis of anaphylactic shock.

This presentation will impact the forensic science community by helping the forensic pathologists in the interpretation of postmortem serum tryptase levels. In addition to that, the number of anaphylaxis cases presented here is big, given the rarity of this cause of death.

Introduction: Anaphylactic reactions are encountered very rarely as cause of death in forensic practice and the postmortem diagnosis can be difficult, given the unspecific autopsy findings. The diagnosis is usually based on several criteria, including an elevated serum tryptase level. The established clinical normal values for serum tryptase can however not be used in the postmortem setting and need to be adapted for postmortem cases. The interpretation of postmortem serum tryptase levels may be tricky. So it is well known that some conditions other than anaphylaxis can lead to high tryptase levels and also false negative results can be encountered.

Aims: The presented study is aimed at describing the diagnostic criteria, including serum tryptase levels that were used to diagnose twelve anaphylactic deaths. Moreover, a postmortem normal value for serum tryptase from controls is computed and compared to the published data in the literature.

Methods: Twelve anaphylactic deaths, investigated in the Victorian Institute of Forensic Medicine in Melbourne (AUS), have been retrospectively analyzed concerning the diagnostic criteria, autopsy findings and postmortem serum tryptase levels. The findings and the serum tryptase levels were compared to those of a control group consisting of 33 cases with identified, non-anaphylactic causes of death. To better represent the reality of forensic practice, the control group has been increased by 17 individuals with unascertained causes of death, for a second comparison. The obtained cut-off level was compared to the published data.

Results: The postmortem diagnosis of anaphylaxis in the 12 cases was mainly based on the circumstantial information surrounding the death, the medical history, and the exclusion of other causes of death. Laryngeal oedema was found in 83% of the anaphylaxis cases and in 17% of the controls. None of them had a skin rash. The tryptase levels of the controls will be presented with known causes of death and of the increased control group after including unascertained cases. Some cases with surprisingly high or low levels will be discussed.

Conclusion: Serum tryptase obtained from peripheral blood is the strongest aid in the diagnosis of anaphylaxis as a cause of death. The majority of anaphylaxis cases have tryptase levels of well above 100 μ g/l, whereas the other causes of death had tryptase levels generally under 41 μ g/l. A grey zone clearly exists, and a number of elements should be present to make the diagnosis of anaphylaxis. Even a strongly positive tryptase result should not automatically lead to the diagnosis of anaphylactic shock. In most cases, other elements can be found to support or reject the diagnosis. Other conditions with elevated tryptase levels exist and should be considered in cases with high levels.

Tryptase, Anaphylaxis, Postmortem

G62 Murder-Suicide in Fulton County, Georgia: 1992-2006

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After attending this presentation, attendees will understand the characteristics of murder-suicides occurring during a 15-year-period in Fulton County, Georgia, with emphasis on circumstances and relationships of perpetrators and victims.

This presentation will impact forensic science community by detailing the features of murder-suicide events and reviewing relevant literature, with the goal of providing information relevant to prevention strategies.

Background: Murder-suicide typically involves one or more homicides followed shortly thereafter (usually at the same time but sometimes later) by suicide of the perpetrator. The Fulton County Medical Examiner's Office previously reported a series of twelve murder-suicide cases which occurred in the years 1988-1991. This report is a follow up study of murder-suicide cases in Fulton County, Georgia, which occurred in the 15-year period of 1992 through 2006. Current data are compared with data from the earlier study and other studies reported in the literature.

Methods: The Fulton County Medical Examiner's Office maintains a comprehensive database which includes data items to record companion cases and for the past seven years, indication of whether death was part of a murder-suicide event. The data base was searched to detect murder-suicide events and to collect demographic, cause of death, and circumstantial information for each case. Results are compared with our previous study, the literature, and the incidents are classified in the context of a previously published classification scheme.

Results: 40 incidents occurred during the 15-year period. There were 40 suicides and 46 homicides for a total of 86 decedents. The number of incidents per year ranged from 1 to 6 with an average of 2.6, and the number of decedents per year ranged from 2 to 17 with an average of 5.5 per year. There were two decedents in 38 of the incidents, three decedents in one incident, and seven decedents in one incident. There was at least one murder-suicide event each year.

In every case, the perpetrator was male. Fourteen of the perpetrators (34%) tested positive for ethanol, five of the homicide victims (11%) tested positive for ethanol, and in three cases (7%), both the perpetrator and victim were positive for ethanol. In 8 cases (26%), the perpetrator was positive for stimulant drugs such as cocaine or methamphetamine.

In 34 incidents (85%), the perpetrator and victim were both shot. One incident involved sharp force injuries of both decedents, another incident involved thermal burns of both decedents, and in four incidents a combination of methods was used. 27 (66%) incidents occurred in or on the property of the perpetrator's place of residence. The most common circumstance was a boyfriend killing a girlfriend (n=13) or ex-girlfriend (n=3). The second most common was a husband killing his wife or ex-wife (n=11). An employee killed a coworker in three incidents. In two incidents, one male killed another male during an argument.

Of the perpetrators (all male), 9 (23%) were White, 6 (15%) were Hispanic/Latino, and 25 (63%) were Black. Both Hispanics and Blacks were overrepresented in comparison with their prevalence (43% and 8% respectively) in the county population while whites were underrepresented (account for about 50% of the population). In 37 incidents (93%), all decedents were of the same race. In three cases, the perpetrator was Hispanic/Latino and the victim was White (non-Hispanic). A male killed one or more females in 34 of the 40 incidents (85% of cases).

The number of days between incidents ranged from 12 to 483 with a median of 125 days and a mean of 142 days. Thus, evidence of short term clustering was minimal except for two incidents in late June and

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early July of 1999. The same year which had the maximum number of incidents (n=6).

Comparison of the present study to our previous study shows only slight differences in the trends observed, which may relate mainly to the much larger size of the most recent case series.

Using the classification scheme of Marzuk, Tardiff, and Hirsch, the most common type of incident (71% of incidents) was "Spousal or Consortial" (in which we included spouses, former spouses, girlfriends, and ex-girlfriends) and the most common motive (27% of incidents) was "Amorous Jealousy." A similar portion of cases involved some form of argument or relationship problem which was not further clarified. Of note, 12 cases (30% of incidents) involved motives that were not apparent. This finding points out the difficulty in clarifying the motive when the people who might be able to explain what happened are dead and further specific information cannot be determined.

All but three incidents involved circumstances in which the deaths of the victims and perpetrators had a close temporal relationship. In one case, the perpetrator died in the hospital after a two months stay for his self inflicted gunshot wound. In a second and atypical case, the perpetrator committed suicide in jail several months after being arrested for the murder of the victim. In the third case, the homicide victim died about five months after the incident from ongoing complications of her gunshot wounds.

Conclusions: Similar to other studies, murder-suicides in Fulton County, Georgia show a low but stable rate of occurrence with a predominance of male perpetrators, female homicide victims, same-race victims, two deceased persons, a victim-perpetrator relationship such a spouse or girlfriend, and causes of death which predominantly involve gunshot wounds.

Murder-Suicide, Homicide-Suicide, Violent Death

G63 Homicidal Deaths in the Western Suburbs of Paris: A 15-Year-Study With Special Focus on Survival Time

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After attending this presentation, attendees will understand homicide trends in an area around Paris and the value of Injury Severity Score (ISS) for the estimation of survival time.

This presentation will impact the forensic science community by helping forensic pathologists in homicide case investigations when questions about victim's survival time are raised.

The goal of this study was to analyze the homicide pattern in the western suburbs of Paris and its evolution between 1994 and 2008. ISS was also assessed to see if it was correlated with the survival time of homicide victims.

All autopsy reports regarding homicides from January 1, 1994 to December 31, 2008 were retrospectively reviewed. All autopsies were performed in the Department of Forensic Medicine and Pathology of Garches. Out of 4,842 autopsy cases reviewed, 511 homicide cases were selected. The following data were recorded: assailants' and victims' characteristics, crime scene location, homicide motive, cause of death, postmortem toxicological results, ISS, and estimated survival time.

Homicide rate steadily declined over the period at the exception of the number of homicide-suicide per year which remained constant. Homicide victims remained unidentified after medico-legal investigations in 2% of the cases. Child and elder homicide cases

represented respectively 10.7% and 8.2% of the cases. Offenders were male in 88% of the cases. Male and female assailants showed distinct homicide patterns: females were involved more frequently in familial quarrel and child abuse. They never killed a stranger and committed homicide exclusively in a private place with a predominance of sharp weapons. Males in contrast assaulted almost equally a stranger or an acquaintance, often in a public place with a predominance of firearm. The victim knew the assailant(s) in 57% of the cases. Homicides mostly took place at the residence of the assailant or the victim. Homicide motive was clearly determined in 71% of the cases. Argument was the most common motive in 44% of the cases. Sexual assault was rarely found (ten cases). Gunshot wounds were the most common cause of death (37%), followed by stab wounds (27%), blunt trauma (19%) and asphyxia (13%). A decrease of gunshot wounds as a cause of death was found over the studied period. Alcohol was the most common toxic detected in blood victim, in 48.5% of the cases when toxicological results were available. Blood alcohol concentration ranged from 1 to 500 mg/dL with a mean value of 150 mg/dL. Survival time was determined in 162 cases and ranged from 0 minute to 25 days. The mean ISS was different according to the cause of death: 3.4 for deaths by asphyxia, 38.6 for deaths by stab wounds, 39.6 for deaths by blunt trauma and 60 for deaths by gunshot wounds. ISS and survival time showed a significant correlation ($r=-0.56$; $p<0.05$) only for short survival time (less than three hours) and after exclusion of deaths by asphyxia (n=58). Correlation was weaker when there was a long time of resuscitation.

In conclusion, this autopsy series research pointed out that homicide pattern strongly differed according to the sex of the victim and of the assailant. ISS could be used to help in estimating the victim's survival time, taking into account the compounding factor of resuscitation.

Homicide, ISS, Survival Time

G64 Pattern of Limb Lesions in Suicidal Hanging: A Criteria Tool in the Distinction of Suspicious Cases

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After attending this presentation, attendees will have a better understanding of the usual pattern of lesions in suicidal hangings and will be aware of the pattern of lesions to be considered suspicious.

This presentation will impact the forensic science community by providing tools to improve the screening of suicidal hangings for possible suspicious cases.

Introduction: In this era of limited resources, hanging cases are investigated in several jurisdictions by a limited scene analysis and a rapid external examination of the body. Full body autopsies are becoming less and less frequent in these cases, based on the assumption that hangings are virtually always suicide. Homicidal hangings are therefore at serious risk to be missed, particularly since they are difficult to detect. However, to recommend a full body autopsy on all hanging victims is not realistic considering the limited human and financial resources.

In a recent six-year retrospective study on the pattern of limb bruises in hanging conducted in the Province of Quebec, Canada, it was suggested that the presence of bruises on the anterior upper limb and the presence of bruises on both the upper and lower limbs were two criteria that should alert the pathologist to be more cautious. The presence of bruises on the posterior lower limb was initially proposed as an additional criterion of suspicion, but failed to reach statistical

significance. The present study aims at evaluating the validity of these criteria on a different population and to further investigate the usual pattern of limb lesions in suicidal hangings.

Material and Methods: A total of 214 suicidal hangings, investigated at the Office of the Chief Medical Examiner in Alberta, were reviewed for the presence and localization of bruises, abrasions and lacerations. An age- and gender-matched control group of non-hanging homicidal strangulations, composed of 51 cases, was similarly studied.

Results: Incidence of limb lesions: Bruises were found in 6% of suicidal hanging victims, abrasions in 5% and lacerations in 1%. Compared to homicidal strangulation victims, suicidal hanging victims are less likely to present bruises ($\chi^2=84.301$; $p=.000$; $\Phi=.564$), abrasions ($\chi^2=75.231$; $p=.000$; $\Phi=.533$) and lacerations ($\chi^2=8.123$; $p=.023$; $\Phi=.175$).

Usual pattern of limb bruises in suicidal hanging: The usual pattern of limb lesions in suicidal hanging victims was confirmed to be the following: bruises and abrasions are mostly found on the posterior part of upper limbs, on the anterior aspect of lower limbs, and on either the upper or lower limb but not to both in a single case. It was also found that bruises are commonly found on the anterior part of upper arms, but not on the anterior part of forearms. The comparative pattern in homicidal non-hanging strangulation does not display this preferential concentration.

Suspicion criteria for limb bruises: Three criteria were statistically confirmed to be in favor of an homicidal strangulation: the presence of bruises and/or abrasions (i) on the anterior forearms (bruises: $\chi^2=16.500$; $p=.001$; $\Phi=.250$; abrasions: $\chi^2=16.224$; $p=.001$; $\Phi=.247$), (ii) on the posterior aspect of lower limbs (bruises: $\chi^2=39.092$; $p=.000$; $\Phi=.384$; abrasions: $\chi^2=25.642$; $p=.000$; $\Phi=.312$), and (iii) on both upper and lower limbs in a single case (bruises: $\chi^2=51.043$; $p=.000$; $\Phi=.439$; abrasions: $\chi^2=24.682$; $p=.000$; $\Phi=.305$).

Conclusion: In the evaluation of a given case, the presence of the following distribution of bruises or abrasions should alert the pathologist to be more cautious and to further investigate the case: the presence of bruises or abrasions on the anterior forearms, on the posterior legs, or on both upper and lower limbs in a single case. Of course, the localization of bruises and abrasions is not to be interpreted without all other scene elements and autopsy findings.

Hanging, Bruise, Abrasion

G65 Decubitus Ulcers and Ligature Marks as Evidence in a Homicide Case

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After attending this presentation, attendees will better understand the application of medicolegal investigation, specifically the role of forensic pathologist during homicide investigation. In addition, attendees will become familiar with the relatively rare injury patterns in forensic practice.

This presentation will impact the forensic science community by providing knowledge to medicolegal investigators, especially in deciding cause and manner of death in equivocal death investigations. This presentation will increase the competence of the medicolegal examiners and forensic pathologists in examination of complicated cases, when the autopsy findings may become unique evidence in the following legal action and adjudication.

The 30-year-old woman was found dead in the house where she was living with her fiancée and her mother-in-law. At initial inspection, bad condition and exhaustion of the body suggested natural death by malignant disease with no preview of medical history. Some unusual circumstances aroused suspicion. The victim was isolated in the dark room with no possibility to call for help, because her private cell phone

was taken away. Crime police found adhesive tapes and linen strap near the bed. Insensitive behavior of the household aroused suspicion and demanded careful pursuit of the following medicolegal investigation.

External examination of the body revealed three different types of injuries: decubitus ulcers (pressure sores), scabs (as ligature marks), and bruises of various ages. The decubitus ulcers stage II and III of the coccyx-sacrum region and on the both sides of the buttocks, ulcers stage II of the left elbow and the left ankle, ulcers stage I of the left trochanter and over the pectoral spine near the left shoulder blade were described. The circular scabs around the neck, and both wrists indicated ligature marks, so as the necrosis of the II-III fingers on the left hand. The bruises of various colors were presented on the left hand and upper arm, as well as along both medial femoral regions. The autopsy findings showed that the sacro-coccygeal ulcers extended into the subcutaneous tissue and secondary resulted in bronchopneumonia with purulent effusion into the left thoracic cavity. The lipofuscin pigmentation of hepatocytes and myocytes as histopathological changes indicated a state of long time deprivation of food. The forensic pathologist pronounced the cause of death violent death by bronchopneumonia caused by infected decubitus ulcers.

It is believed that no similar cases described in the recent literature have been found. Homicide of a young woman by the infliction of decubitus ulcers caused by immobility and fixation of the victim's body with ligature (tapes and strap) including elements of social and physical separation combined with starvation has not yet been described in the criminal records in Croatia.

The forensic psychiatry expert determined the specific relations between the victim and the perpetrators. This study concluded that the perpetrators didn't act alone. The male perpetrator was a drug addict who had permanent schizotypal disorder of personality, with characterization of egocentrism, latent aggression, lower tolerance threshold and emotional coldness. His mother was a person with dominantly narcissistic and dissocial personality disorder, with an intention to control the life of her son. The victim was a person with predominantly passive-dependent personality disorder, psychologically and socially predetermined to victimization. Forensic psychiatrist concluded that the perpetrators planned the crime together, carried on by the motive of jealousy.

According to Croatian Penal Code the perpetrators of a criminal offence were convicted of intentional murder to 30 years imprisonment.

The case presented shows the importance of a detailed crime investigation and close cooperation between crime police and forensic pathologist, especially if the presumed course of events is ambiguous. Recognition of the relatively rare injury patterns and understanding the mechanism of death seems to be the most important factor in elucidation of the presented homicide case.

Decubitus Ulcers, Ligature, Homicide

G66 Soccer Scams, Search Engines, Scientists, and Slaughter: Investigating a Complex Double Homicide in North-East England

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After attending this presentation, attendees will see the value of using relevant subspecialty expertise in forensic pathology and the benefits of good communication between the various experts and investigating authorities in ensuring that evidence given in court is reliable and supported by validated scientific principles.

This presentation will impact the forensic science community by showing how a complex case can be brought to a satisfactory conclusion by methodical examination of the available evidence.

In 2008, two Chinese nationals who had been students at Newcastle University were found dead in their home. They had clearly been the victims of homicide and a pet had also been killed. There was virtually no evidence at the outset as to when or why the murders had occurred and no suspect existed. Scene examination showed that both victims had been bound and suffered significant blunt force trauma. At autopsy, evidence of incised wounds was identified in one victim and signs of asphyxia in the other.

The brains were submitted to a forensically experienced neuropathologist who provided valuable evidence with respect to the survival period after injury. The meal that one of the victims had eaten when last seen alive had been at the restaurant where she worked. The nature of this meal was known and the gastric contents of this victim were examined by both the pathologist and a scientist to attempt to identify the components of the stomach contents and the degree of digestion.

Although a national appeal was made on television for information, a suspect was developed by an unusual method. A strong case including DNA evidence was made and ultimately this individual was convicted on two counts of murder.

Good communication between the experts and police led to the development of a powerful and reliable case assisted by relevant subspecialist expertise.

Blunt Trauma, Homicide, Organized Crime

G67 Death Certification of “Suicide by Cop”

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After attending this presentation, attendees will understand the concept of “suicide by cop” and the criteria used to certify these deaths as suicides.

This presentation will impact the forensic science community by discussing examples of “suicide by cop” and why suicide (and not homicide) is the appropriate manner for these deaths.

A death certification of “suicide by cop” is controversial among some medical examiners and coroners (ME/C). These are often complex investigations and the opinions of the medical examiner must take into consideration all relevant issues. Five such deaths are presented that were certified as suicides and discuss the medicolegal issues involved with these certifications. In order to certify such a death as a suicide, certain criteria should be met. The five criteria used to make this certification include evidence of: (1) suicidal intent; (2) intent to be shot by law enforcement; (3) possession of a lethal weapon or facsimile; (4) intentional escalation of the encounter; and, (5) legal use of force by law enforcement. These legal actions of law enforcement are what distinguish these deaths from other instances of “assisted-suicide” that would be certified as homicides if they involved the illegal actions of another.

All of the decedents were male and their average age was 34 years (range 26 to 43). Both ethanol and cocaine were detected in two of the decedents and the other three had a history of psychiatric illness. All of the decedents possessed weapons or a facsimile of a weapon. There were three handguns, two knives, and one silver cigarette lighter in the form of a gun.

Suicide by cop is a circumstance that involves the completion of intentional acts that may result in dichotomous determinations of the manner of death. In some jurisdictions, these deaths are certified as homicide. Since these deaths occur at the hand of another, the invoked reasoning is that homicide therefore dominates the certification. But what if there was reliable evidence that a person wanted to die and committed an intentional act to further that goal? If the death was the result of an intentional act to do self harm or cause death of one’s self,

then the manner of death is more appropriately certified as “suicide” in these instances despite the fact that the decedent did not pull the trigger.

For police shootings, the conventional certification remains “homicide” in the absence of other compelling circumstances. But just because these deaths occur at the hand of another, there should not be an automatic homicide determination in all instances. Suicide should be considered in these deaths. Despite the absence of direct self-infliction, there is overwhelming evidence that these five individuals intended to end their own lives. Their use of an unusual method to accomplish this goal may inappropriately result in a reflexive certification of homicide. Instances of suicide by cop and contend that these types of deaths are best certified as suicides will be presented.

Suicide, Police, Manner

G68 Study of Lethal and Non-Lethal Filmed Hangings: New Insight Into the Pathophysiology of Hanging

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After attending this presentation, attendees will have a better understanding of the pathophysiology of hanging, of the effect of the type of suspension and ischemic habituation on the agonal sequence, and on the appropriate scientific answer to the time to die by hanging.

This presentation will impact the forensic science community by providing new insight into the pathophysiology of hanging, based on the ongoing study of the working group on human asphyxia.

Introduction: Contemporary understanding of the pathophysiology of hanging is still largely based on old writings and experimentation from the end of the 19th century and beginning of the 20th. Apart from a few animal studies that gave very limited information on the pathophysiology of hanging in human, there was little new development on this issue until the creation of the Working Group on Human Asphyxia in 2006. Here presented are the newest results from this ongoing study.

Material and Methods: Fourteen lethal filmed hangings (nine autoerotic accidents, four suicides, and one homicide) were analyzed, as well as three non-lethal filmed hangings by an autoerotic asphyxia practitioner.

Results and Discussion: *Lethal filmed hangings:* In the fourteen lethal filmed hangings, the following sequence of agonal responses was observed: rapid loss of consciousness in 10 s ± 3 s, mild generalized convulsions in 14 s ± 3 s, decerebrate rigidity in 19 s ± 5 s, beginning of deep rhythmic abdominal respiratory movements in 19 s ± 5 s, decorticate rigidity in 38 s ± 15 s, loss of muscle tone in 1 min 17 s ± 25 s, end of deep abdominal respiratory movements in 1 min 51 s ± 30 s, and last muscle movement in 4 min 12 s ± 2 min 29 s.

Effect of the type of suspension: A comparison of time delay for agonal responses in complete suspension and incomplete suspension do not reveal impressive differences. These results suggest that the type of suspension may not be an important factor in the timing of agonal responses and therefore in the time to irreversible damage and death.

Effect of ischemic habituation: Considering that autoerotic practitioners might develop over time a certain ischemic habituation over time, it is theoretically possible that these cases present a deceleration of the sequence. On the other hand, since they often play for a longer period with the hanging process before the final hanging, it could be argue that on the contrary, their hanging sequence will be accelerated. Overall, the time delays for the early responses to hanging seem to be relatively similar between both groups, with the exception of an accelerated start of deep abdominal respiratory movements in the autoerotic practitioners. As for the late responses to hanging, they seem to be decelerated in autoerotic practitioners.

Non-lethal filmed hangings: In the three non-lethal filmed hangings, a loss of consciousness was observed in 8 to 16 seconds, followed by convulsions in 9 to 26 seconds. Decerebration rigidity was observed in one non-lethal filmed hanging (at 20 seconds). The ligature, which was not tied tightly to the shower rod, then detached from it, causing the fall of the man and the interruption of the hanging. Upon interruption of the hanging, the man quickly regained consciousness and seemed to present a full recovery without any noticeable symptoms.

Estimation of the time to irreversibility and to die by hanging: The scientific basis for the generalized assumption that death by hanging occur in three to five minutes will be reviewed. There is no forensic study to sustain this estimate of five minutes to die. In fact, this number seems to be based on three types of studies: a series of near-hanging victims in emergency medicine, studies of carotid endarterectomy, and physiopathological studies of brain ischemia. Though this estimation of the time is certainly precise and accurate enough for the needs of clinicians, it will be demonstrated that scientific evidence are not strong enough to be used in court. So how long does it take to suffer irreversible damage by hanging or by strangulation? The only honest and scientifically valid answer is not known.

Asphyxia, Hanging, Pathophysiology

G69 Pitfalls in the Interpretation of the Hyoid and Thyroid Fractures in Strangulation: The Importance of Anatomical Variations

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After attending this presentation, attendees will have a better knowledge of the importance of anatomical variations in the interpretation of fractures of the hyoid bone and thyroid cartilages.

This presentation will impact the forensic science community by developing and increasing awareness of the pitfalls associated with anatomical variations of the hyoid bone and the thyroid cartilage in strangulation cases.

Strangulation is defined as asphyxia by closure of the blood vessels and/or air passages of the neck as a result of external pressure on the neck. Three subtypes are recognized: hanging, ligature strangulation, and manual strangulation.

A proper neck dissection is a key element in the investigation of these deaths. Despite the usefulness of x-ray and computed tomography as ancillary techniques, manual dissection of the neck structures remains the most widely used technique to assess the integrity of neck structures. Considering the relative complexity of the neck dissection, it is important that it is performed by a trained forensic pathologist.

Apart from basic anatomical background and technical skills, forensic pathologists are in general well trained in recognizing postmortem artifacts encountered during the neck dissection. Unfortunately, anatomical variations as pitfalls in the interpretation of fractures of the hyoid bone and thyroid cartilage are however unknown to most. This comes to no surprise considering that forensic textbooks and the forensic literature have failed to pay any attention to these anatomical variations.

The anatomists have described several anatomical variations of the hyoid bone and thyroid cartilage that are of great interest to forensic pathologists. The triticea, a very small cartilage located in the thyroid-hyoid membrane, is encountered in approximately 13 to 16% of individuals. This cartilage can easily be mistaken as a fracture of the superior horns of the thyroid cartilage. Asymmetrical length of the superior horns of the thyroid cartilage, morphological differences between horns, and unilateral absence of one horn are all variations that

also constitute pitfalls in the interpretation of fractures of the thyroid cartilage. In the hyoid bone, the forensic pathologist should be aware of the following possible variations: unusually long great horn, uncommonly long lesser horns, difference in the fusion time of the greater horns to the body, and calcification of the stylohyoid ligament. The consistency of the hyoid bone and thyroid cartilage in relation to the victim's age should also be taken into consideration in the interpretation of autopsy findings.

Forensic pathologists should be aware of the anatomical variations of the hyoid bone and thyroid cartilage and should be trained in recognizing them, in order to avoid erroneous interpretation of autopsy findings. The role of x-ray and computed tomography as ancillary techniques will be discussed, but the importance of a proper manual dissection, with palpation of the fractures, will be reinforced. After removing the viscera from the chest and abdominal cavities and removing the brain (dry neck dissection), it is recommended to dissect *in situ* the muscles layers and then to remove the neck organs from the mouth and cervical column, in order to perform a dissection *ex-situ* of the hyoid and thyroid cartilage. Ultimately, the hands and eyes of the pathologist constitute an invaluable tool, provided there is proper training and knowledge. The dissection technique to assist in the discrimination of anatomical variations versus fractures of the neck structures will be further described.

Despite the tremendous importance of correct interpretation of anatomical variations in the identification of fractures of the neck structures in strangulation, this issue has not been properly discussed in the forensic literature so far. This presentation is aimed to fulfill this gap.

Hyoid, Thyroid Cartilage, Strangulation

G70 A Comparison Study of Homicides Between Beijing, China and the State of Maryland, United States

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After attending this presentation, attendees will have learned the epidemiological characteristics of homicides in Beijing, China and the state of Maryland, United States.

This presentation will impact the forensic science community by illustrating the differences in the pattern of homicides between China and the United States, and by discussing the influence of cultural dimensions and socioeconomic development on violent crime.

A retrospective comparison study was conducted on homicides occurring in 2008 comparing Beijing, China and the State of Maryland, United States. Beijing, the capital of China, with a population of 16,950,000, covering 6.489 square miles, is made up of two suburban counties and 16 urban districts. Maryland, with a population of 5,633,597 and a total area of 12,407 square miles, comprises twenty-three counties and Baltimore City. In 2008, a total of 398 homicides occurred in Beijing. The homicide rate was 2.34 homicides per 100,000 population. Maryland, however, had 536 homicides (9.51 per 100,000 population), which was more than four times as high as the homicide rate in Beijing. Males were much more likely to become homicide victims than females in Maryland (Male: Female = 5.2:1, based on the rate), when compared with homicides in Beijing (Male: Female = 1.4: 1). The age distribution of homicide victims was similar between Beijing and Maryland, with the majority of the victims in their 20's to 40's.

The most common cause of homicide in Beijing was sharp force

injury (52.8%), followed by blunt force injury (24.1%), asphyxia due to suffocation/strangulation (17.8%). Only two deaths were caused by firearm injury combined with sharp force injury. On the other hand, the most common cause of homicide in Maryland was firearm injury (74.8%), followed by sharp force injury (10.3%), blunt force injury (5.0%), and suffocation/strangulation (3.5%). There was a significant difference between Beijing and Maryland regarding the homicide death scene location. More than 71% of the homicide victims in Beijing were found inside of buildings, such as residential houses (44.2%), business/government offices (10.0%), stores (7.5%), night clubs (6.5%), and other facilities (2.8%). However, only 37.9% of the homicide victims in Maryland were found inside of buildings with fewer than 30% of the victims found in residential houses. The majority of Maryland homicide victims were found either on the street (42.9%), or in the park/wood/field (12.9%), or other outside locations. The possible motives of homicide in both regions will also be discussed.

Forensic Science, Homicide, Epidemiology

G71 Blood at the Scene of Death Due to Hanging: Artifact or Antemortem

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After attending this presentation, attendees will understand the distinctive difference between antemortem and postmortem collection of blood, the dynamics of blood collecting at the scene, principles of artifacts, importance of determining that the blood at the scene of crime was not antemortem but was a postmortem phenomenon, correlating the blood with the injuries, and example of dubious presentation of suicidal and homicidal deaths due to asphyxia.

This presentation will impact the forensic science community by showing how suspicion and or allegations of not reporting injuries or reporting incorrectly are related to the evidence of blood at the scene of crime. Blood oozing out of injuries sustained during medical treatment needs to be differentiated from those injuries that were inflicted after the death of an individual. Misinterpretations can be reduced and scope and diagnostic accuracy could be enhanced by the exclusion of antemortem nature of blood at the scene of occurrence.

In India, those who do autopsies are generally not supposed to visit the crime scene. Autopsy opinions about cause and manner of death are sometimes in conflict with the opinion of those who had observed blood at the scene. In order to set aside an autopsy opinion of "suicidal hanging" and to believe that of "ligature strangulation" in three different cases, proving how blood at the scene could be postmortem was a big challenge.

Manner in which the blood at the scene had been perceived during the investigation or even some time after the occurrence and investigation was significant. Such a perception formed the basis to confront the autopsy opinion in three controversial cases. Baring the truth that blood at the scene was not that had oozed out of the injuries sustained during life in these cases makes an interesting case. In the first case of suicidal hanging, bleeding was from the injury that was inflicted after the death by the tip of a scissors used to cut ligature material around the neck. The second case relates to a probe into the reinvestigation of a suicidal death of a hanged victim who had been discovered dead on the fifth day. Earlier investigation and autopsy opinion of hanging were considered botched. The contention was that the victim had injuries; these injuries were not reported and had been missed deliberately both by the investigators and in the autopsy. The blood at the scene was the result of collection from constant dribbling due to postmortem hypostasis. It was not as was being presumed to have collected at the scene from some missed injury on the front of the body of hanged victim. The third case was of a lady found dead in her own house. Co-existence

of a thread like ligature mark around her neck with the fresh bleeding cut throat injury and bleeding sharp weapon injuries on both the wrists remained a mystery. One of these or both of these were the cause of deaths remained the issue. Death was due to ligature strangulation became the diagnosis that blood had come out of the injuries which were caused by shaving blade after the death.

Antemortem looking postmortem blood raised issues to challenge the credibility of the autopsy opinion and or police investigation in three cases. A case study to show how misinterpretations of blood at the scene discredited family version as well as autopsy opinion of hanging in the case of two suicidal deaths will be presented. Inference indicating ligature strangulation appeared weak and ineffective so long as antemortem appearing injuries were found to be postmortem cuts in the third case. It is recommended that death investigators be familiar with the sensitivity to exclude the probability of blood at the scene being postmortem and unrelated to the actual mechanism of death.

Antemortem, Postmortem, Blood

G72 The Influence of the Meteorological Factors on Occurrence of the Suicide Cases

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The goal of this presentation is to demonstrate the correlation of the dependency between meteorological factors in defining the reasoning in suicides for forming training for prevention and alertness.

This presentation will impact the forensic science community by assisting in increasing the understanding of suicide.

During the investigation of suicide cases, the focus is ordinarily on the location of the event, the type of death, personal information and additional documents but it is also important to study other factors influencing the death, factors like meteorological conditions. Full-fledged suicide has many affects on society and many scientists pay very close attention to it, but most of the significance is that suicide is a social and medical problem.

Meteorological and heliophysics factors as well as socio-economic events have a great influence on the emotional state of an individual, and may also be factors in the occurrence of several diseases. Moreover, they may also increase the occurrence of suicide.

Factors such as atmospheric pressure, air temperature, humidity, and solar radiation have been fully analyzed with respect to the influence on suicide. Reports from suicide cases with conclusions of medical examiners for a five-year period were provided by the Main Bureau of Forensic Medicine in Tashkent, Uzbekistan. Information about temperature, humidity, atmospheric pressure, rain, and magnetic storm indices in Tashkent city were obtained from Uzhydromet, the Hydrometeorological Services Center in Tashkent.

Study results were analyzed for significance using the Student t-test method.

The results of the analysis of both suicide cases and meteorological factors have been combined and adequate statistics had been created. After certain procedures it had been highlighted that the correlation between two types of factors is indirect. This correlation was worked out by Health Institute of the Ministry of Health of the Republic of Uzbekistan for early prognosis of suicide occurrences affected by many factors.

This study of the effects of meteorological factors on suicide rates showed a strong correlation only with atmospheric pressure and air temperature. The method of direct correlative relationship (2, 3) worked out by the Republican Information Analytical Center was applied to this data to study the effect of many meteorological factors on suicide rates. The results of this study allowed for the creation of a formula for predicting the number of suicides cases as a function of air temperature

and atmospheric pressure: $X = 0.014198 \{ T (^{\circ}C) \} - 0.0000708 \{ P (GPa) \} + 0.65990$; where, X= number of expected suicides per day; T= expected air temperature; P= expected atmospheric pressure. According to given equation, the average fluctuation of the number of expected occurrences is ± 0.05 , at a confidence of 95%.

The above study shows that there is a certain relationship between meteorological factors such as air temperature and atmospheric pressure with the occurrence of suicide cases. The developed formula based on the combination of meteorological factors makes it possible to predict the expected suicide states and take preventive measures.

Forensic Pathology, Suicide, Meteorological Factor

G73 Complex Suicide: An Unusual Case With Six Methods Applied

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After attending this presentation, attendees will be acquainted with complex suicide, potential methods applied, determination of main-dominant cause of death, and will be provided with more details about traumatic brain injury caused by screwdriver.

This presentation will impact the forensic science community describing six methods in committing complex suicide that should be of great interest in common forensic practice.

Complex suicides are committed by using more than one method. They account for 1.5% to 5% of all suicides. Depending on the time delay between the employed suicidal mechanisms they can be defined as “primary complex suicides” if the mechanisms are applied simultaneously and “secondary complex suicides” if the mechanisms are applied in quick chronological sequence.

The report presents a case of complex suicide of a 44-year-old male, found dead in the vicinity of his car, in a deserted frozen field few kilometers away from the nearest town. The doors of the car were opened, and victim's head and clothes were soaked in blood. Blood spots were found on both front car seats. Neither weapons nor any tools were found around his body outside the car. A farewell letter was handwritten on two sheets of paper and was found on the dashboard of the car. The motive for committing suicide was not given in this letter. On the right front car seat there were blood spots, a screwdriver handle, an automobile crane, one razor blade, one cell phone, car keys, a pencil, and a woolen hat. In front of this seat there were two half-emptied red plastic bottles with hydrochloric acid, and one almost empty transparent plastic bottle with traces of liquid of unknown origin. A single receipt from the nearby town supermarket was found in the car. One screwdriver, pack of razor blades, and two bottles of concentrated hydrochloric acid were listed in the receipt. Police investigation excluded homicide and no medical data confirmed mental illnesses.

The autopsy revealed wrist cuts, neck cuts, acid burns in the GI tract, multiple stab wounds to the head by screwdriver, and several uncertain signs of hypothermia. In the parietal region, along the midline, there was an epidural hematoma measuring 5x1 cm in diameter. The brain was swollen, with flattened gyri and narrowed sulci, measuring 1.64 kg. Marked indentations on the ventral surface of cerebellum, indicating tonsillar herniation were found. The brain tissue along all wound tracts was debrided, but there were no diffuse injuries in white matter, nor were concentric zones of necrosis around the tracts noticed. Toxicology analysis (GC-MS) of gastric and intestinal content revealed Cypermethrin (synthetic pyrethroid used as an insecticide in commercial agricultural applications), while analysis of blood, urine and bile was negative. The same substance was identified in liquid from transparent plastic bottle, taken from the scene.

The stab wounds to the head were determined to be the cause of death, while external hemorrhage and hypothermia were contributing factors. This is the first case of complex suicide reviewed in literature where six suicide methods were applied. This particular case is interesting because the victim used a screwdriver as a tool for inflicting stab wounds to the head, which is a rare suicidal method.

Complex Suicide, Traumatic Brain Injury, Screwdriver

G74 Bitten by Snake Shot: Attempted Homicide and Successful Suicide With Multiple Gunshot Wounds

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The goal of this presentation is to illustrate an unusual case of an attempted homicide and successful suicide with a revolver and multiple snake shot cartridges.

This presentation will impact the forensic science community by illustrating the need for close collaboration between the forensic pathologist and the firearm examiner when dealing with cases of unusual gunshot wounds.

Introduction: Suicide is one of the most important public health issues in the United States. Suicide represents the eleventh leading cause of death in the United States. Suicides comprise approximately 12% of the caseload of the Allegheny County Medical Examiner's Office in Pittsburgh, Pennsylvania. Suicide rates for this country have been relatively stable over the past decade averaging approximately ten per 100,000 populations. The most common method of suicide in the United States is the use of a firearm.

Homicide-followed-by-suicide (referred to as “homicide-suicide”) incidents are rare events but can have a profound impact on families and communities. The National Violent Death Reporting System based on 2003-2005 data, revealed 408 homicide-suicide incidents in 17 participating states. Most incidents were committed with a firearm (88.2%) and perpetrated by males (91.4%), those over 19 years of age (97.6%), and those of white race (77.0%). Over 55% of male homicide-suicide perpetrators had prior intimate partner conflicts.

Materials and Methods: The case involved a 53-year-old Caucasian male and his wife with a long standing history of domestic violence. The couple began to argue when suddenly the decedent pulled out a revolver and shot his wife in the face several times. The wife ran downstairs, exited the house, and ran to the neighbor's house for help. She was transported to a local hospital, treated for three gunshot wounds to her face and then subsequently released weeks later.

The decedent was found in the upstairs bedroom in bed with a revolver lying on his left leg. Two wounds were noted to the left and right sides of his head.

Results: The external examination revealed a Caucasian male with two contact penetrating gunshot wounds to both sides of his head. Dense soot deposits were present on the skin and within the wound tracks. Faint muzzle abrasions with micro-stretch lacerations were identified surrounding the entrance wounds. Gunpowder residue was grossly visible on both the left and right hands. Radiographs of the head revealed two separate aggregates of pellets. Autopsy revealed a gunshot wound of entrance just lateral and slightly superior to the right orbit. The path of the pellets was leftward through the orbital rim, posterior, and inferior to the orbital globe and came to rest in the sphenoid sinus. The second entrance wound entered superior and anterior to the left ear. The path of the pellets was rightward through the frontal bone and frontal lobe of the brain where they were recovered.

The firearm used by the decedent was a revolver made in West Germany chambered in 22 long rifle. The ammunition in the revolver consisted of five spent rounds and one live cartridge of .22 caliber long rifle shotshells loaded with number (size) 12 shot.

Conclusions: Collaboration between the pathologist and firearms examiner concluded that the decedent shot himself near his right orbit first and then changed hands and shot the lethal round into the left frontal region of his head. This is supported by gunshot residue on both hands and autopsy evidence that the path of the pellets on the right side of the head did no major damage. A literature review revealed only two published papers pertaining to the use of snake shot or shot shells. This case report offers to further build upon the knowledge of terminal ballistics of handgun shot shells.

Snake Shot, Handgun, Suicide

G75 Survived Strangulation: A Case Report

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The goal of this presentation is to analyze and discuss the injury pattern potentially associated with situations of survived strangulation and the various consequences that may result from them, based on real cases. This presentation will also attempt to determine, if findings and symptoms of victims can be intensity of the assault and the severity of strangulation and if general evaluation criteria can be established on the basis of objective findings.

This presentation will impact the forensic science community by presenting severe survived strangulation cases researched, and introducing other cases described in literature. Difficulties usually exist in clinical forensic medicine regarding the interpretation of the findings in reference to the intensity and duration of the assault and, ultimately, the threat it represented for victim's life. This assessment is particularly important when conclusions must be drawn in the context of penal law, in order to allow the court to decide about the life risk involved in situations of aggression.

Cases Report: Several cases are presented involving different situations, from victims of assault to incidences of accidental self-inflicted strangulation. The majority the cases presented are of severe life-threatening strangulation that is cases with petechial bleedings on conjunctivae, mucosal surfaces and facial skin, as well as otorrhea, loss of consciousness, loss of urine, vomiting, etc.

Conclusions: The interpretation and significance of the injury pattern is discussed as well has the contribution that this pattern may give to a differential diagnosis between assault and self-inflicted strangulation and to the evaluation of the severity of the situation and the threat to life. Also stressed is the fact that forensic assessment must be as detailed as possible, due to the fact of a rapid change of the lesions pattern, with the risk of becoming impossible a correct interpretation of the facts. Finally, the transitory physical consequences of these situations and of the permanent results that may result from them, as well as of their contribution to an appreciation of the severity of the aggression will be discussed. The analysis of these cases also stress the importance, as previously stated by Plattner et al (2005), of a clinical and radiological examination in addition to the forensic examination. It also shows that applicability in forensic practice of the classification in three different degrees of severity of these situations, proposed by Plattner et al (2001).

Strangulation, Injury Pattern, Survival

G76 Cause of Sudden Death Due to Cardiac Rhabdomyoma in an 11-Month-Old Baby

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After attending this presentation, attendees will become familiar with the possibility that a completely asymptomatic benign cardiac tumor may induce sudden death in a previously healthy infant.

This presentation will impact the forensic science community by making attendees aware of the insidious development of benign cardiac tumors also in infants and children, focusing the possible responsible mechanisms of sudden death in such cases and providing a reference for additional study on these subjects.

Neoplasms of the heart can be characterized as primary and secondary. Primary cardiac neoplasms occur infrequently in both adult and pediatric age groups. In the general population, their incidence ranges between 0.17% and 0.19% in unselected autopsy series. In infants and children, cardiac tumors were reported at a frequency of 0.027%. Approximately 75% of primary cardiac tumors are benign, and 25% are malignant, in the general population. Benign lesions usually predominate, making up more than 90% of all pediatric tumors. Approximately 50% of the benign tumors are myxomas, and about 75% of the malignant tumors are sarcomas.

Rhabdomyoma is the most frequently occurring cardiac tumor in children. It usually presents during the first few days after birth. It is associated strongly with tuberous sclerosis, a hereditary disorder characterized by hamartomas in various organs, epilepsy, mental deficiency, and sebaceous adenomas. Fifty percent of patients with tuberous sclerosis have rhabdomyoma, but more than 50% of patients with rhabdomyoma have or will develop tuberous sclerosis. The exceptional patient is one with a solitary, single rhabdomyoma who does not have or develop tuberous sclerosis.

Over 90% of rhabdomyomas are multiple and occur with approximately equal frequency in both ventricles. The atrium is involved in fewer than 30% of patients. Pathologically, these tumors are firm, gray, and nodular and tend to project into the ventricular cavity. Micrographs show myocytes of twice normal size filled with glycogen and containing hyperchromatic nuclei and eosinophilic-staining cytoplasmic granules. Scattered bundles of myofibrils can be seen within cells by electron microscopy.

The most common presentation is heart failure caused by tumor obstruction of cardiac chambers or valvular orifice flow. Clinical findings may mimic valvular or subvalvular stenosis. Arrhythmias, particularly ventricular tachycardia and sudden death, may be a presenting symptom. Atrial tumors may produce atrial arrhythmias. The diagnosis is suggested by clinical features of tuberous sclerosis and is made by echocardiography.

Benign cardiac tumors in childhood have an excellent prognosis when completely excised and appear to have a good short-term prognosis even when excision is incomplete. Symptomatic tumors often are both multiple and extensive, particularly in patients with tuberous sclerosis, who unfortunately, have a dismal long-term outlook. In such circumstances, surgery offers little benefit.

Case Report: A mother was bathing her 11-month-old baby. Suddenly the infant showed a worsening dyspnoea. Parents accompanied the baby to the emergency room immediately, but despite the reanimation manoeuvres, the doctor could only pronounce the death. The infant had a negative obstetric, remote and recent pathological

anamnesis, except for a documented fall two days before. Also the familiar history was negative for sudden death.

A complete postmortem examination was performed within 48 hours after death. The body was that of a regularly developed 11-month-old infant. External examination was insignificant, except for the presence of a little and superficial wound on the sternal region.

The internal examination revealed a pedunculated mass at the cardiac apex, a second superficial subepicardial neoformation at the posterior wall of the left ventricle and a third transmural nodule of the posterior wall of the left ventricle. A polyvisceral congestion, cerebral and pulmonary oedema, with a massive increase in lung weight were also evident.

The histological examination of cardiac specimens, stained with haematoxylin–eosin, showed a demarcation and separation of the three masses from the surrounding regular parenchyma. The striated muscle cells appeared diffusely vacuolated, enlarged, with round to oval slightly irregular nuclei and variable cytoplasmatic clearing. There were occasional spider cells; muscular tissue residues were also visible. The immunohistochemical studies documented a positive expression of myoglobin, Actin, Vimentin, Desmin, CD34. The result with antibodies Anti-Ki67, -S100 was negative. This microscopic examination was consistent with rhabdomyoma.

Cultural tests and toxicological screening resulted negative. There were no signs of sclerosi tuberosa.

It was concluded that the infant had three cardiac lesions consistent with a primary cardiac tumor, the rhabdomyoma, which caused the sudden death. In particular one tumoral mass occupied almost the whole posterior wall of the left ventricle, rising from the apex to the valvular level, so compromising the regular contraction of the left ventricle. The neoplasms probably had caused two days before a near syncopal episode that the parents erroneously referred as a fall.

Sudden Infant Death, Cardiac Rhabdomyoma, Benign Cardiac Tumors

G77 Suicide by Table Saw — A Slice of Interpretation

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The goal of this presentation is to illustrate an unusual means of suicide with a home radial arm circular table saw.

This presentation will impact the forensic science community by illustrating the need for close collaboration between the forensic pathologist and the scene investigators (in combination with careful photography) to elucidate the sequence of events and to rule out the involvement of other individuals in unusual cases involving violent, non-firearm related, means.

Introduction: Suicide represents a common manner of death in the United States. A painful means (with or without the expectation of a rapid loss of consciousness) are uncommon. The use of a electrical saws for suicidal purposes is documented in the literature, but remains a very rare event. The use of violent means of suicide is even more uncommon in individuals with no significant prior history of psychological disorder(s).

Case Presentation: The subject of this case is a 50-year-old Caucasian male who became recently depressed due to debt problems. The man and his wife had discussed the possibility of dying together in a murder-suicide. It is in question whether the wife reported a domestic assault on the same morning which she managed to escape from her husband, before calling the police. The decedent was found dead in his garage shortly thereafter on the morning of November 24, 2009.

The investigation of the scene revealed a plugged in table saw. The body was lying on a large pool of blood about five feet away from the table saw. The walls of the garage were extensively covered with blood spatter in a pattern of arterial spray. The table saw itself had been overturned and had blood on both the saw blade, and on the upper and lower surfaces of the saw.

The autopsy on the decedent noted an oblique, Y-shaped incised wound in the right side of his neck. The wound was located on the superior anterolateral aspect of the neck, beneath the right mandible and measured 14 cm in total length, 0.4 cm in width, and 3.5 cm in maximal depth. The edges of the wound are abraded along the superior margin and smooth along the inferior margin. The wound transected the right jugular vein and the right external carotid artery and penetrates into the right sternocleidomastoid muscle. The cause of death was exsanguinations due to the incised wound of the neck. Postmortem toxicology study was negative.

Discussion: Investigation was emphasis on ruled out the wife or others might have been involved in the death of her husband due to the initial findings at the scene, the absence of a suicide note and the unusual means used. Further interview of the wife revealed that decedent and his wife had a discussion of ending their own lives with a murder-suicide fashion. The 6-14 inch table circular saw used in this case had double protective features to prevent self injury. Further study indicated there is the possibility that the saw can be used by self to produce the similar injury as the decedent sustained. It can also be explained that people keep consciousness and moving their bodies within short of time after sudden loss of large amount of blood.

Conclusions: Suicide itself is much more common in individuals with long standing psychological problems, including bipolar mood disorders, depression, and schizophrenia. Violent means of suicide have been more closely associated with bipolar disorders with tendency towards self mutilating behavior. A differential thought process must be considered to interpret the pattern of events surrounding the scene of a death by violent means. Cooperation between the forensic pathologists, the police and crime scene investigators made it possible to reconstruct the unusual situation and to exonerate a third party.

Suicide, Forensic Pathology, Table Saw

G78 The Significance of Gross Adrenal Hemorrhage — Undiagnosed Waterhouse-Friderichsen Syndrome: A Case Series

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After attending this presentation, attendees will understand the importance of finding gross adrenal hemorrhage at autopsy, and that further laboratory studies and clinical-pathologic correlation is warranted to identify the signs and symptoms of pre mortem adrenal dysfunction.

This presentation will impact the forensic science community by addressing how bilateral adrenal hemorrhage can complicate severe sepsis of various origins, not only severe meningococcemia. Clinical suspicion of sepsis and septic shock warrants clinical studies to diagnose adrenal hemorrhage and insufficiency. Undiagnosed adrenal hemorrhage will result in an unfavorable outcome despite adequate treatment.

Adrenal hemorrhage and clinical adrenal insufficiency is classically associated with meningococcemia as part of the Waterhouse-Friderichsen syndrome. It is proposed that non-traumatic adrenal hemorrhage in cases of sudden unexplained death are associated with

bacterial sepsis of various etiologies and that undiagnosed adrenal insufficiency may contribute to the fulminant clinical course.

Adrenal hemorrhage and resultant clinical adrenal insufficiency has been reported in literature as an uncommon complication of bacterial sepsis and is generally associated with an unfavorable outcome in the majority of cases. Other causes named in the literature include stress, anticoagulation therapy, and hypotensive events. Therefore, the finding of adrenal hemorrhage at autopsy is not necessarily associated with sepsis and premortem functional adrenal insufficiency, as is seen in Waterhouse-Friderichsen syndrome. Four cases of non-traumatic gross adrenal hemorrhage are identified in 800 consecutive forensic autopsies and are described and analyzed, with particular attention paid to the patient's signs and symptoms possibly secondary to adrenal failure and the clinical course. It was found that patients with this grossly identifiable adrenal hemorrhage die suddenly as a consequence of acute illness of several days duration. All subjects were males, of different ethnicities, and with ages ranging from 2 to 47. All subjects have a clinical history suggestive of sepsis. At autopsy the most relevant findings are in the lungs, where findings range from heavy, congested lungs to gross findings of necrotizing pneumonia with abscess formation and empyema. Postmortem cultures yielded positive results in three out of four cases, with *Staphylococcus aureus*, *Streptococcus pneumoniae*, and *Pseudomonas aeruginosa* determined to be the definitive agent and the underlying cause of death in each case respectively. The fourth case had a positive culture with yeast and a coagulase negative staphylococcus. No cases had a positive culture for *Neisseria meningitidis*. In each case, signs and symptoms compatible with premortem adrenal insufficiency were reported; in no instance was the adrenal hemorrhage clinically identified. The precise mechanism(s) of adrenal hemorrhage in sepsis or other initiating condition(s) is unclear. However, once adrenal hemorrhage ensues, significant morbidity and mortality may result from adrenal crisis including shock and death. The pediatric population is statistically at increased risk for this complication. In light of the clinical information and autopsy findings, a component of adrenal failure may have contributed to the grave consequences of infection. Herein, the causes and potential consequences are discussed of adrenal hemorrhage by reviewing a series of four cases in light of the available published literature and conclude that additional autopsy and clinical studies may be warranted to determine the clinico-pathologic correlation of this postmortem finding.

Adrenal Hemorrhage, Waterhouse-Friderichsen, Sepsis

G79 Metastatic Calcification of AV-Node as a Cause of Complete Heart Block and Death

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After attending this presentation, attendees will have a better understanding of the mechanism, and the common and uncommon complications associated with dialysis-associated myocardial calcification.

This presentation will impact the forensic science community by increasing awareness of some of the possible complications of renal failure, such as myocardial calcification and conduction abnormalities, in individuals on dialysis.

Metastatic calcium deposition into soft tissue is a well documented phenomenon that occurs rarely in people treated with dialysis. The pattern of calcification and the organs involved is highly variable and thus the symptoms are myriad. A case is presented of a 37-year-old woman on nightly ambulatory peritoneal dialysis for 20 months. She had stage 4 renal failure due to uncontrolled hypertension. She presented to the hospital complaining of shortness of breath and cough of two days'

duration. She had not been feeling well enough at home to perform her dialysis for the past two days. At admission she had a GFR of 2, was hyperkalemic (6.3 mEq/L), anemic with thrombocytosis and leukocytosis (23.5 K/uL) and a left shift. She had developed a new third-degree heart block with a ventricular rate in the 30's. Her troponin-I was elevated at 1.56 ng/mL. Her total calcium was 9.4 mg/dL and her phosphorus was also elevated at 18.6 mg/dL for a calcium x phosphorus product of 174.8 mg²/dL². She was transferred to the ICU where she became asystolic for 5-6 seconds, but had a spontaneous return of circulation. A transvenous pacemaker was placed emergently with good capture and effective right ventricular pacing. However, she quickly became hypotensive, lost consciousness, and became pulseless. After 35 minutes of unsuccessful resuscitative efforts she was pronounced dead. The case was referred to the Office of the Medical Examiner due to her sudden and somewhat unexpected clinical decline.

At autopsy, the left ventricle demonstrated a uniform mottled pail-yellow process. The coronary arteries had thin, pliable vascular walls with widely patent lumina. Microscopic exam revealed widespread calcium deposits in the myocardium including the conduction system. There was also evidence of acute myocardial ischemia. Cardiovascular complications are the leading cause of death in patients with end-stage-renal-disease (ESRD). Derangements of calcium and phosphate metabolism are known to lead to soft tissue calcification. The calcification of the coronary arteries in patients with ESRD is a common cause of morbidity and mortality. The National Kidney Foundation recommends that the calcium-phosphate product be maintained below 55 mg²/dL² to minimize the risk of metastatic calcification of soft tissue and vasculature. In patients with a severely elevated calcium-phosphate product the deposition of calcium can be rapid. If the deposition occurs in the cardiac conduction system sudden cardiac death can occur without the presence of coronary artery calcification.

Pathologists should be aware of this potential complication of ESRD in cases of sudden death in patients with elevated calcium and phosphate or in cases in which the values were not obtained near the time of death or known at the time of autopsy.

Dialysis, Calcification, AV-Node

G80 Postmortem Interval and Cardiac Troponin Effect

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The goal of this presentation is to show the cardiac troponin effects in PMI and its value in daily forensic use.

This presentation will impact the forensic science community by demonstrating the statistical data of the cardiac troponins experimentally and the estimation of PMI accordingly and also the daily use of it.

In clinical practices, cardiac troponins (cardiac myofibril-specificproteins) are specific markers of myocardial damage. In addition, measurements of cardiac isoform of troponin are recognized as important tests in the postmortem diagnosis of myocardial necrosis when such a lesion is suspected but cannot be established. Previous studies have suggested the possible application of these markers in the postmortem diagnosis of acute myocardial infarction. However, some reports showed that elevated postmortem cardiac troponin I (cTnT) levels in cardiac tissue and pericardial fluid may reflect postmortem interval. Postmortem interval may provide valuable information for

evaluation cases in both criminal and civil law pursuits, for their elucidation as well. Time-since-death markers have lagged behind the progress in technology of the past years. Since the earlier attempts, failed to meet the definite postmortem interval, for variable reasons with much success, the postmortem biochemical changes in various body fluids and tissue have been tried for the estimation of time of death. The degradation of cardiac Troponin I in myocardial tissue and pericardial fluid has been investigated. The goal of this study is to investigate the potential use of myocardial tissue and pericardial fluid cTnI level as an estimator of postmortem interval. Cases selected from routine necropsies performed in the Council of Forensic Medicine, Istanbul. Samples were obtained from 98 deceased, where exact postmortem interval was known. Isolation of cTnI from heart tissue and pericardial fluid was chosen because it is found in a highly protected internal location.

The findings were elucidated according to patient records, scene of death, autopsy, and complementary toxicological and histological studies, depending on the probable intensity of myocardial damage and cause of death. No statistically significant difference was found between cause of death and titration alterations of cTnI in cardiac tissue and pericardial fluid specimens ($p>0.05$). On the other hand, alteration in the level of cTnI in the pericardial fluid dependent on the period of time after death showed statistically significant positive correlation ($r=0.523$ $p<0.0001$). Especially differentiation between period of first 12 hours after death and interval beyond could be established within confidence interval of 95% using the estimation of pericardial fluid cTnI level. Meaningful statistical correlation in between the pericardial effusion and cardiac tissue cTnI titrations ($r=0.427$ $p<0.0001$) was noticed. This result shows us the protein degrading effect of the PM autolysis to the pericardial effusion. This is a similar finding with the similar studies and it is very valuable to show the autolytic degradation instead of the reflection of the tissue necrosis. The positive correlation between the level of pericardial fluid cTnI and the postmortem interval and discriminative property of this marker for estimation of the postmortem interval should provide a superior tool for this purpose. The data presented demonstrates that this technique represents a major advance in time since death determination providing reliable quantitative biochemical markers from a protected organ versus estimates such as those based on direct temperature measurements.

Furthermore, it could be shown that cardiac tissue is not influenced by autolytic changes in the postmortem interval to a considerable extent. Although previous forensic pathological studies have suggested the possible application of cardiac troponins in the diagnosis of myocardial infarction, there appears to be insufficient data with regard to its influence of postmortem interval. These results suggest that immune enzymatic studies concerning postmortem differential diagnosis of myocardial infarction may provide considerably reliable data with probability of false positive results on a negligible level. In forensic medicine, there is a need for more sensitive biochemical markers for estimation of postmortem interval and diagnosis of myocardial injury. A study of the distribution of biochemical markers in different fluids is of great significance in postmortem diagnosis, because their distribution depends on the location of tissue damage and release kinetics. Further studies are required to compare these results and create the possibility for new conclusions.

Postmortem Interval, Cardiac Troponin I, Forensic Autopsy

G81 Ante- and Postmortem In-Human Cocaine Packs Detected by Computed Tomography

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After attending the presentation, attendees will understand how to detect intra-corporal cocaine packs on CT. The differences of body packing, stuffing, or pushing will be elaborated and the varying appearance of the packs in CT will be demonstrated. Further, the necessity of a tight collaboration of the custody ward, the forensic institute, and the radiology department will be shown.

This presentation will impact the forensic science community by raising awareness of the difficulties and pitfalls on CT imaging of drug mules, understanding the variety of drug containers, and the upcoming medicolegal issues.

Purpose: The goal of this presentation is to depict the findings on computed tomography (CT) in detection of concealed cocaine – filled packs in the alimentary tract of living and dead human transporters.

Materials and Methods: The study population consisted of 15 antemortem and one postmortem CT exams with detected intra-corporal cocaine containers. The images were assessed retrospectively by investigators with special training and experience in reading images of drug carriers. Radiological findings were compared with listed evidence in the feces or alimentary tract of each detained suspect or deceased victim.

Results: Cocaine-filled containers were detected by CT in each case. The appearance and morphologic shape were compared to the evidence secured on a custody ward or during autopsy. Window leveling from abdominal window to lung window of the CT images was crucial and allowed for correct diagnoses.

Conclusion: Reading CT images of drug mules needs special knowledge of the appearance of the various drug containers and of the important window leveling in order to detect even hypodense or tiny packs within the alimentary tract. A reliable and fast method such as CT is needed due to the limited space at custody wards to triage holding, discharge or transfer to regional prison. During the last years, forensic and medical issues have lead to an increasing number of if needed, judicially warranted CT examinations. Pre-autopsy postmortem scans allow for exact localization of incidental or suspected findings of foreign bodies such as in-human drug containers. Obviously, the radiologist needs to be well schooled in the appearance of the drug containers in order to diagnose those correctly – therefore a tight collaboration with the custody ward, the associated forensic institute and the radiology department is desirable.

Body Packer, Cocaine, CT

G82 Decomposition in a Closed Vehicle Environment in Southern Ontario

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After attending this presentation, attendees will understand the importance of chemical and entomological evidence associated with decomposing remains concealed in a closed vehicle environment. This

presentation will impact the forensic community by providing new information regarding the decomposition process in a vehicle trunk in southern Ontario and providing more accurate estimates of time since death in this unique environment.

A body placed in a closed vehicle environment will undergo a distinctly different process and rate of decomposition than a body placed in an outdoor environment. A closed vehicle has the potential to significantly affect decomposition processes by reducing entomological access to the body, increasing ambient temperatures, and promoting desiccation and mummification of the remains. In Canada, there is currently no published literature which has studied the effect of a closed vehicle environment on entomological activity and the chemical processes which occur during soft tissue decomposition. This information would be valuable to forensic pathologists and coroners when estimating time since death in forensic investigations involving decomposed remains recovered from a vehicle.

The goal of this study was to investigate the chemical process of soft tissue decomposition and the entomological evidence associated with a body placed in the trunk of a vehicle. The study was conducted in the southern region of Ontario, Canada during the summer months of June and July. Two pig carcasses of similar biomass were used in the study. The experimental carcass was placed in the trunk of a dark-colored vehicle and sealed. The control carcass was placed on the soil surface approximately ten meters from the vehicle. A data logger was placed in the vehicle to record temperature and humidity. A weather station was placed near the control carcass to record ambient temperature, humidity, and rainfall. Soft tissue samples were collected from the upper and lower torso region of the carcasses. Entomological evidence was collected directly from the carcasses and from pitfall traps surrounding the carcasses. Samples were collected at regular intervals until the carcasses reached the skeletonization or dry remains stage.

Decomposed soft tissue was analyzed using gas chromatography-mass spectrometry to determine the lipid degradation process and resulting fatty acid content within the samples. Unsaturated and saturated long-chain fatty acids were identified at all stages of the decomposition process. Variations in the lipid degradation pathways were evident between the experimental and control carcasses. Adult and immature insects were collected from the carcasses in order to determine the succession throughout decomposition. An important delay of insect colonization was observed in the vehicle as well as a significant decrease in species composition.

Observational measurements confirmed that the decomposition process was distinctly different in the closed trunk of the vehicle when compared to the decomposition process on the soil surface. The chemical, entomological, and environmental data provided additional confirmation of the distinct process in which a decomposing body will undergo in a closed vehicle environment. This information will be valuable to law enforcement agencies and forensic pathologists and may aid in providing more accurate estimations of time since death.

Forensic Entomology, Decomposition Chemistry, Closed Vehicle Environment

G83 Child Abusive Head Trauma in Portugal

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The goal of this presentation is to better understand how child Abusive Head Trauma (AHT) is managed in Portugal.

This presentation will impact the forensic science community by filling the void of epidemiology background concerning fatal AHT in Portugal, and will allow comprehensive knowledge of the Portuguese experience on this issue. Only then will it be possible to develop assertive and coordinated policies and strategies for action in this field in order to minimize the number of cases as well as its consequences. Until now, in Portugal, only isolated and non-articulated studies have been made on this issue, reflecting only loco-regional incidences or even only the numbers of one organization. For these reasons, it is not possible to infer what is really going on at a national level.

The absence of a systematic approach on child abuse (CA) makes it impossible to have the real knowledge of the prevalence and incidence of this problem in the Portuguese population. Currently there are no more than estimates of certain entities, certainly underestimating, from the Ministry of Justice, the *National Commission for the Protection of Children and Young People at Risk* (CNCJR), the *National Institute of Legal Medicine* (INML), the criminal police forces, the victims' support associations, or the health care services. Furthermore, the most important problem is that the referred data represents only a portion of incidences because frequently cases are not reported. However, gathering such sort of data is vital in order to find the proper and most suitable approach to these situations in Portugal.

In AHT cases, it was verified that in the last years there has been an important increase in the number of published reports in the international medical literature describing AHT (Hymel KP, 2002) and considering that it represents the most frequent cause of death due to CA, the main cause of traumatic death in children under 1-year-old (Duhaime AC e col, 1999) and the cause of significant morbidity, with up to 50% of survivors having permanent neurologic sequelae (Duhaime AC e col, 1996). Between 24% and 33% of traumatic brain injuries (TBI) hospital admissions in children under 2-years-of-age are from AHT (Duhaime AC e col, 1987; Dashti SR e col, 1999). The incidence of severe inflicted TBI in Scotland is 24.6 infants per 100 000 person-years which is comparable with epidemiologic data in the United States, where this incidence is 29.7 infants per 100 000 person years (Barlow KM, Minns RA, 2003; Keenan HT e col, 2003). In fact, it is known that for AHT up to 30% of the cases are difficult to be initially recognized (Jenny C e col, 1999), mainly because victims, almost under 2-years-of-age, cannot describe the abuse (Bechtel K e col, 2004), and because many cases are of mild or moderate severity (Berger RP e col, 2004).

However, in spite of all these difficulties, the various forms of AHT (including shaken baby syndrome (SBS)) are now well recognized and diagnosed in most countries (Barlow KM e col, 2005) which cases are being identified and reported; however, doesn't seem to be the case in Portugal. The intervention in a situation of CA can be initiated by multiple kinds of professionals of different institutions. Among those professionals teachers, childhood educators, physicians (mostly pediatricians, practitioners, and gynecologists), nurses, psychologists, policemen/women, and social workers are highlighted. According to the Portuguese Criminal Law these professionals are mandatory reporters

and according to the Protective Law and the Deontological Code (in what physicians concern), they have the duty to report suspected cases. The problem is that there are numerous initial referral sources, multiple professionals (with different formations and awareness, presenting possible "prejudices" and non-official instructions and forms for reporting cases.

In Portugal there are no published data concerning non-fatal AHT, and this work represents the first national approach regarding fatal cases due to this kind of abuse. Analyzing the fatal cases of suspected CA observed in the medico-legal services of Portugal, between 2005 and 2008, it has been verified that AHT represented only 12.5% of the suspected CA causes of death (1.2 infants per 100,000 person years), despite in the literature, AHT represents the most frequent cause of death due to CA. The single diagnosed case of SBS will be presented.

These Portuguese results must be carefully analyzed and compared with other foreign studies, which are completely different. According to the facts, it is presumed that an important number of cases of AHT is still undiagnosed or underdiagnosed in Portugal (being diagnosed only when specifically looked for), or remain unreported or underreported by the health professionals.

Child Abuse, Abusive Head Trauma, Shaken Baby Syndrome

G84 Gravesoil Microbial Community Structure During Carcass Decomposition

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After attending this presentation, attendees will understand that there is potential for the use of fatty acids to characterize gravesoil microbial community with the ultimate goal of estimating postmortem interval (PMI).

This presentation will impact the forensic science community by the development of an additional method to determine extended PMI. This additional method can be used in conjunction with other methods to estimate PMI, such as forensic entomology.

Estimating PMI is important for every death investigation. It allows for the acceptance or rejection of alibis as well as helping to identify victims. At present forensic entomology is arguably the most reliable means to accurately estimate PMI at outdoor death scenes. However, active blowfly larvae, which are critical to insect based estimates of PMI, can leave a body as early as ten days postmortem. When active blowfly larvae are not present at a death scene, forensic science is often ill equipped to estimate PMI accurately.

A controlled laboratory experiment was conducted to determine if soil microbial ecology has the potential to be used as an estimator of PMI. To do this incubation units were constructed that comprised petri dishes (150 mm x 25 mm) filled with 360 grams (g) of washed sand inoculated with 40 g of Pawnee clay loam soil. Soil was collected from Nine Mile Prairie, a natural tall-grass prairie ecosystem, which is located approximately nine miles northwest of Lincoln, Nebraska. Soil of the Pawnee series is a fine, montmorillonitic, mesic Aquic Argidoll (Mollisol). These incubation units were calibrated to a water holding capacity of 55% and left to equilibrate for seven days in plastic containers (20 cm x 34 cm x 11 cm) that contained methanol washed pea gravel and distilled water (100 ml) to regulate humidity.

After seven days, a mouse carcass (killed with carbon dioxide) was placed on its left side on the inoculated sand within 30 minutes of death. Nylon mesh (0.1 mm x 0.1 mm) was then used to cover the plastic container to prevent insect colonization. The temperature was kept at approximately 20°C during the experimental period and the water

content of the inoculated sand was maintained at 55% every 3-4 days by adding distilled water. Carcass decomposition was monitored every 24 hours for 35 days using a decomposition scoring system. In addition, carcass mass loss was measured at 7, 14, 21, 28, and 35 days postmortem. A destructive harvest design was used to avoid the influence of carcass disturbance on the rate of decomposition. Following carcass harvest, inoculated sand was collected and analyzed for lipid phosphorus, fatty acid methyl esters, pH, total nitrogen, and total carbon. This experiment was replicated four times and controls (inoculated sand with no carcass) were used. Results and discussion will be presented to demonstrate the effectiveness of soil microbial ecology to act as an estimator of PMI.

Forensic Taphonomy, Extended Postmortem Interval, Ecology

G85 Laceration of the Inferior Vena Cava Following Blunt Abdominal Trauma in a Case of Child Abuse

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The goal of this presentation is to describe and discuss a child abuse case with multiple blunt injuries that include blunt abdominal trauma with laceration of the inferior vena cava (IVC).

This presentation will impact the forensic science community by demonstrating an uncommon finding resulting from blunt trauma in a child abuse case.

The majority of injuries to the IVC are due to penetrating trauma. Only 10% of these injuries will be caused by blunt trauma. This may be due to the fact that the IVC is a retroperitoneal organ and is therefore relatively protected from injury. Injury as a result of blunt trauma would only result from a force of great magnitude.

This case involved a 22-month-old, Hispanic, male infant who arrived dead to the emergency room. The stepfather stated that he witnessed the infant falling to the ground while walking and hitting his head against the adjacent wall. The stepfather tried to resuscitate the child but he continued to lose consciousness. He waited for the infant's mother to arrive home and they took the child to the emergency room. His social history revealed that he lived with his mother and the stepfather and there was no family history of child protective services involvement. At the time of the event, he was under the stepfathers' care. The stepfather denied any physical abuse against the child.

At autopsy the body corresponded to a well-developed and well-nourished male infant. He was 33 inches tall and weighed 31 pounds. External examination of his face and head showed multiple recent contusions and abrasions over the face and scalp. Multiple foci of subgaleal hemorrhage were present over the skull. The brain had mild subarachnoid hemorrhage over the left parietal and occipital lobes. Examination of the brain disclosed no other trauma. The head had no fractures. The torso also revealed multiple recent contusions. The abdomen was moderately distended. After entering the peritoneal cavity, 150 mL of liquid blood and 35 grams of blood clots were noted. There was a laceration to the proximal suprahepatic segment of IVC with presence of blood clots adjacent to the laceration. Moderate hemorrhagic infiltrate was present in the subintimal layer of the IVC along the supradiaphragmatic segment of the vein extending to the right atrium of the heart. Gross examination of the abdominal viscera found no other source of bleeding. The right pleural space had 40 mL of liquid blood. The right and left lungs had multiple contusions. Small lacerations were present next to the hilum of the right lung. Examination

of the extremities showed multiple recent contusions and no fractures. Toxicological evaluation was negative for alcohol, cocaine, opioids, and cannabinoids. The cause of death was blunt force injuries and the manner of death was ruled a homicide.

Intra-abdominal hemorrhage is most commonly associated with a clear history of trauma. In young children, the liver and spleen are the most common abdominal viscera to sustain a traumatic injury. Lacerations of the inferior vena cava resulting from blunt trauma are relatively rare, but extremely serious with a high mortality and may be difficult to repair. The majority of injuries of the IVC are due to penetrating trauma and only a small percentage is caused by blunt trauma. Lacerations to the IVC are uncommon injuries in the pediatric population. Lacerations of this vessel indicate a force of great magnitude with a profound level of injury. The presented case has evidence of blunt trauma in multiple regions of the body. The abdomen and thorax were the most severely affected regions. The unique feature of this case is the finding of IVC laceration with no other abdominal viscera involvement. In this case intr-thoracic and intra-abdominal tensional forces produced by blunt trauma to the torso could explain the lacerations of the IVC and hilar area of the right lung.

Laceration of Inferior Vena Cava, Blunt Trauma, Child Abuse

G86 Inferior Vena Cava Compression: A Possible Mechanism for Arrest Related Death

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After attending this presentation, attendees will understand a potential pathophysiologic mechanism of arrest related death (ARD) not previously studied or discussed in the literature.

This presentation will impact the forensic science community by providing a possible explanation for sudden, arrest-related death that is not yet established in the literature.

The physiology of sudden ARDs proximal to restraint has not been elucidated. Prior work has not suggested a relationship between position, restraint, or thorax compression up to 50 lbs with regard to clinical impact on respiration. However, the impact of these variables on Central Venous Return (CVR) has not been studied. Decreased CVR is a theoretical concern in a subject with tachycardia from resistive exertion, mental excitement, or sympathomimetic ingestions. A sudden change in CVR could cause an acute decrease of cardiac preload leading to possible decreased coronary artery perfusion pressure and ischemia or the induction of a maladaptive neuro-cardiogenic reflex. This, in turn, could lead to a brady-asystolic cardiac arrest. This study used ultrasound to measure the size of the Inferior Vena Cava (IVC) as a surrogate marker of CVR when positional change and thoracic compression occurs.

This was a prospective study of human volunteers. Subjects had ultrasounds of their IVC in transverse and longitudinal planes performed in four positions. Maximum and minimum measurement values were obtained in each position after accounting for respiratory variability. The four positions were: (1) standing; (2) lying prone; (3) lying prone with 100 lbs of weight applied uniformly to the upper back; and, (4) lying prone with 147 lbs of weight applied uniformly to the upper back. The weight was meant to simulate thoracic compression during a restraint procedure. A custom table and weight mechanism was used to allow access to visualize the IVC in the prone position and to apply the weight

uniformly to all subjects. IVC values were measured with a handheld ultrasound with a phased array (5-2MHz) transducer, operated by an RDMS sonographer. Data were analyzed using descriptive statistics and k sample for equality of medians test.

There were 24 subjects that completed the study protocol. The median (interquartile range) IVC measurements for all positions are as follows:

- Longitudinal maximum was 1.86 cm standing (1.57-2.16), 1.67 cm prone (1.05-2.26), 1.205 cm with 100 lbs compression (0.83-1.58), and 0.805 cm with 147 lbs compression (0.46-1.29), ($p < 0.0001$).
- Longitudinal minimum was 1.21 cm standing (1.01-1.51), 1.14 cm prone (0.64-1.61), 0.70 cm with 100 lbs compression (0.45-1.02), and 0.28 cm with 147 lbs compression (0.0-0.79), ($p < 0.0001$).
- Transverse maximum was 1.63 cm standing (1.43-1.93), 1.45 cm prone (1.17-2.02), 1.12 cm with 100 lbs compression (0.76-1.65), and 0.74 cm with 147 lbs compression (0.46-1.13), ($p < 0.0001$).
- Transverse minimum was 1.18 cm standing (0.93-1.39), 1.01 cm prone (0.77-1.47), 0.38 cm with 100 lbs compression (0.0-1.15), 0.31 cm with 147 lbs compression (0.0-0.52), ($p < 0.0001$).

There was significant difference between the IVC size in the longitudinal and transverse planes at maximum and minimum between all positions. The IVC size was greatest while standing. It became sequentially smaller with prone positioning and application of weight force. It was smallest while lying prone with 147 lbs of thorax compression. These findings support a possible pathophysiologic mechanism of ARDs that has not previously been reported. Further study in this area is recommended.

Arrest Related Death, In-Custody Death, Sudden Death

G87 Intra-Abdominal Hemorrhage Associated to an Intrapartum Rupture of the Umbilical Cord: A Case Report

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The goal of this presentation is to describe and discuss a case of an intrapartum rupture of the umbilical cord leading to an intra-abdominal hemorrhage and newborn death.

This presentation will impact the forensic science community by demonstrating an uncommon case of intra-abdominal hemorrhage and death of the newborn as a complication of the rupture of the umbilical cord in a precipitous delivery.

Intra-abdominal hemorrhage in the newborn is uncommon. Bleeding from umbilical vessels in the cord can occur in the perinatal period, the predisposing factors being a short cord, varices, velamentous insertion of the cord, or true knot of the cord. Even more uncommon is bleeding secondary to rupture of the umbilical cord.

A 25-year-old gravida 6, para 4, came in active labor at 36 6/7 weeks of gestation. The mother had a late prenatal care and vaginal infection. The case was complicated at delivery due to violent expulsion of the baby girl who was caught by the physician attending the delivery. The umbilical cord ruptured causing hemorrhage to the baby and the mother. Apgar scores were 1, 4, and 6 at 1, 5, and 10 minutes, respectively. The baby was in respiratory distress, pale with poor response to bag-mask ventilation. Neonatologist intubated the baby in delivery room and she was transferred to Neonatal Intensive Care Unit (NICU). Initial work up showed blood gases results as follows: PH 7.35, pCO₂ 32 mmHg, and pO₂ 54 mmHg. Hemoglobin was 15.7 and

Hematocrit 44.1%. Skeletal survey was negative and Head Ultrasound showed mild left ventricle dilation and no evidence of intraventricular hemorrhage. The next day the baby continued with respiratory distress with significant anemia, Hb was 10.9 and Hct 30.4%. Despite blood transfusions and other therapeutic measures the baby remained critically ill with marked hypoxia and poor perfusion. On the 3rd and 4th days at NICU, a tense abdomen was noted with paleness below the level of the diaphragm and plethoric upward, suggestive of compartment syndrome secondary to aortic compression due to hemoperitoneum. A Penrose drain was placed for abdominal decompression but patient did not improve and died.

At autopsy the body corresponded to a female preterm baby. She was 18.7 inches tall and weighed 6.2 pounds. External examination did not show signs of trauma. Among the medical intervention there was an umbilical arterial catheter in place without disruption of the artery. After entering the peritoneal cavity, 30 ml of liquid blood was noted and some blood clots in the right subdiaphragmatic area. As the peritoneal cavity was entered, it was noted that the umbilical vein and falciform ligament were disrupted. A hematoma was noted at the site of disruption adjacent to the peritoneal surface. The liver had a non-ruptured subcapsular hematoma at the anterior and superior surfaces of the left lobe without lacerations of the parenchyma. The rest of the thoracic and abdominal organs had no signs of trauma. The brain had no hemorrhages or lesions. The placenta weighted 509 grams with a centrally inserted umbilical tri-vascular cord that measured 11 x 1.3 cm. On microscopic examination revealed acute chorioamnionitis. Toxicological evaluation was negative for alcohol, cocaine, heroin and cannabinoids.

The normal umbilical cord resists trauma, the forces of normal delivery, and does not bleed. However, in dysmature infants the cord is thin and weak and liable to rupture. In precipitous delivery, a rapid increase in cord tension can rupture the fetal aspect of the cord. Short or entangled cords may rupture, as may abnormal cords, such as those with velamentous insertion on the placenta. Although birth trauma involving intra-abdominal organs is also uncommon, it must be suspected in the newborn with pallor, abdominal distension, anemia, and shock without evidence of external blood loss, intracranial hemorrhage, or gastrointestinal bleeding. The size of the infant and the presentation at delivery are important risk factors for abdominal trauma. The liver is the abdominal organ most commonly injured in the birth process. Subcapsular hematomas rather than hepatic lacerations are more apt to occur.

In this case, several recognizable factors increased the risk of umbilical cord rupture, such as prematurity of the infant combined with a precipitous delivery. Disruption of the umbilical vein represented the source of intra-abdominal bleeding. The subcapsular hematoma could be attributed to the abdominal birth trauma or be part of the tensional injury secondary to the rupture of the umbilical cord.

Umbilical Cord Rupture, Intra-Abdominal Hemorrhage, Subcapsular Hematoma

G88 Aortic Aneurysm Rupture Into the Lung With Formation of Pseudoaneurysm

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The goal of this presentation is to describe and discuss a case of aortic aneurysm rupture into the lung parenchyma with formation of pseudoaneurysm.

This presentation will impact the forensic science community by demonstrating a rare complication of a thoracic aortic aneurysm.

Rupture of thoracic aneurysm into the lung with formation of pseudoaneurysm is rare. There are few reported cases discussing the diagnostic approach and management of this complication. In the researched literature there are no reports of this complication as an autopsy finding.

This case involved 72-year-old, black Hispanic male with history of poorly controlled arterial hypertension and two cerebrovascular accidents. He was a heavy smoker and occasional alcohol drinker. He was found lying supine on the street. The paramedics pronounced him dead at scene after evaluation. There were no signs of violence or foul play at scene.

At autopsy the body corresponded to a well-developed and well-nourished adult male. He was 66-inches tall and weighed 152 pounds. External examination showed no significant evidence of trauma. Reflection of the skin over the anterior thorax showed no significant hemorrhagic infiltrates or fractures. On internal examination the left thoracic cavity contained 700 grams of clotted blood and 600 ml of liquid blood. Examination of the thoracic organs revealed that the source of bleeding was a ruptured aneurysm of the middle third of the descending thoracic aorta. The aortic aneurysm ruptured into the parenchyma of the lower lobe of the left lung forming a pseudoaneurysmatic structure that contained a fusiform mural organized thrombus that measured 16.5 x 6.5 x 5.0 cm. Cut sections of the affected pulmonary parenchyma demonstrated that the cavitary lesion was surrounded by a well formed and circumscribed wall. Sections of the thrombus showed a surface with a multilayered arrangement. Focal areas of hemorrhage were present in the pulmonary parenchyma surrounding the cavity. The aorta showed severe atherosclerosis with calcification and focal ulceration of the atherosclerotic plaques. Histopathologically the aorta had no evidence of inflammation; however, degenerative changes were recognized near the possible rupture site. The heart weighed 300 grams and had mild left ventricular hypertrophy. The rest of the thoracic and abdominal organs had no remarkable macroscopic pathology. Postmortem toxicological evaluation was negative for alcohol, cocaine, opioids, and cannabinoids. Serological test for syphilis was negative.

Reports of patients with aortic aneurysm rupturing into the lung with formation of pseudoaneurysm are few. There are no reported cases in the researched literature describing the presence of this condition as an autopsy finding. An aortic aneurysm or dissection that ruptures into the lung parenchyma or erodes into a bronchus can lead to acute, massive hemoptysis, hemothorax and death. This case is particular because the aneurysm ruptured into the visceral pleura and lung parenchyma forming a pseudoaneurysmatic structure where the blood lodged. Two factors appeared to combine and contribute in the formation of this pseudoaneurysmatic structure, delaying the free extravasation of blood to the pleural cavity and imminent death. First is the anatomic location of the aortic aneurysm. In this case the aneurysm was located in the mid portion of the descending segment, adjacent to the medial aspect of the lower lobe of the left lung. The second factor is the elasticity of the lung parenchyma that cushioned the aortic aneurysm wall, allowing a slow passage of blood with formation of the cavity. Rupture and extravasation of blood to the pleural cavity occurred when the intracavitary pressure exceeded the elastic capacity of the tissues surrounding the pseudoaneurysmatic structure. Fibrous tissue attachment between the lung and aorta could have also played a role, but it was not clearly demonstrated at autopsy.

Aortic Aneurysm, Pseudoaneurysm, Lung Parenchyma

G89 Is DNA Purified From Forensic Autopsy Material Suitable for Molecular Biological Studies?

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After attending this presentation, attendees will understand more about the suitability of DNA, purified from forensic autopsy samples for advanced molecular research.

This presentation will impact the forensic science community by providing information about how decomposition and time from death to autopsy affects the usability of DNA for molecular studies. Knowledge about the degree of DNA fragmentation and degradation is an important tool for planning of future molecular biological studies.

The quality of molecular-biological studies obviously depends on the tissue in which the markers must be investigated. At forensic laboratories, a large number of frozen, biological samples are stored (collected at the autopsies), which can be used as templates for molecular biological studies. These samples are extremely valuable for all types of molecular biological studies in both diagnostic and research purposes. The decomposition and thereby the following changes in quality of DNA occur shortly after death. Degradation and fragmentation of DNA purified from autopsy material depends on several factors, such as time since death to autopsy, the degree of postmortem changes, the keeping of the corpse, external and environmental influences, storage of samples, and the addition of the chemicals to blood samples and other tissues for storage. It is believed there are no studies on this issue. The current study is a pilot for a major project, which is to define the molecular biological markers for sudden unexpected death. The suitability of purified DNA from tissues taken at autopsies including frozen blood with or without additional chemicals and paraffin embedded and frozen tissue is validated, as template for molecular biological studies in order to define the main risk factors for DNA fragmentation and degradation. By using PCR primer sets that amplify DNA fragments of varying length and DNA extracted from tissue samples with different degree of postmortem decomposition. Using the internal autopsy database the study group is defined consisting of tissue samples without signs of decomposition of tissue, with moderate decomposition of tissue and with severe decomposition. Frozen tissue samples of the detected cases (blood samples and muscle tissue) are available as well as frozen blood samples with the addition of potassium fluoride. DNA from tissue samples were purified using commercially available kits. Ten different PCR primer sets were designed to amplify 100 to 1000 basepair long fragments of human genomic DNA. PCR products were analyzed by agarose gel electrophoresis and ethidium bromide DNA staining.

Preliminary results suggest that the degree of fragmentation and degradation of DNA after death increases corresponding to grade of decomposition of tissue. The lengths of DNA fragments in samples with high grade of decomposition are significantly shorter than in samples without decomposition of tissue. It was possible to generate DNA fragments of at least 1,000 basepair lengths from samples taken from individuals that died within one week before autopsy was performed. On the other hand DNA samples from individuals that died at least two weeks before autopsies only could generate PCR product up to 600 basepair long.

Validation, DNA Fragmentation, Tissue Decomposition

G90 Evaluation of a New Approach for Estimating the Postmortem Interval Based on the Direct Skin Surface Analysis Using FTIR Spectroscopy

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The goal of this presentation is to determine with accurate methods the Postmortem Interval (PMI).

This presentation will impact the forensic science community by facing one of the main issues in forensic sciences, the estimation of time since death (postmortem interval). Most methods currently employed have considerable inaccuracy. To be able to determine PMI is one challenge that can change a forensic investigation, and give answers, that until now were not properly supported in court.

The estimation of postmortem interval is a main issue in forensic sciences. Most methods currently employed have considerable inaccuracy.

Most of these methods are based on medical knowledge. With this work we intend to solve a forensic problem with the help of other areas of science not usually involved in medical studies.

The interaction of infrared (IR) electromagnetic radiation with the matter is a widely established technique to probe the chemical composition of materials.

The IR spectrum is divided into three zones; near- (14000-4000 cm⁻¹), mid- (4000-400 cm⁻¹) and far-infrared (400-10 cm⁻¹). The mid-infrared (MIR) region is used to analyze the fundamental vibrations of molecules and is strongly absorbed so materials have to be analyzed as thin films or in small path length cells (e.g., milk analysis).

Near-infrared (NIR) spectroscopy is based on molecular overtone and combination vibrations, which are forbidden by the selection rules of quantum mechanics. This means that NIR can penetrate much further into materials than MIR. This makes NIR very useful in probing bulk material with little or no sample preparation.

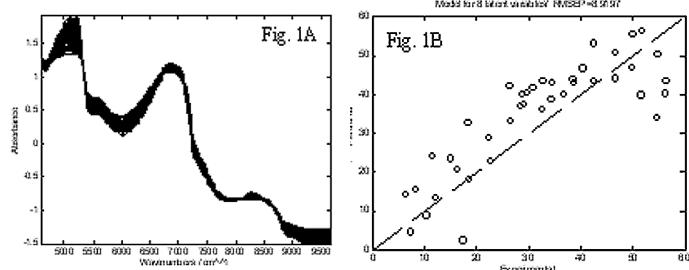
Because NIR probes the overtone and combination bands the spectra are usually very complex. Individual bands can not be assigned to specific features as with MIR. This means multiple wavelength (multivariate) calibration techniques are used to extract structural information. The design of powerful software packages, such as PLSplus/IQ, allows users with minimal chemometric experience the opportunity to generate and maintain their own calibration models without relying on general models from a third party that are not specific to their materials.

The increased processing power of computers has allowed the introduction of Fourier Transform (FT) infrared analyzers. Prior to this technology instruments either had to either use filters to look at the absorption of specific wavelengths or use diffraction gratings to scan through the wavelengths and measure the changing absorptions. FT technology uses interferometers that allow all the information at all wavelengths to be collected simultaneously. This means much more information can be collected in a shorter time.

Fourier transform near-infrared (FT-NIR) spectroscopy is an analytical technique that has gained great popularity in recent years. It is an effective tool for investigating chemical changes at molecular level and its major strengths include fast and easy equipment operation, good accuracy and precision, and the potential to perform nondestructive analyses. In its reflectance mode, FT-NIR spectroscopy is widely used to study, for example, the human skin and other tissues. And in the last

few years, using fiber-optic technology, the direct real-time in situ analysis became possible.

The utilization of FT-NIIR spectroscopy is being studied here to directly test the human skin in order to, in combination with chemometric data analysis (PCA – principal component analysis; PLS – partial least-squares models), look for possible surface chemical changes occurring after death that may correlate with PMI. Studies performed to date (20 cases) showed promising results. Figure 1A shows typical spectra obtained from six corpses in the 48 hours postmortem period and Figure 1B shows the correlation between the predicted PMI versus the known (real) time since death.



This study shows the usefulness of coupled with chemometric data analysis for estimating PMI, and the importance of the interaction between different areas of knowledge.

Postmortem Interval, FTIR Spectroscopy, Accuracy

G91 Unusual Style Cut Throat Injury: A Case Report

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After attending this presentation, attendees will understand the circumstances and possibilities of injuries in a rare case of self-inflicted cut throat injury.

This presentation will impact the forensic community by helping officials responsible for the maintenance of law and order to administer justice.

Suicide is one of the leading causes of death in the world. The incidence and pattern of suicide vary from country to country where cultural, religious, and social values play a vital role. Hanging, poisoning, drowning are the common methods of committing suicide. Suicide by incising one's own throat without hesitation marks remains a rare, and only few cases have been reported in forensic literature. An unusual and rare case of self-inflicted cut throat injury of a 45-year-old ex-military man without tentative cuts over the neck, which has resulted from a curved sharp weapon is presented.

A case report of self-inflicted cut throat injury without tentative cuts, a rare event is presented. Such cases are rare to be reported in forensic literature. It is recommended that medico legal death investigators be aware and familiar with such injuries in a detailed autopsy, which may ultimately prove or disprove the case, which may be of significant value to the investigating authority.

Self-Inflicted, Cut Throat Injury, Hesitation Marks

G92 Mass Fatality Management: A Multi-National Perspective

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After attending this presentation, attendees will understand the challenges faced a multi-national recovery and identification effort.

This presentation will impact the forensic science community by presenting lessons learned from the field in a multi-national mass fatalities incident, which can be applied to a future incidence response.

In response to the Haiti Earthquake, several international organizations responded to assist in fatality management and repatriation of non-Haitian human remains. Each of the fatality management and response organizations was dispatched by a governmental agency, but with little coordination between the organizations. Initially, the prohibitive conditions of an entire Haitian infrastructure in disarray and the extreme difficulty of providing for the logistical requirements of supporting a deployable morgue unit without local support was the primary factor limiting human identification efforts. However, difficulty in determining jurisdiction and logistics of repatriation of multi-national citizens became one of the primary difficulties in the response effort. A major complexity in the recovery and victim identification of foreign nationals was the number of independent countries on the ground attempting to identify their own citizens for repatriation. Another major factor was the actual recovery of the victims that were buried under tons of rubble, which were a safety hazard for recovery personnel.

Not only was the logistical aspect of this operation complex, but the recovery and initial identification of the multi-national victims was extremely difficult. This is the first global mass fatality incident where an attempt had to be made to determine the nationality of the victims prior to recovery to ensure accurate identification, repatriation and disposition of the remains. The coordination of antemortem biological information was crucial to this effort and it took a great deal of coordination between countries.

This presentation will discuss how to more effectively coordinate a mass fatality response in the event of future disasters involving multi-national populations from multiple countries with varying capabilities for fatality response as well as the complexity of victim identification in this scenario.

Fatality Management, Mass Disaster, Mortuary Operations

G93 Improving Evidence and Victim Recovery Protocols at the Mass Fatality Incident

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After attending this presentation, attendees will understand problems faced by coroner and medical examiners relative to their responsibility to properly recover and identify plane crash victims. Attendees will be presented with effective strategies and protocols for dealing with these scenes.

This presentation will impact the forensic science community by describing efficient and effective evidence and victim recovery protocols applicable to large-scale, widely-dispersed mass fatality scenes.

The crash of a major airliner results in an extremely chaotic situation. After the first responders have dealt with survivors and fire resulting from the crash, the processing of the scene can commence. The primary goals of this processing effort are: (1) determining the cause of

the crash; (2) comprehensively recovering the victims and their personal effects; (3) determining the identity of all of the biological tissue; and, (4) removing all of the debris from the site.

With respect to the first goal, in the United States; if the cause is likely accidental (vehicular malfunction or human error), the National Transportation Safety Board (NTSB) will be in charge of the investigation. If it is instead determined that criminal intent may have been involved, the Federal Bureau of Investigation (FBI) will take custody of the scene.

The efforts of both the NTSB and FBI are focused on the non-human evidence at the scene. The recovery, identification and interpretation of the human remains (Goal 2) are the province of the Medical Examiner/Coroner (ME/C). While nearly all ME/C offices can deal with the morgue component of victim identification on their own or, they can request the services of federal groups such as DMORT, most offices do not possess the training, expertise, experience, or protocols to deal with a large scale scene containing the highly fragmented and commingled remains of large numbers of victims. This presentation will demonstrate that the best approach to the processing of outdoor crime scenes, especially large-scale scenes such as a plane crash, is to employ forensic archaeological methods. A new set of protocols for the processing of large-scale disaster scene will be presented.

The new protocols are based on the Weldon Spring protocols developed during the past decade (Dirkmaat and Hochrein 2000). The Weldon Spring Protocols are based on a systematic sequence of search, documentation, and recovery methods that is intended to result in the most efficient and effective scene processing effort. By effectiveness we refer to the proportion of physical and contextual evidence identified, documented, and recovered at the scene, while efficiency relates to the time and personnel required for effective recovery completion under a particular protocol. The goal of the present study was to optimize these two factors through the logistic and technological enhancement of the Weldon Spring protocols. To attain this, different technological configurations, affecting all the components of the protocol, from evidence location to data acquisition and recordation, were developed and tested in terms of their efficiency and effectiveness at real forensic cases and realistic mock scenes. Comprehensive guidelines for needs assessment and decision-making, targeting the identification and resolution of trade-offs related to technology availability and amortization, budgetary and personnel constraints, and training were also developed, in an attempt to offer different configuration alternatives to fit the needs and resources of a wide array of agencies without significant effectiveness losses.

The technological enhancements include high-resolution GPS units for the quick recordation of precise spatial recording, bar code scanning for data entry and sharing, and the utilization of wireless networks at the scene. The combination of these elements resulted in a reduction of recording times from minutes to just a few seconds, higher data integrity, with a standardization of evidence codes and the virtual elimination of any risk of reference duplication. This translates into an almost automatic coordination of all the recovery teams involved, in a manner that not only reduces the amount of time required by each team to locate, map, document and recover each evidentiary item, but also allows more teams to be deployed simultaneously at the scene.

Mass Fatality Incident, Forensic Archaeology, Victim Recovery

G94 Telluric Movements of Death: The Cemetery of Gargano's Mafia Inside the Ravine of Zazzano (Foggia, Italy)

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The goal of this presentation is to offer a multidisciplinary approach in forensic investigation that presents identification of victims as belonging to victims of local criminal organization. Skeletal remains of four different cadavers were recovered in a ravine, a surprising movie of this recovery completes the peculiarity of the case.

This presentation will impact the forensic science community by discussing how skeletal remains recovery requires a multidisciplinary approach in forensic activity, and identification of missing represents the principal aim.

The Gargano, also known as Spur of Italy is a subregion of Italy which coincides with the headland stretching in the North of Puglia and corresponds to the East of the Province of Foggia. It is entirely surrounded by the Adriatic Sea except in the West, bordering the Tavoliere. The frequent and constant carsic erosions in this area produced cavities that, in time, due to telluric movements created grottoes, dolins, and ravines hundreds meters underground. A ravine is a small valley—almost like a canyon but narrower—which is often the product of stream cutting erosion. Ravines are typically classified as larger in scale than gullies, although smaller than valleys. A ravine is generally a slope landform of relatively steep (cross-sectional) sides, on the order of twenty to seventy percent in gradient. Ravines may or may not have active streams flowing along the down slope channel which originally formed them; moreover, often they are characterized by intermittent streams, since their geographic scale may not be sufficiently large to support a perennial watercourse. The ravine of Zazzano is located on the Gargano area. The ravine is a 30 meter large ravine, 107 meters deep underground which was used in the past as abusive rubbish dump. Old and wrecked cars were also put down the ravines, stacking on each other in column. During a cleaning operation, local authorities, a team of speleologists found human skeletal remains and activities were interrupted. A prosecutor was immediately alerted and forensic pathologists were called for scene investigation, skeletal remains recovery, and identification. In a wrecked car, one completely skeletonized cadaver was found with its clothes; a reddish rope still tied to the arms bones and the head found inside a plastic bag. A second completely skeletonized cadaver was found later in another wrecked car some meters down the previous one. Bones of a third cadaver were recovered on the ground of the ravine, partially covered by mud. The cadaver lying in a prone position; head, thorax, and upper arms were found inside a jute bag, a reddish rope still tied lower arms. A fourth cadaver, completely buried under the mud was found, lying in supine position; the head was found inside a plastic bag. Recovery activities were completed in three days. A video recording of recovery was performed and is presented. Local authorities identified the owners of recovered wrecked cars. Forensic activities involved radiological investigation by means of standard approach and total body multislice TC scan contributing in determining causes of death: suffocation, gunshot wounds and efforts of mutilation, variously combined. Anthropological investigation determined sex and race of skeletons; dental records and dental casts were performed by forensic odontologists. DNA profile has been developed for identification. At the end of forensic examination all the fourth cadavers were identified as

belonging to men suddenly missed in the nineties, suspected as victims of the local criminal organization. The gravine is now famous with the name of cemetery of the Gargano's mafia.

Skeletal Remains, Ravine, Homicide

G95 Use of Multidetector Computed Tomography (MDCT) in the Evaluation of Gunshot Wounds

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After attending this presentation, attendees will understand the process used by the Armed Forces Medical Examiner System (AFMES) to integrate MDCT into the evaluation of gunshot wounds. Attendees will be able to describe the advantages and limitations of utilizing MDCT in the evaluation of gunshot wounds.

This presentation will impact the forensic science community by detailing a novel approach to overcome the limitation of the visualizing entrance and exit gunshot wounds with MDCT.

Postmortem forensic imaging is a critical tool in the evaluation of gunshot wounds. Traditionally, fluoroscopy and digital/plan film x-rays have been utilized to document and locate bullets and bullet fragments in cases of gunshot wounds. In the last several years, traditional imaging techniques in conjunction with postmortem MDCT has made it possible to obtain precise three-dimensional localization of bullets and bullet fragments. In addition, this technique has been shown to be an effective method for aiding in the documentation of gunshot wound paths and evaluation of internal organ injury prior to autopsy.

One of the main limitations of utilizing MDCT in the evaluation of gunshot wound paths is the inability of MDCT to precisely locate the surface entry and exit wounds. Although the presence of gas in the soft tissue and disruption of tissue surfaces may be helpful in the precise location of these wounds, the collapse of the temporary cavities, compression of soft tissue defects and the position of the body on the scanning table can limit the detection of the entry and exit wounds.

In order to overcome this limitation, a novel technique was developed utilizing radio-opaque markers. Briefly, the body is first imaged by digital x-rays to identify any bullets or bullet fragments in the body or clothing. Next, digital photographs of the body and gunshot wounds are taken and the locations of the gunshot wounds are marked with a 1.5 millimeter radiopaque marker. The body is then imaged with MDCT. The resulting images are processed with imaging software to produce a three-dimensional image of the body with the precise location of the entry and exit wounds on the skin surface. Reconstructed images are manipulated to obtain any desired orientation of the body and wound pathway. These images can then be used to demonstrate the gunshot wound pathways in medicolegal proceedings. It must be noted that this technique does not overcome the limitation of MDCT in distinguishing entrance gunshot wounds from exit gunshot wounds. This distinction is made by combining the postmortem forensic imaging with the findings from the external inspection and internal dissection of the body.

Computed Tomography, Gunshot Wounds, Virtual Autopsy

G96 Gunshot Wounds Covered by Different Textiles: Determination of GSR Through Micro-CT Analysis

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After attending this presentation, attendees will have novel information on the role of Micro-CT analysis of gunshot wounds for estimating the firing range.

This presentation will impact the forensic science community by adding new data on the estimation of the firing distance of intermediate-range gunshot wounds in clothed victims, through a micro-CT analysis of the gunshot residue.

Estimation of the firing range is often critical for reconstructing gunshot fatalities, where the main measurable evidence consists of the gunshot residue (GSR). Several techniques and methods have already been used for characterizing GSR, such as Atomic Absorption Spectroscopy, Neutron Activation Analysis, Autoradiography, Routine-CT, Scanning Electron Microscopy, and Histochemistry. Recently, a novel approach, based on the use of Micro-CT, proved to be an objective, reliable, rapid, and inexpensive tool for estimating the firing range in intermediate-range shots.

Aim of the Study: It is well known that the presence of clothes covering the body heavily affects the distribution of GSR on the entrance wound, hindering the estimation of the firing range on the basis of the sole macroscopic inspection.

The goal of the present study was to evaluate the differential distribution of GSR, with regard to the different kinds of textiles covering the skin, by means of micro-CT analysis, with the final purpose of reconstructing the firing distance.

Materials and methods: Human legs, surgically amputated, were cleaned of dried blood and any other contaminants, and cut into sections of approximately 6 cm in length.

A total of 60 sections were selected; each section was covered with a single type of textile, chosen among cotton fabric ($n = 15$), jeans ($n = 15$), leather ($n = 15$), and waterproof synthetic fabric ($n = 15$). Bare skin sections were used as controls ($n = 15$).

Firing was carried out perpendicularly at distances of 5, 15, and 30 cm, using a .32 pistol loaded with full-jacketed bullets. A total of 75 shots were performed (five replicates for each distance). After each firing test, the gunshot wounds were photographed and formalin fixed.

The skin specimens, comprising the epidermis, dermis, and subcutaneous fat, were cut into parallelepipeds (height 1 cm, side 1 cm) with a lancet. Samples were scanned following standard processing procedures, using a high resolution scanner.

The acquired raw data were reconstructed with reconciliation software, which uses the back-projection algorithm to reconstruct axial subsequent images saved as bitmap format. The bitmap images were analyzed by a CT analysis software: the selected volume of interest (VOI side of 1 cm and height of 3.8 mm) was focused in the centre of the specimen in order to have the entire entry wound positioned in the middle. All the samples were binarized using the same parameters.

The percentage of GSR deposit was calculated analyzing all particles with a density higher than 1000 Hu (particles with a density lower than 1000 Hu were excluded to reduce iron artefacts). The 3D images were reconstructed through a Ct-Vox Software.

Results: The visual inspection of the skin did not allow the estimation of the firing distance for the covered gunshot-wounds; the

morphological features of the entrance wounds (blackening and tattooing) were, indeed, not discernible.

The micro-CT analysis revealed that:

- GSR particles were less represented in cases compared to controls;
- In cases GSR particles were distributed inside the cavity and the fatty tissue of the entrance wound, while in controls they were present mainly on the skin around the hole; and,
- Increasing the firing range, the radiological detection of GSR progressively decreased in both cases and controls, allowing a good discrimination of the firing distances tested in the present study.

Conclusions: Micro-CT analysis might be useful for the forensic assessment of the firing range, particularly when the morphological features of intermediate-range wounds are not visually discernible (i.e., black people or clothed victims).

Forensic Pathology, Gunshot Wounds, Firing Range

G97 Child Abuse vs. Cachexia: Do Healing and Acute Rib Fractures Trump a Diagnosis of Probable Cardiac Dysrhythmia Due to Electrolyte Abnormalities

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After attending this presentation, attendees will gain an awareness of potential differential diagnoses between forensic anthropologists and medical examiners/coroners on child deaths becomes evident.

This presentation will impact the forensic science community by informing attendees of the difficulties that accompany medical/anthropological diagnoses of child abuse, and the complications that arise when specialists attempt to contribute to cause and manner of death in infants.

One of the most difficult tasks confronted by forensic pathologists is the determination of cause and manner of death in suspected child abuse cases. In the last 15 years, forensic anthropology has demonstrated a potential for contributing to the cause of death, by systematically examining questionable skeletal areas after processing the skeletal elements free of soft tissue for a close look. Certainly, an accurate analysis of acute and healing fractures contributes immensely to a final diagnosis of infant's deaths. But do the two professions, with different approaches and diverse responsibilities, ever conflict in diagnoses? Of course they do. Below is a case where such a conflict arises.

An unembalmed body of a well developed, poorly-nourished female was examined and autopsied. The body appears younger than the reported three-months. Inanition is evidenced. The pale skin shows no acute injuries, or scars, nor were there any indications of trauma from the external exam. A V-shaped incision was performed previously by a tissue harvest team to remove the heart and proximal aorta. The clavicle and first rib on the right side were sectioned for this procedure. The first indication of skeletal injuries is first discovered during the internal examination of the ribs, where hemorrhage, acute, and possible healing rib fractures are visible.

Pathologic diagnoses documents small body size, where height and weight are diagnosed as in the 3rd percentile for age. Morgue examination weight is 7 lbs 6 oz, where birth weight was 6 lbs 3 oz. This presents neglect or failure to thrive. Also noticed is documented dehydration and small organ weights. Finally, blunt force skeletal injuries are present, with acute, chronic, and acute-on-chronic rib fractures. History indicates that aunt called 911 at 15:30 after last seeing the child alive at 8:30 that morning. The aunt is the legal guardian.

The anthropologist was called in at the first recognition of skeletal trauma. At that point it was decided to remove all ribs, both clavicles, and vertebrae C-7 through L-4 after extensive photographic documentation. These were processed free of obvious soft tissue, but preserved in anatomical position to give a better idea of three dimensional relationships of the complicated trauma to bone.

Dry bone examination combined with faxitron radiographs indicate numerous rib fractures as listed in Table 1.

Table 1. Summary of rib fractures in 3-month-old infant.

RIB FRACTURES				
Acute	Chronic	Stable Chronic	Acute On Chronic	Other Procedure
15*	6	10 (3 questionable)	2	1 (tissue bank)

*All rib head apex tears

As one would guess, the anthropological report documents and describes the 33 insults to bone that clearly point to non-accidental trauma, with the history as reported. However, from a medical examiner point of view, this case was everything but a clear case of child abuse.

It is ruled the death of this 3-month-old as attributed to probable cardiac dysrhythmia due to electrolyte abnormalities. Postmortem testing for calcium and vitreous sodium yielded abnormally low levels. Multiple blunt force injuries in the form of acute and chronic rib fractures were also noted at autopsy. No external signs of trauma are seen on the body. Differential diagnoses of the infant's abnormalities include natural and non-natural causes. Neglect and child abuse cannot be ruled out, however, nor can a natural cause such as a metabolic disorder be eliminated. To complicate issues, the infant had been taken to the pediatrician regularly and they were treating the low body weight. The last physician visit was 16 days before death. In view of these issues, the manner of death is best certified as "Undetermined."

Maybe the question in this case should be formulated, "Do diagnoses of probable cardiac dysrhythmia due to electrolyte abnormalities trump healing and acute rib fractures?" To the anthropologist perspective, this is an unsettling thought. To the medical examiner/coroner, while still unsettling, their responsibilities are medical interpretations of cause and manner of death, not simply biomechanic interpretations of bone fracture. The repercussions of a homicide ruling without a traumatic cause of death are immense. Thus, the debate goes on.

Child Abuse, Cachexia, Healing Rib Fractures

G98 The Identification of French Victims in the Massive Earthquake on January 12, 2010 in Haiti

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The goal of this presentation is to give attendees a clear understanding of France's structure and procedures in terms of identification of its nationals in the event of a major natural disaster and to demonstrate that the international response is as efficient and effective as it is at a national level.

This presentation will impact the forensic science community by showing the successful collaboration between a forensic scientist and a first response rescue team. To illustrate this, the French national team of identification was followed on site at Port-Au-Prince from January 13, 2010 until April 1, 2010. It also demonstrates that an early intervention is key to optimizing the effectiveness of the identification process and to achieving the overall success of the operation.

The earthquake that struck Haiti's capital Port-au-Prince caused more than 200,000 deaths. The major contributing factors to such high casualties were primarily its incredible strength and secondly the

instability of the existing infrastructure. The challenges that had to be overcome were the significant increase of sanitary requirements and the issue of corpses' management. Identifying such a high number of victims proved extremely difficult firstly because of such a large volume of corpses and secondly because of their high levels of depreciation. The success of this operation was only made possible due to a thorough preparation combined with a structured and systematic approach.

In response to similar events, France has a national DVI team (Unité Nationale d'Identification des Victimes de Catastrophes – UNIVC) since 1992. It was established by the Criminal Research Institute of the National Gendarmerie (IRCGN). The team is made up of specialists from the Criminal Identification Department who are able to be deployed on site very quickly and are trained to be adaptable and responsive to any given situation.

Since 2006, authorities based in the French island of Martinique, in the West Indies, have been focusing on contingency and emergency plans due to the island's major exposure to natural risks and its remote location. These revised response procedures were put into practice for the first time in Haiti in 2009 to such great effect that it has subsequently brought about modifications of the national strategy (plan ORSEC). This strategy encompasses a forensic scientist, with expertise in mass deceased management, as part of the initial first aid response team.

The first evaluation reported at least 70,000 deceased in PORT-AU-PRINCE 24 hours after the earthquake. The police's chief of the United Nations and the Haitian Prime Minister, who were actually themselves survivors of the disaster, were immediately contacted to organize the clearance and logistic requirements, as well as the coordination of the mass burial of corpses in common graves commencing 36 hours after the earthquake.

Communication was a key factor in this operation not only with the population, to dispel the myth that corpses in a disaster can cause the rapid spread of diseases, but also with the international nursing staff to reiterate that sanitary precautions in the movement of bodies.

The second major objective was to perform an accurate census of the deceased French nationals by locating and collating their position at the time for the purposes of identification and repatriation to families. This was achieved by setting up an "antemortem" unit at the French embassy for the registration of missing persons and reported fatalities.

Between 72 and 96 hours, 30 names were indexed. Survivors were then contacted and advised on the best practices for the storage of the deceased prior to burial. These instructions also gave details on how to preserve vital evidence i.e. ensuring personal effects of the corpses were not removed, drawing up an accurate map to locate corpses, collecting local and national coordinate.

As a result, all French deceased nationals (33 of approximately 1,200 present) were identified by the end of March 2010 and placed in a temporary mortuary at the French embassy with thanks to the close cooperation of the American and Canadian DVI.

Identification, Mass Disaster, Earthquake

G99 Comparison of Methods for Measuring Decomposition of Submerged Carrion in Fresh Water

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The goal of this presentation is to determine a method for measuring submerged decomposition experimentally that limits contamination to the carrion.

This presentation will impact the forensic science community by discussing how, currently, there is no standard for measuring submerged decomposition *in situ*. This study compared current proposed methods for experimentally measuring the amount of decomposition undertaken by carrion underwater, and hopefully, the results may guide future underwater decomposition research, using more standardized techniques that limit contamination of the decomposition process.

Continuous monitoring of decomposition and calculations of the postmortem submersion interval (PMSI) of carrion at depth can be problematic for forensic investigators due to risk contamination of the carrion caused by the extraction from the experimental environment and weighing processes. Underwater photography and evaluation utilizing the Heaton et al. total aquatic decomposition (TAD) score at depth was compared to weighing the carrion before and after submersion, as well as full forensic necropsies. The actual time of submersion was known for each carrion. Perinatal piglets were used as human analogues for experimental purposes. This study suggests that weighing the piglets after they have been submerged in fresh (stagnant) water yields inconsistent results due to the unpredictability of algae growth in water ecosystems with high algal contamination. In addition, while underwater photography does reveal some evidence of decomposition *in situ*, usefulness is limited by required training, expensive equipment, and further algal growth issues which can obscure the visual data. The results of this study indicate that in order to objectively measure decomposition over time, the carrion should be examined either at depth using the TAD scoring system, or a set of piglets should be submerged with one piglet harvested from the experimental environment over set periods. This piglet should then undergo a pathological examination (with histological sampling and TAD scoring, as was done in this study), rather than relying on underwater photography. This allows for normalization between piglets and excludes weight and algal growth issues, thereby showing the amount of decomposition over time. The acquired TAD score can then be used with the calculated Accumulated Degree-Days (ADD) to determine an approximate PMSI. These results may not be generalizable to other submersion conditions in water ecosystems with different salinity, temperature, degree of algae growth, and amount of other animal activity.

Underwater Decomposition, Postmortem Submersion Interval, Visual Scoring System

G100 Fatal Sexual Violence Against Women: Normative, Baseline Studies of Postmortem Genital Anatomy — What Can We Say About Normal?

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After attending this presentation, attendees will better understand the nature and appearance of the postmortem anogenital tissues; be able to discuss findings from control groups of normative, baseline studies for comparison with cases of fatal sexual violence; and discuss taxonomy, examination adjuncts, and database variables useful in the postmortem sexual assault evaluation.

This presentation will impact the forensic science community by improving the diagnostic acumen of the forensic examiner, helping avoid ambiguity of interpretation of clinical findings in postmortem genital examinations, and improving knowledge about fatal sexual violence against women.

Until recently, a paucity of data existed on the “normal” appearance of the genital anatomy during the postmortem interval. There is a lack of data from scrutiny and photodocumentation of the postmortem anogenital tissues. The use of colposcopy is well established for both adult and child *living* victims. During the autopsy, gross visualization alone may not allow the detection of the more subtle findings that usually constitute genital trauma in sexual assault (Crowley-AAFS: 2003). Comparisons to either living sexual assault victims or postmortem cases of non-sexual etiology were extremely difficult.

This presentation proposes to describe ongoing research on postmortem genital anatomy. These cases constitute the first normative, baseline data on the anogenital tissues during the postmortem interval. The focus of the present discussion is to describe the findings from two normative, baseline control groups, with a total sample of 48 female cases.

Group I consists of 30 female cases drawn from the Body Donation Program, at the University of California, Davis, California. Most donors are received \leq 24 hours of death. All cases selected for this baseline study are fresh, or fresh-frozen, vs. embalmed. Cases are examined based upon availability, i.e., female gender and received by the program in a time frame compatible with access by the primary investigator.

Group II consists of 18 coroners’ cases, from another jurisdiction. These were also examined using the mobile colposcopy and examination system described by Crowley (JFS: 2004). The manner of death was accidental in seven cases and natural in 11.

Materials and Methods: This research project is an observational study, with a cross-sectional design. The examination methodology employs photocolposcopy at 7.5X, 15X magnification, or both, plus 35 mm photography via the colposcope. In most cases, additional photographs are taken with a 35mm single lens reflex (SLR) manual or digital camera, for comparison to colposcopy. Inspection and photodocumentation of specific anogenital sites is employed, prior to manipulation of the genital tissues. On select cases, concomitant application of a 1% solution of toluidine blue dye has also been incorporated, in order to evaluate the reliability of this general nuclear stain as an adjunct to the postmortem examination. The same 12 anatomic sites are visualized, inspected, and photographed in both controls and sexual homicide cases. These include the labia majora, peri-clitoral area, peri-urethral area, labia minora, hymen, vagina, cervix, perineum, fossa navicularis, posterior fourchette, anus, and rectum.

There are some core data elements germane to both control and sexual homicide groups. These include age and reproductive status, (pre-pubertal, reproductive age, peri-menopausal, and post-menopausal) and genital examination techniques. Other common variables include the unique case identifier, date and time of the examination, interval from death to arrival in forensic science morgue, general condition of

body, race and ethnicity per CDC definitions, cause and manner of death, and contributory and/or concomitant medical and gynecological conditions, especially those presenting lesions.

The 30 female cases from Group I range in age from 60-99 years. The mean age is 83.1 years old. This is a largely homogeneous group; 93% of the sample is Non-Hispanic/White. The majority of Group I presented to the forensic science morgue within 24 hours. Postmortem mucosal autolysis was present at a minimum of one out of the 12 anatomic sites in 80% of the sample. Postmortem skin slip in the anogenital area was present in 16.6%. A 1% Toluidine blue dye solution was applied and decolorized with a dilute acetic acid solution in 21 of the 30 body donor cases. There was a false positive uptake in 100% of the cases. This was true regardless of the anatomic site of dye application.

The age range for the 18 cases in Group II was 32 months to 89 years of age. The mean age was 47.87 in this Group. The ethnicity and race distribution was as follows: Non-Hispanic/White (66.6%); Non-Hispanic/Asian Pacific Islander (5.5%); Hispanic/White (11%), and African American (16.6%). The postmortem interval to arrival at the forensic science morgue was \leq 24 hours in 88.8%, 96 hours in 5.5%, and \geq 5 days (active decay) in 5.5%. Postmortem mucosal autolysis was present in greater than 50% of Group II. Toluidine blue dye was not applied to any in this sample.

Discussion: The postmortem arena superimposes a unique set of factors. Many were not previously studied or documented in the literature. Analysis of results from baseline studies allows eventual comparison to genital injuries sustained by both sexual homicide victims and living sexual assault victims. A relational database was described (Crowley, AAFS: 2010) as a method to simplify and quantify data for interpretation, analysis, and linkage to other cases.

Taxonomy germane to the postmortem arena should incorporate salient terms that will be consistent and universally applicable and acceptable within the forensic community (Crowley & Peterson: AAFS, 2004). Postmortem artifact, such as *mucosal autolysis* and *skin slip*, visualized in the anogenital tissues, is documented for each anatomic site. Inclusion into case documentation permits aggregate summaries of individual and population-based summaries. Appropriate taxonomy and correct identification of “normal” will help improve our diagnostic acumen and increase the reliability of our methodology.

The significantly false positive results obtained from application of Toluidine Blue dye on the postmortem anogenital tissues should preclude any recommendation for its use in the postmortem sexual assault examination. It appears to be consistently picked up by the shedding tissues that comprise part of the normal artifact. The inexperienced examiner might misconstrue this for a significant finding.

It is certainly true that in equivocal cases, the forensic pathologist can simply remove en bloc, for dissection and microscopic evaluation, the tissues germane to genital findings. However, it may prove to be beneficial to have an initial *in situ* examination of the anogenital anatomy, via colposcopy. The ultimate goal of this research is to improve our understanding of what is normal, and what is not, during the postmortem interval for the anogenital tissues. In this manner, the capacity and understanding of fatal sexual violence against women will continue to grow.

Fatal Sexual Violence Against Women, Body Donation Program, Colposcopy

G101 The Effects of Household Chemicals on Blow Fly Oviposition and Development Using Human Cadavers

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After attending this presentation, attendees will have a better understanding of the effects that household chemicals have on the insect's role in the decomposition of the human body. This research was inspired from a murder that occurred in Lafayette, Indiana where the perpetrator sprayed Raid® on the body of the victim. This led researchers to question what effects Raid® and other household chemicals have on blow fly activity and subsequently estimations of the postmortem interval (PMI).

This presentation will impact the forensic science community by exploring the hypothesis that bodies treated with the chemical ammonia would not significantly vary from bodies with no treatment and bodies treated with Raid® would significantly vary. This hypothesis was based on the results of previous research conducted on swine.

Six human bodies, (four male and two female), were obtained for use in this study and frozen prior to placement in the field. This research was conducted at the Anthropological Research Facility at the University of Tennessee in Knoxville. The field research started on July 18, 2010 and concluded on August 6, 2010. The bodies were placed in the field in sealed body bags and allowed to thaw for a period of 48 hours prior to treatment with chemicals. After the bodies were removed from the bags they were checked for any evidence of insect activity and none was observed. Two bodies (male) were not treated with chemicals and served as controls. Two bodies (one male, one female) were coated with 1275 g (3 cans) of Raid for Flying Insects, (active ingredients 0.05% permethrin, 17.5% tetramethrin, 0.05% d-cis/trans allethrin). Coating involved spraying the bodies with Raid until runoff occurred. Two bodies (one male, one female) were coated with 9.45 L (5 bottles) of Great Value brand household ammonia. The ammonia was poured onto the body until runoff occurred. Treatments were randomly assigned using a random number generator. The bodies were monitored and photographed twice daily and notes were taken to document blow fly activity. The following major stages of insect activity were noted: adult flies, fly eggs, fly larvae, migrating fly larvae, presence of beetles, and the end of maggot migration (characterized by the absence of observable larvae on the body). This allowed researchers to document differences in development time as well as the initial onset of blow fly life stages. Adults and larvae were collected following standard operating procedures outlined in Haskell and Williams (2008) each day to document any differences in species composition or development among treatments. Larvae were collected in KAA (composed of 95% Ethanol (77%), Acetic Acid (15%) and Kerosene (8%)) and adults in 70% EtOH.

The research was still in progress during the writing of this abstract, but the results and conclusions of the study will be discussed during the presentation.

Forensic entomologists are often asked by law enforcement agencies to provide an estimation of the PMI using insects. If chemicals are applied to a body and that has an effect on the blow fly activity, then the estimation of the PMI is therefore compromised. The data obtained from this research will impact the forensic science community by helping to overcome this obstacle when chemicals are involved and yield more accurate assessments by forensic entomologists.

Forensic Entomology, Chemicals, PMI

G102 Mass Disaster Procedures: Forensic Pathology and Genetic Techniques Used to Locate Nine Missing People in the Calabria Region (Southern Italy)

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After attending this presentation, attendees will understand the importance of a unified and well organized multidisciplinary approach resulting in a set of guidelines useful during a mass exhumation.

This presentation will impact the forensic science community by documenting the management of the first mass exhumation and DNA identification of one hundred corpses. This procedure will be useful in the future following an actual mass disaster event.

The Public Prosecutor's Office of the city of Paola (CS, Calabria Region, Southern Italy) opened an investigation into a number of criminal offenses that have repeatedly occurred in aged care facilities where people with physical and psychological handicaps are managed.

The aged care facility manager was a suspect and due to his irregular management was arrested.

In different periods over recent years nine residents had gone missing from the house. The resident's families reported this to the legal authorities about their missing relatives to the legal authorities. Moreover the families expressed concern that during the last meeting when they saw their relatives, they were all injured.

An investigation was organized in order to find the missing patients. This was concentrated in the local cemetery where the police found unmarked graves without any identification.

The public prosecutor gave permission to the Legal Medicine Department of Magna Graecia University of Catanzaro to exhume the unmarked graves and examine each corpse so they could be identified.

In a period of 15 days, 101 corpses were exhumed for identification using DNA and to determine if any trauma had occurred either antemortem or perimortem.

The medico-legal task force which was multi-disciplinary consisted of three phases: a planning phase; a pre-analytical phase; and, an analytical phase.

Planning Phase: During this phase mass disaster operative procedures were enacted. A medico-legal camp was built close to the cemetery area. Briefing meetings were organized to coordinate the schedule of pathologists, molecular biologists, entomologists, mechanical engineers, computer scientists, physics, and law enforcement agents (Arma dei Carabinieri and fire brigade).

Pre-Analytical Phase: Under the direction of the coordinating pathologist, pneumatic tents were positioned courtesy of the fire brigade. Each tent had its own purpose (external inspection, x-ray, autopsy, biological laboratory). The camp site was powered by portable electric generators. Moreover, the camp set up was established in order to prevent the infestation of insects attracted by human remains which would complicate or invalidate the medico-legal analyses. Approximately 40 people worked each day in the camp.

Analytical phase: This phase was developed in the Genetic Laboratory of the RIS, Carabinieri Messina. The methodology was previously validated at the Forensic Genetic Laboratory of Magna Graecia University where techniques had been previously established to extract DNA from old and badly preserved bones. The main difficulty of this work was the DNA extraction from corpses in colliquative, corification, and skeletonization stages.

A piece of femur diaphysis (4 cm length) was sampled from each corpse and fixed in alcohol. Subsequently all muscle tissue and internal trabeculae (if present), was removed from the bone. The bone was then washed in water-alcohol-ether, then pulverized and demineralized.

The pulverization of 0.5 g of bone was achieved by impact and friction using 30 Hz frequency and spun together with a single tungsten carbide ball inside a cylindrical steel container.

The bone powder demineralization was obtained using an EDTA solution 0.5 M pH 8.0.

After chloroform extraction, the DNA purification was completed using silica gel columns.

The quantity of obtained DNA was determined by REAL-TIME PCR technique.

The DNA personal profiles were obtained with multiplex amplification and subsequent separation in capillary electrophoresis.

The results obtained allowed the DNA identification of the corpses regardless of their stage of decay. The obtained DNA profiles were compared with relatives to confirm the identity of the exhumed bodies.

Mass Disasters, Forensic Pathology, Forensic Genetics

G103 Variance in Growth Rates of *Calliphora vomitoria* on Different Tissue Types: Mass Raised vs. Single Raised

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After attending this presentation, attendees will have a better understanding of the variances in growth rates for *Calliphora vomitoria* that occur not only when raised on differing tissue types, but also when raised in mass versus single.

This presentation will impact the forensic science community by demonstrating the need for further understanding of larvae activity and growth rates on differing tissue types.

Without a more thorough understanding of larvae species and their possible species specific growth rates and interactions with tissue types, the use of them in determining postmortem intervals (PMI) is suspect.

Recent studies show that there are significant differences in maggot growth rates depending on what type of tissue they consume. While previous studies have determined that the structure of the tissue didn't make a difference, what exactly causes the variation in growth rates has not yet been discovered. Since most comparison studies have been conducted using lab raised larvae (commonly grown on cow liver or pig liver), there may be significant problems with using such larvae to determine PMI in real cases. To better understand the implications of the variation in growth and development, development rates of larvae raised on various tissue types need to be explored more completely. This raises the question of whether the specific tissue consumed, or a change within the mass's activity, causes a change in growth rate.

A comparison between single raised larvae and mass raised larvae was used to judge the possible connection between being raised in mass and differences in growth rates on varying tissue types. If the difference in growth rates between different tissue types was not related to being mass raised, then single raised larvae and mass raised larvae from the same tissue type would show the same variations in growth rates.

This experiment examined the growth rates of single versus group raised maggots (N=100) on various tissue types. Growth rate differences were measured in two ways: mean maggot size, and instar stage. Larvae were procured from eggs laid in the lab by a mixture of wild caught and lab raised *C. vomitoria*. Larvae were laid on kidney, liver, heart, lung, or brain before being transferred within an hour of hatching to the tissue on which they were to be raised. All larvae were transported from the tissue on which they were laid to either a piece of the same tissue type or a different tissue type. By this means, it could be seen if a variation in origin tissue and sustenance tissue for a larvae during the first instar stage had an effect on the rate at which it matured.

Each tissue type had three replicates of masses being born and raised on the same tissue type and three replicates of larvae being born and raised on differing tissue types, for six replicates in total. Single raised larvae were replicated in groups of twenty for each origin tissue, resulting in batches of forty replicates total per a raising tissue type. All larvae were killed approximately six days after hatching and were measured by length from mouth to instar markings to the nearest .01 µm.

Whether the tissue type on which a larva was born was switched during first instar was not statistically significant. However, the relationship between size, tissue type, and whether a larva was mass grown or single grown was significant. In PMI studies larvae are used to determine PMI based on length at time of death, or time needed to grow them to adulthood in a laboratory setting combined with accumulated degree days. The variations in growth seen in this study differ from those seen with previously studied species, signifying that tissue based variations in growth rates are species specific. The wider variance in lengths noted in mass raised larvae as compared to single raised larvae indicates that size is not the best determinant of age as previously presumed. These results could mean a significant change in the way fly larvae are viewed and utilized in the field of taphonomy and forensic entomology for determining PMI.

Development Rate, Forensic Entomology, Postmortem Interval

G104 Identification of Two Homicide Victims and Linking of Separate Crimes Solved by Radiographic Discovery of a Healed Bullet Wound.

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The goal of this presentation is to provide details on the investigation, and forensic examination of two separate homicide cases which were solved based on the radiographic discovery of an old healed bullet wound. A primary point of discussion of this presentation will be how the smallest and least suspected piece of evidence can be utilized to solve a difficult case or cases. The importance of detailed forensic anthropological examination in skeletonized or badly decomposed cases will be noted during the presentation.

This presentation will impact the forensic science community by providing present and future forensic investigations insight as to the forensic analysis of decomposed and skeletonized remains so as determine the identity of deceased as well as the possible cause and manner of death. The forensic audience attending the presentation will become more aware of the importance of old healed injuries in the identification process as well as possibly identifying past activities or linking criminal activity.

In the summer of 2006 near Warren, Ohio skeletonized remains of an adult individual were discovered in a heavily vegetated area near a water treatment facility. The remains of the deceased were noted to be without any associated clothing or foot ware. Forensic anthropological

examination of the remains found them to be consistent with that of a Negroid male who was in his fifth decade of life at death. Based on the environmental conditions at the scene and the decompositional state of the remains a postmortem PMI of approximately six to eight months was assigned. The lack of soft tissues, absence of skeletal trauma in addition to the absence of clothing and location of the remains were noted as extremely suspicious by the coroner's pathologist.

Approximately two years passed while the remains of the deceased remained unidentified. In June of 2008, another set of skeletonized remains were discovered near Warren, Ohio. The remains discovered were recovered from several plastic garbage bags that were located along a highway. Each of the garbage bags recovered contained various portions of a highly decomposed body that had been dismembered. Forensic anthropological examination of the dismembered remains revealed them to represent a single individual that of a Negroid male who was in his mid to late twenties at death.

Detailed examination of the remains revealed that the dismemberment had been accomplished with a saw. The sawing dismemberment was noted as unusual as the cuts were made along the longitudinal/saggital plane of the body. A major portion of the middle and lower vertebral column had been cut longitudinally including a near perfect halving of the sacrum. A single gunshot wound was noted on the skull and considered to be the probable cause of death.

While conducting an examination of the innomates for aging and sexing purposes a very slight and almost unnoticeable small depression was noted along the inferior side of one of the innomates. The slight depression which was adjacent to the inferior side of the sciatic notch at first appeared to represent a simple skeletal anomaly attributed to human skeletal variation. Radiographic examination of the innominate revealed the presence of a fairly intact nine millimeter bullet. The bullet was removed from the innominate utilizing a small craft saw and submitted as evidence of an old healed bullet wound.

The discovery of the old healed bullet wound served as a key lead to the identification of the homicide victim. Identification of the victim led police on an investigation that in turn resulted in the identification of the prior unknown remains discovered near the water treatment facility. Further investigation of this case revealed that the earlier death was also a homicide and led to the arrest of the killer.

Anthropology, Ballistics, Human Identification

G105 Utilizing Multi-Detector Computerized Tomography to Evaluate Concrete-Encased Human Remains

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After attending this presentation, attendees will recognize the value of postmortem multi-detector computerized tomography (MDCT) evaluation of an unusual case of human dismemberment followed by encasement in concrete; appreciate the value of MDCT osseous examination and documentation; learn methods to utilize MDCT analysis of concealed biologic remains and review procedures utilized for orientation and extraction of human remains from concrete.

This presentation will impact the forensic science community by expanding the scenarios in which the use of MDCT may be utilized to improve postmortem evaluation and will demonstrate opportunities to utilize MDCT in medical examiner/coroner facilities where MDCT is reasonably available.

The Mesa County Coroner's Office is situated in rural Western Colorado at Community Hospital in Grand Junction, Colorado. Because the morgue is located within the hospital, state of the art radiographic equipment and ancillary staff are available.

Case Report: the decedent is a 41-year-old male homicide victim whose dismembered remains were concealed with concrete in two five-gallon plastic buckets. According to police reports, the decedent was killed by his son who later confessed and led police to his father's remains which had been stored in a shed for approximately two months following the homicide and dismemberment. Unable to determine the veracity of the reported circumstances, the presence of human remains was confirmed using MDCT. The remains were limited to the decedent's head with cervical spine, hands, feet, and heart. The imaging also served to establish preliminary forensic findings, namely the presence of a bullet in the left orbit. In addition, fractures of the left and right orbital plates were noted, while the remainder of the calvarium was intact. Other osseous findings include a fracture of the left distal second metacarpal and left distal first phalange, as well as a metal plate in the left orbit. In order to remove the remains from the buckets with minimal damage, the outside of the buckets were marked to indicate the orientation of the remains. A circular saw with a concrete cutting blade was used to cut into the concrete along predetermined planes of predetermined depth. The properly oriented concrete incisions allowed for coronal separation around the head providing anterior and posterior intact concrete mold halves. External examination of the head revealed that the skin and portions of soft tissue had been removed prior to encasement. The ears and eyelids were missing, and the eyes were sunken and softened due to decomposition. A small caliber, slightly deformed bullet was recovered from the left frontal sinus/superior orbital ridge. Due to the intentional removal of the decedent's facial skin and postmortem change, the entry wound was not visible and range of fire could not be determined; however, absence of soot from sections around the remaining soft tissue likely exclude a contact gunshot wound. In the absence of postmortem MDCT or conventional radiographs, it is entirely possible that the presence of a gunshot wound could have been overlooked. While the extent of brain decomposition precluded its examination, the MDCT and gross examination findings indicate that the bullet did not penetrate the cranial cavity. Examination of the outer table of the left orbital ridge of the calvarium revealed hemorrhage in the soft tissue. Neck and throat examination indicate the unlikelihood of strangulation based on the presence of an intact hyoid bone, thyroid cartilage, and thyroid cornu and absence of hemorrhage of the laryngeal mucosa. Because of the limited amount of remains available for examination, trauma to the remainder of the decedent's body could not be evaluated and therefore the cause of death was classified as undetermined. The manner of death was classified as homicide. Positive identification of the remains was established by comparison with antemortem dental records and confirmation of an orthopedic metal plate in the left brow.

In summary due to the location of our morgue facility, MDCT is readily available and was utilized to confirm the presence of human remains concealed in concrete. Furthermore, MDCT permitted orientation of the remains for optimal removal, documented orthopedic devices to augment identification, and assisted in the evaluation of injury. This defendant pled guilty and the case did not appear in court. If court proceedings had ensued, the use of a three dimensional volumetric MDCT rendering would have been utilized to present information to the jury. It is believed, a three dimensional volumetric rendering provides objective detailed visual imagery without the graphic, frequently repulsive appearance of wound photographs, and MDCT is useful in the evaluation of selected postmortem examinations.

Multi-Detector Computerized Tomography, Gunshot Wound, Homicide

G106 Use of Multidetector Computed Tomography (MDCT) in the Medicolegal Investigation of Human Remains After a Natural Disaster

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After attending this presentation, attendees will understand the process used by the Armed Forces Medical Examiner System (AFMES) to integrate multi-detector computerized tomography (MDCT) in the handling of human remains recovered from the natural disaster in Haiti. Attendees will be able to describe strengths and limitations of the process model employed.

This presentation will impact the forensic science community by offering one alternative for processing human remains following a natural disaster or other mass casualty event.

A disaster mortuary is established both to identify victims and determine cause and manner of death. Conventional radiography has been routinely used to screen for foreign bodies, personal effects and anatomic, dental, or surgical findings. MDCT has proved to be a useful technique in support of forensic examination in military and civilian mortuaries. The disaster in Haiti provided the AFMES the opportunity to utilize MDCT in the processing of victims of that event.

The three step processing model used employed: (1) digital radiography and whole body MDCT; (2) visual external inspection of the body; and, (3) forensic autopsy if steps one and two did not establish reasonable explanation for cause and manner of death or produced findings that required internal examination (e.g., ballistic fragments, external wounds).

There were 28 cases received and 27 processed using the model (one case did not have MDCT). In 20 cases MDCT and visual inspection showed evidence of blunt force injury and no suspicious findings. The medical examiner did not perform an autopsy and cause/manner of death was "blunt force injury/accident." In 19 of 20 non-autopsied cases MDCT gave more information than digital radiology, the exception being a case where disarticulated bones were received. Key findings were skeletal injuries to the head/neck, spine, thorax, and pelvis. In seven cases MDCT and visual inspection was judged inconclusive and complete autopsy was performed. These cases were signed out as "probable positional asphyxia/accident" (2), "cardiac arrhythmia/natural" (2), "blunt force injury/accident" (2) and "complications of a natural disaster/accident" (1). None of the 27 cases showed internal metallic fragments or suspicious external wounds. In 23 of 27 cases, moderate to severe decomposition was present and our prior forensic experience was helpful in distinguishing changes related to postmortem decomposition, recovery and handling from acute injury sustained during the event.

In conclusion, the use of MDCT together with external visual inspection by a medical examiner provided sufficient information to establish cause and manner of death in 74% of the cases sent to the AFMES during recovery operations in Haiti. This related directly to the ability of MDCT to determine findings consistent with blunt force injury not apparent on digital radiographs. This model using MDCT and visual inspection offers a rapid alternative for investigating human remains recovered after a natural disaster. It is believed that MDCT alone without external visual inspection by a medical examiner would not be adequate. It is also recognized that a medical examiner may deem a full autopsy to be required for a variety of other reasons (e.g., statutes, policy directives).

Computed Tomography, Natural Disaster, Virtual Autopsy

G107 Evaluation of the Randox Whole Blood Drugs of Abuse (DOA) Microchip Arrays for Use With Alternative Postmortem Samples as a Rapid Near-Body Screen

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The goal of this presentation is to illustrate a rapid and simple tissue preparation method which allows drugs of abuse (DOA) to be screened using the Randox whole blood DOA microchip arrays.

This presentation will impact the forensic science community as the entire process can be undertaken and results obtained in the mortuary whilst the postmortem is taking place. Also the quantity of sample needed to screen may obviate the need to remove large tissue samples for laboratory analysis, saving time and costs, especially in negative cases.

A procedure is described that allows small aliquots of postmortem samples of blood, urine, vitreous humor, liver, and psoas major muscle to be analyzed for the following drugs, simultaneously: acetaminophen, amphetamine, barbiturates, benzodiazepines, benzoylecgonine, buprenorphine, cannabinoids, fentanyl, ketamine, lysergic acid diethylamide (LSD), methadone, methaqualone, methylamphetamine, methylenedioxymethamphetamine (MDMA), opioids, phencyclidine (PCP), propoxyphene, tricyclic antidepressants, zaleplon, zolpidem, and zopiclone.

Femoral blood, urine, vitreous humor, liver, and psoas muscle were obtained from forensic autopsies, ranging from suicides to natural causes. Tissue samples were cut into 1 centimeter cubes and homogenised with 1 millilitre SPE diluent. The homogenates were centrifuged for ten minutes at 3000 rpm and 70 microlitres of supernatant transferred to Eppendorf tubes. The samples were then diluted 1:3 with SPE diluent. Femoral blood, urine and vitreous humour were prepared and applied to the assay following the manufacturer's protocol for whole blood. Femoral blood from each case subsequently underwent confirmatory analysis using high performance liquid chromatography with diode array detection (HPLC-DAD) and liquid chromatography tandem mass spectrometry (LC-MS/MS).

Over 100 postmortems were screened for a combination of the previously mentioned drugs of abuse. A good agreement was obtained between the Randox assays and HPLC-DAD and LC-MS/MS analyses. Of the positive cases, urine and liver samples had a greater percentage agreement with confirmatory analyses than femoral blood, vitreous humor, and psoas muscle. The discrepancies between assay screening and confirmatory analysis may reflect differences in drug distribution between tissues as well as confirmatory analyses detecting concentrations below the assay's cut-offs.

In conclusion, the Randox whole blood DOA arrays can be used to alternative postmortem samples rapidly and simply. The simple procedure will benefit the forensic community as the entire process can be undertaken and results obtained in the mortuary while the postmortem is taking place. Also the quantity of sample needed to screen may obviate the need to remove large tissue samples for laboratory analysis, saving time and costs, especially in negative cases.

Drug Screening, Postmortem, Alternative Samples

G108 Postmortem Vitreous Beta-Hydroxybutyrate: Interpretation in a Forensic Setting

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After attending this presentation, attendees will be aware of the range and frequency of postmortem vitreous beta-hydroxybutyrate (BHB) levels likely to be encountered in a forensic setting.

This presentation will impact the forensic science community by providing a more thorough basis for interpreting vitreous BHB levels.

Beta-hydroxybutyrate is one of three ketone-related substances commonly measured in the clinical laboratory and is also useful in postmortem testing. Ketones increase when the primary metabolic fuel source switches from glucose to fatty acids. Ketones are most useful as a marker for diabetic ketoacidosis and are also increased in alcoholic ketoacidosis, starvation states, and severe infectious disease processes. They can be measured in many body fluids including blood, urine, and vitreous fluid during postmortem investigations.

The medical examiner is often faced with an elevated vitreous BHB level that appears to have little or no bearing on the case. When can elevated vitreous ketones be safely ignored? This retrospective study was undertaken in order to gain a better understanding of the frequency and usefulness of postmortem vitreous BHB levels in the forensic setting. Moderately elevated levels were common and were not often related to the cause of death. More severely elevated levels of BHB were related to the cause of death with increasing frequency as the levels increased. Markedly elevated vitreous BHB coupled with elevated vitreous glucose usually indicated diabetic ketoacidosis. When vitreous BHB was elevated and the vitreous glucose was low, an alcohol related death was common.

A computer database was searched for postmortem vitreous beta-Hydroxybutyrate (BHB) levels measured in 1,795 forensic cases over a six year period (2003 to 2009) in the normal course of death investigation. Levels ranged from 0 to 22.7 mmol/L and averaged 1.2 mmol/L. 562 (31.3%) were less than 0.4mmol/L . 637 (35.5%) were between 0.4 and 1.2 mmol/L. 439 (24.5%) were between 1.2 and 2 mmol/L. 105 (5.85%) were between 2 and 6 mmol/L. 52 (2.9%) were greater than 6 mmol/L. Comparison of vitreous BHB with vitreous glucose levels in 1,781 cases showed moderately good correlation $r=0.731$. Comparison with blood alcohol levels in 1,561 cases showed no correlation $r= -0.053$. Diabetic ketoacidosis was diagnosed in 76.9% of the cases with vitreous BHB above 6 mmol/L; 37.5% to 13.5% of cases with decreasing BHB levels from six to two mmol/L and less than 2% of cases with BHB less than 2.0 mmol/L. Alcoholic ketoacidosis appeared in only 4 cases. Conditions thought to be ketogenic (diabetes, alcoholism, severe infections) were found in over 92% of the cases with BHB above 6 mmol/L and a third of the cases with BHB levels below 2.0, 1.2, and 0.4 mmol/L. Cases of sudden violent death, age 20-40 and less than 90 minutes from incident to pronouncement time, and with no obvious reason for elevated BHB amounted to 11 cases and showed vitreous BHB levels closer to normal with an average of 0.57 mmol/L. The BHB level was elevated (0.4 – 1.72 mmol/L) in 32 of 34 SIDS-like cases included in the study.

Beta-Hydroxybutyrate, Death Investigation, Sudden Infant Death Syndrome

G109 The Rising Trend of Ecstasy and Mimic Drugs Among Teenagers in Santa Clara County, California — A Guide and Awareness for Medical Examiners, Coroners, and Toxicologists

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The goal of this presentation is to educate the forensic community about the rise of ecstasy use and mimic drugs in California.

This presentation will impact the forensic science community by presenting a comprehensive report detailing the current growing trend of illicit pill ingestion among teenagers in Santa Clara County to include ecstasy, as well as, other mimic drugs (phenylpiperazines) which may escape detection in a basic toxicologic analysis. At the end of the presentation, attendees will be introduced and will be able to appreciate the new trend of "thizzin" and "popping" by teenagers in this county as well as nationwide. This presentation will also reiterate the importance of complete toxicologic screens on fatal overdoses to help identify common and not so common drugs of abuse and/or cutting agents.

According to 2001 data collected by the Substance Abuse and Mental Health Services Administration (SAMHSA), there have been approximately 100 deaths resulting from ecstasy overdoses in the United States. Nationwide, ecstasy abuse seems to outweigh methamphetamine abuse and only lags behind alcohol, marijuana, and cocaine as a popular drug of abuse among 12th graders. What is most disturbing is the indiscriminate ingestion of different colored and shaped pills ("thizzin") advertised to teenagers as ecstasy, when in reality, some of the ecstasy pills may be cut with cocaine, heroin, phenylpiperazines, and talc, just to mention a few agents. In Santa Clara County, a rise is being seen in teenagers abusing ecstasy and ingesting pills which may be composed of various drugs, some which may evade the basic toxicology screen. In the past year, Santa Clara County has seen two deaths resulting from ecstasy intoxication or complications thereof. Recently, a male who attended a rave party in a surrounding county died of an acute ecstasy overdose.

A retrospective search over the past nine years at the Santa Clara County Medical Examiner/Coroner Office disclosed a total of five ecstasy overdoses, two within the past year. In April 2009, a 22-year-old female was found deceased in a motel room after partying all night and ingesting ecstasy. During the course of the evening, she complained of headaches and began vomiting. Her friends left her alone in the motel room only to find her deceased hours later. The autopsy examination revealed a morbidly obese woman with an unremarkable internal examination except for marked brain swelling and pulmonary edema. Toxicology revealed the peripheral blood was positive for MDMA at 140 ng/mL (non-lethal) and its metabolite MDA at 20 ng/mL. Vitreous electrolytes revealed a profound electrolyte abnormality that consisted of hyponatremia. The cause of death was attributed to ecstasy-associated hyponatremia.

In January 2010, a 16-year-old adolescent was ingesting ecstasy with friends and had ingested a total of four tablets along with energy drinks when she became unresponsive shortly thereafter. Autopsy examination revealed that both coronary ostia arose from the same semi-lunar cusp but the coronary arteries pursued a normal anatomic course, along with findings of marked pulmonary and cerebral edema. Toxicology revealed the peripheral blood was positive for MDMA at 3200 ng/mL (fatalities arise at 1000 ng/mL) and its metabolite MDA at 140 ng/mL. Death was attributed to an ecstasy overdose.

After this period of recent fatalities, a survey of 1,852 students was conducted at two large comprehensive high schools and two continuation high schools located in Santa Clara County. A one-page anonymous

questionnaire to identify use of various mind altering substances was administered from March 24, 2010 to May 12, 2010 to students ranging from ages 14-19.

In all, 25.32% of all respondents admitted to “ever use” of ecstasy (469 out of 1852) which is 390% higher than the teens responding to the national 2009 Monitoring the Future Survey (MTF) and nearly twice the level from the national 2009 Parents and Teens Attitude Tracking Study Report (Partnership for a Drug Free America) (PATS). Additionally, 8.48% of the teen respondents admitted to the use of ecstasy in the past 30 days; 471% higher than the MTF results and 41% higher than the PATS results. Students who had taken ecstasy admitted to maximum doses ranging from one to ten tablets with an average of four tablets. Results from the review of pictures of pills from www.ecstasydata.org by a smaller subgroup of 30 students confirmed that 70% contained phenylpiperazines

For at least local teen populations and perhaps growing geographical regions, it is hypothesized that the drug's ease of availability, reduction in its cost, limited awareness of the risks and risk of death, growing teen permissive attitudes and enabling behaviors from their social subculture, appear to have pushed this drug to their third most frequently used drug surpassed only by marijuana and alcohol. Complete toxicological screens are suggested in this population given their extreme dosing behaviors and the apparent frequent presence of phenylpiperazines.

Ecstasy, Mimic Drugs, Rise in Use

G110 Laboratory Variation and Postmortem Redistribution in the Interpretation of Postmortem Fentanyl Levels

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After attending this presentation, attendees will understand the principles of postmortem redistribution and interlaboratory variation and how to best utilize those concepts when evaluating postmortem fentanyl levels in central and peripheral samples.

This presentation will impact the forensic science community by providing an understanding the importance of using caution when interpreting very small, quantified fentanyl levels in postmortem samples.

The concept of postmortem redistribution has been extensively studied in some drugs, such as amitriptyline. The concept has also been looked at in regards to fentanyl, which due to its transdermal delivery mechanism, has interesting and unique pharmacokinetics and likely undergoes postmortem redistribution. It is hypothesized that fentanyl levels drawn from peripheral samples in the field, hours before autopsy, would be significantly lower than fentanyl levels in peripheral and central blood samples drawn at autopsy.

For this study, ten cases had fentanyl levels drawn in the field by investigators. The fentanyl level in this sample was compared to the level of fentanyl in peripheral and central samples taken at autopsy 15-24 hours later. Fentanyl levels are measured in very small quantities, ng/ml. At these very small amounts, the standard laboratory error could also greatly impact the values reported by the laboratory. In the process of comparing field and autopsy specimens and autopsy peripheral and central samples, we also sent most samples to a second accredited forensic toxicology lab. The ratios between the field and autopsy specimens and the heart and femoral blood levels were compared, and the interlaboratory variation was evaluated as well.

The spearman correlation coefficient was similar (0.41) for the field and autopsy specimens from a single case analyzed at laboratory #1 as the coefficient for a single heart blood sample run at laboratory #1 and laboratory #2 (0.62) and a single autopsy peripheral blood sample run at laboratory #1 and laboratory #2 (0.57). Thus, the variation in values was similar between the same specimen analyzed at two different laboratories and between samples drawn from different sites and at different times. Other evaluations of the heart:femoral blood ratio of fentanyl and measurements of correlation and variation will be discussed.

Fentanyl, Postmortem Redistribution, Interlaboratory Variation

G111 Toxicology and Pathology of 149-Methadone-Related Deaths

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After attending this presentation, attendees will understand that careful interpretation of methadone related deaths in the presence of concomitant drug intake and pathological changes is very important.

This presentation will impact the forensic science community by illustrating the difficulty of interpreting postmortem methadone blood levels due to the possible interaction with other drugs acting on the QT-interval or on the cytochrome P450, as well as the presence of pathological changes.

Methadone-related deaths are often difficult to interpret, especially in the presence history of chronic drug use, concomitant intoxications and if pathological changes are observed. Historically, the presence of methadone was often considered to be an incidental finding of the postmortem examination, unrelated to the cause of death. It was recently reported that methadone may prolong the QT interval, resulting in torsade de pointes. Sudden deaths with therapeutic levels of this synthetic opioid have been reported. Moreover, clinicians are increasingly aware of interactions between methadone and other drugs that prolong the QT interval or decrease the elimination rate of methadone.

The goal of this study was to evaluate methadone related deaths by dividing them into three groups according to the peripheral blood level of methadone: lower than 200 µg/L, 200 to 1000 µg/L, and higher than 1000 µg/L. The primary purpose of the study was to determine whether differences exist between the presence of illicit drugs, drugs acting on QT interval and drugs metabolized by cytochrome P450. This study also aimed to determine whether there are differences between the cardiac, hepatic and pulmonary pathology of the three groups.

Materials and Methods: Methadone-related cases were reviewed retrospectively. The age of the victims ranged between 17 and 65 years. Most of the cases were male (109 cases). For all cases the complete autopsy, including histological examination and a full toxicological screening, was performed.

Results: The methadone blood levels were lower than 200 µg/L in 37 cases; between 200 and 1000 µg/L in 89 cases; and higher than 1000 µg/L in 23 cases. In the last group methadone was detected in hair for all victims. Hair analysis was performed in 61 cases: 49 cases tested positive for methadone (80.3%) and 39 cases were positive for cocaine. Higher methadone blood levels were observed in men (p -value 0.052) and did not differ significantly by age.

Only in five cases methadone was alone, in 90 cases other drugs metabolized by cytochrome P450 were found, without significant

differences between the three group (*p*-value 0.81). Illicit drugs were found in 62 cases (*p*-value 0.29), drugs acting on QT interval in 79 cases (*p*-value 0.07) and respiratory depressant drugs, mostly benzodiazepines, in 139 cases (*p*-value 0.38).

Different pathological changes (cardiac, pulmonary, hepatic) were observed in 97 cases (*p*-value 0.24). Coronary disease was observed in 60.6% of chronic methadone or cocaine abusers.

Discussion: This study illustrates the difficulty of interpreting postmortem methadone blood levels due to the possible interaction with others drugs acting the QT-interval or on the cytochrome P450, as well as the presence of pathological changes. The various interactions between drugs remain unclear and do not appear to be related to the methadone blood level. Genetic variability may exist in the response of sub-group of individuals to the drug and its metabolism, making them more susceptible to an overdose. More postmortem studies should be performed in order to further understand and prevent fatalities which are mostly often observed during substitutive programmes or during illicit intake.

Methadone, QT Interval, Overdose

G112 Deaths in Unlicensed Alcohol Rehabilitation Facilities

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After attending this presentation, attendees will be aware of the risk of death in unlicensed alcohol rehabilitation facilities.

This presentation will impact the forensic science community by making pathologists aware of a series of deaths of alcohol abusers in unlicensed facilities, and making the public aware of the risks of alcohol withdrawal without medical intervention.

A series of 17 deaths in alcohol rehabilitation facilities occurred in Los Angeles County between 1996 and 2010. In each an intoxicated Spanish-speaking alcoholic man was dropped off at an alcohol rehabilitation group by his family. The individuals remained at the facilities for varying periods of time and underwent several procedures for detoxification.

Reported treatment methods have included use of restraints, forcing the victim to drink ethanol or isopropanol, restraint with forced ingestion of alcohol, application of onions to the feet, and inserting a spoon in the victim's mouth.

In three cases there was a history of restraint use. Two additional decedents had both ethanol and isopropanol in the blood, although it was unclear whether the isopropanol was given at the facility. The causes of death included alcohol overdose, alcohol withdrawal, hemoperitoneum due to cirrhosis and a ruptured splenic vein, and diabetic ketoacidosis related to chronic pancreatitis. Most cases were closed as accident or natural, although three cases involving restraint were ruled homicide. In some cases, other members of the group were charged with involuntary manslaughter and false imprisonment.

The police are familiar with these groups and are able to close the facilities. However, new groups often form at the same addresses, requiring additional police action. Los Angeles County has disseminated a public health warning about these centers and has published a list of 57 alcohol treatment centers using non-medical methods of detoxification. However, it has been difficult to eradicate these groups.

It is recommended that medicolegal death investigators be aware of this information, as similar groups may exist in other areas.

Alcoholism, Investigation, Detoxification

G113 Was This Drug Overdose Due to Intravenous Injection or Oral Ingestion of Heroin — Can You Tell?

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After attending this presentation, attendees will be alerted to and understand potential pitfalls associated with interpreting opioid levels in various body fluids and other matrices. This will be illustrated by presentation of a recent case where a question requiring an answer was whether heroin had been taken intravenously or orally. Research data will be presented followed by an explanation of the various mechanisms thought to cause these apparently anomalous findings.

This presentation will impact the forensic science community by informing attendees of the pharmacokinetics of opioids in the gastrointestinal system, and alerting them to the dangers of not fully understanding the behavior of these drugs in the body.

Death due to heroin overdose is almost always the result of intravenous injection of the drug in Australia. A case is described where a heroin overdose was initially thought to be the result of oral ingestion of the drug, primarily as a result of higher concentrations of morphine in stomach contents than in blood. During the subsequent criminal trial and investigation, however, the issue of the entero-hepatic circulation of morphine was raised as a possible reason for the presence of morphine in the stomach contents.

For many drugs and poisons, a simple way of making the distinction between oral and parenteral administration is to analyze the stomach contents and compare the levels of the drug in the stomach with those in blood; a higher stomach contents concentration of the drug would generally be strong supportive evidence for the assertion that the drug or poison was administered orally. Morphine; however, in common with a range of other drugs, undergoes entero-hepatic circulation as part of the metabolism and elimination of the drug. The entero-hepatic circulation is a complex mechanism whereby chemicals that have undergone conjugation reactions in the liver, such as morphine, once in the gastrointestinal tract, may be subject to passive re-uptake, entering the circulation via the hepatic portal vein, returning to the liver where the chemical can be biotransformed again and then re-eliminated. Morphine may undergo several cycles of entero-hepatic circulation resulting in a significant increase in the retention time and its consequent duration of action. Further, both during life and in the perimortem and postmortem period, the pyloric sphincter offers at best a partial barrier to reflux of morphine-containing gastrointestinal contents from the duodenum to the stomach.

These mechanisms would explain the presence of significant concentrations of morphine in the stomach contents of intravenous heroin users and we hypothesised that such physiological mechanisms can result in higher concentrations of morphine in stomach contents than in blood, despite the drug having been administered intravenously.

This study reports on the distribution of opioids in blood, stomach contents, urine, liver and bile in 29 deaths due to intravenous heroin overdose. The mean total and free blood morphine concentrations were 0.60 mg/L and 0.32 mg/L, respectively, and the mean stomach contents total morphine concentration was 1.16 mg/kg. All cases had detectable morphine in the stomach contents, and 24 of 29 cases had higher concentrations of total morphine in stomach contents than in blood. The mean total morphine concentration in bile was approximately 100 times that in blood, and the liver total morphine concentration averaged twice that of blood levels.

Morphine was detected in the stomach contents in all cases in this study, and in 83% of cases the stomach morphine level was higher than that in blood. This would indicate that the entero-hepatic circulation materially affects morphine levels in the body, and that reflux of morphine from the duodenum into the stomach appears to be the norm, at least after death. Furthermore, even if the gall bladder had been removed surgically at some prior time, stomach morphine concentrations can still be higher than the blood total morphine levels, as illustrated in one case.

It's concluded that the current study demonstrated that stomach morphine levels cannot be relied upon to determine whether heroin had been orally or intravenously administered. Given the large number of drugs and poisons which undergo entero-hepatic circulation, it would appear prudent to not make comment on route of administration of such drugs unless definite evidence of oral ingestion of the drug can be obtained, for example through visualization of appropriate pill fragments.

Heroin Overdose, Illicit Drug Use, Pharmacokinetics

G114 First Reported Case of Bromo-Dragonfly Fatality in the United States, San Jose, California, County of Santa Clara

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The goal of this presentation is to educate the forensic community of overdoses with rare chemicals used by young adults.

This presentation will impact the forensic science community by illustrating and emphasizing the importance of a thorough scene investigation, keeping an open mind to the curiosity of young adults and drug experimentation, and good communication with the consulting laboratory.

Like LSD, Bromo-DragonFLY is a psychedelic hallucinogenic drug that is extremely potent. In 1998, Matthew Parker synthesized Bromo-DragonFLY and because the molecule's structure resembled a fly, it was nicknamed FLY. Bromo-DragonFLY is a psychedelic phenethylamine and a non-subtype selective 5-HT2 (serotonin) agonist, considered less potent than LSD, but exhibits a longer duration of action and can last for up to two to three days.

The drug is ingested and the mechanism of drug toxicity is unclear, but based on numerous reports from individuals experimenting with this particular drug and their side effects, the mechanism of action appears to involve a severe peripheral vasoconstriction. Delayed onset of seizures, gangrenous extremity involvement, and extremely bad trips have been reported with one drug trip being described as "It was like being dragged to hell and back again many times. It is the most evil thing I've ever tried. It lasted an eternity."

In September 2009, the Santa Clara County Medical Examiner Office was called to the scene involving the sudden death of an otherwise healthy 18-year-old white male. According to the investigation, he was experimenting with and ingesting a new drug called 2C-B-FLY, which had been purchased through the internet, with his brother and his brother's girlfriend. The decedent's brother stated that the decedent ingested the least amount of the drug. Over the next two to three hours, the decedent appeared to be having a "difficult trip" then underwent seizure-like activity and became unresponsive. The decedent could not be resuscitated by emergency services and expired. The autopsy examination revealed an unkempt white male whose autopsy was unremarkable except for marked pulmonary edema, a non-specific finding seen in drug overdose cases and a thymic cyst. Because the medical examiner had no experience with 2C-B-FLY, additional insight

to the drug and its effects was gained by searching a online library, a website suggested by the decedent's father. During this time, the comprehensive toxicology screen on the peripheral blood reported the presence of phentermine at a concentration consistent with therapeutic levels, marijuana, nicotine and cotinine, and atropine, most likely due to resuscitative attempts. The medical examiner remained suspicious that this death represented an acute drug overdose, especially in light of the circumstances surrounding the death, and consultation with a toxicologist was pursued.

Further information gathered later in the course of the investigation revealed that in October 2009, a batch of Bromo-DragonFLY, purchased from Denmark, was distributed as the less active compound 2C-B-FLY, with a packaging label of "batch b1," one of which was purchased by the decedent's brother. Toxicological analysis specifically for 2C-B-FLY and Bromo-DragonFLY was undertaken. The analytical technique used for this work was gas chromatography/mass spectrometry (GC/MS). 2C-B-FLY was not detected in any of the specimens. Only Bromo-DragonFLY was detected in each of the specimens at the following concentrations: in peripheral blood 22 nanog/mL; in gastric fluid 38 nanog/mL; in urine 28 nanog/mL; and in bile 350 nanog/mL. Bromo-DragonFLY levels in beta-glucuronidase treated urine and bile were 49 ng/mL and 470 ng/mL, respectively. Review of the literature revealed one paper from Denmark in 2009 of an 18-year-old woman who died of a fatal Bromo-DragonFLY overdose and the reported femoral blood concentration was 4.7 ng/mL (MF Andreasen et al., 2009).

Since October 2009, rare lethal overdoses were reported from the distributed batch and to our knowledge this case represents the only United States fatality resulting from Bromo-DragonFLY. The decedent's brother and his girlfriend were admitted to the hospital for observation, and luckily recovered from their drug trip, although both were experiencing effects of the drug hours later. Both parties reported the drug trip was long lasting and not a comfortable experience.

In summary, this case illustrates the combined efforts of the medical examiner-coroner office and the toxicologist to identify the substance which led to the sudden death of a young adult experimenting with a purchased, non-controlled drug from overseas. Although our case represents the only reported fatality from Bromo-DragonFLY in the United States, it serves to illustrate and emphasize the importance of the combined efforts of different agencies to help render a cause and manner of death.

Bromo-Dragonfly, Overdose, Drug Experimentation

G115 Sudden Unexpected Infant Death: Lymphocytic Meningoencephalitis With Multiple Retinal Hemorrhages

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After attending this presentation, attendees will learn how multiple retinal hemorrhages extending to the ora serrata are not diagnostically specific for abusive head trauma (shaken baby syndrome).

The presentation will impact the forensic science community by expanding the list of conditions in infants associated with multiple retinal hemorrhages that extend to the periphery of the retina.

This presentation will inform attendees of something they do not know—multiple retinal hemorrhages, involving the peripheral retina and extending to the ora serrata in infants, are not specific for abusive head trauma (shaken baby syndrome).

Numerous authors contend that specific ophthalmological findings in infants and young children with abusive head trauma (AHT) include numerous retinal hemorrhages that extend far into the periphery of the retina. Listed non-traumatic causes of retinal hemorrhages—coagulopathy, sepsis, meningitis, vasculopathies, increased intracranial pressure, and cardiopulmonary resuscitation—reportedly do not result in the multiplicity and peripheral distribution of the hemorrhages associated with AHT.

This case presents a 7 $\frac{3}{4}$ -month-old male infant with multiple retinal hemorrhages extending to the ora serrata who died suddenly and unexpectedly from severe, diffuse lymphocytic meningoencephalitis. He had had rhinorrhea and upper respiratory congestion for about two weeks. His mother had been giving him acetaminophen every four hours. Otherwise, he had been healthy. He was placed down for a nap around 2:30 p.m. and was found unresponsive at about 3:00 p.m. Resuscitative efforts were begun immediately. A call was made to 911 at 3:05 p.m. and EMS arrived at 3:13 p.m. He was transported to the emergency department (ED) and arrived at 3:35 p.m. He was pronounced dead at 4:07 p.m. following 32 minutes of resuscitative efforts in the ED.

The medicolegal autopsy was performed 17 hours after he was pronounced dead. There was no evidence of trauma, skull fractures, intracranial hemorrhages or injury of the brain or spinal cord. Microbiological cultures of blood, trachea and lung were non-contributory. A skeletal survey did not reveal any evidence of acute or healing fractures. Subsequent toxicological analysis did not detect any licit or illicit drugs that caused or contributed to his death.

Postmortem monocular indirect ophthalmoscopy detected multiple retinal hemorrhages. The fundal hemorrhages in the left eye were over the posterior pole extending past the equator and abutting the ora serrata in all four quadrants; three small retinal hemorrhages were in the right globe.

His calvarial *dura* was smooth with areas of hyperemia and congestion of dural vessels, but no subdural extravasated blood or membranes were present. The dural venous sinuses were patent and the leptomeninges had no areas of extravasated blood. The cerebrum had a well-defined grey-white junction with no lesions in the cortex, white matter, or subcortical nuclei. The cerebral ventricles were of normal caliber and the ependymal lining of the ventricles appeared normal for age. The brainstem was normally developed with no gross abnormalities. The cerebellum exhibited normal folia, white matter, and dentate nuclei. The spinal cord had no areas of hemorrhage or exudates.

Microscopically, the cerebrum, brainstem, and cerebellum showed a multifocal lymphocytic infiltrate with numerous microglial nodules and neuronophagia. The inflammatory process involved the cerebral grey and white matter (including the basal ganglia), brainstem grey matter, and cerebellar white matter. The brainstem involvement was diffuse, with inflammatory foci in the midbrain, pons, and medulla; the spinal cord was not involved. No viral inclusions or areas of necrosis were seen. There was lymphocytic involvement of the cerebral leptomeninges and small perivascular lymphocytic collections were just deep to the ependyma. No significant ventriculitis was present. Immunohistochemical (IHC) stains for CD4 and CD8 showed a multifocal T-cell inflammatory infiltrate within the cerebral parenchyma and around blood vessels. An IHC stain for CD20 highlighted a smaller number of B-cells around blood vessels and within the parenchyma. The ICH stain for CD68 highlighted the microglial nodules and IHC stains for CMV, HSV-1, and HSV-2 were negative. The Centers for Disease Control performed IHC testing for panentero viruses and EV71 plus polymerase chain reaction (PCR) for enterovirus and parechovirus—all were negative.

Meningoencephalitis is a rare complication of common infantile viral infections. Most viral infections with central nervous system manifestations cause either meningeal involvement, namely aseptic meningitis, or a mild clinical syndrome of meningoencephalitis rather than a fatal form of encephalitis. The causative agent in this case was not

apparent despite IHC and PCR testing for enteroviruses and parechoviruses. Of particular interest, this infant had numerous retinal hemorrhages in the left globe distributed posteriorly, equatorially, and peripherally—a finding considered by many authors unique to AHT and indicative of repetitive acceleration-deceleration injury (shaken baby syndrome). It is imperative that forensic pathologists not equate multiple retinal hemorrhages with a peripheral distribution exclusively with AHT. Postmortem ocular findings must not be interpreted in isolation, but correlated with the circumstances of the death plus the anatomic and histopathologic findings.

Retinal Hemorrhages, Lymphocytic Meningoencephalitis, Abusive Head Trauma

G116 Parietal Pseudofracture in Children Suggesting Non-Accidental Trauma: A Report of Two Cases and Review of the Literature

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After attending this presentation, attendees will learn the characteristics of variation in sutures of the pediatric skull that may make it difficult to distinguish from real fractures based on imaging criteria alone.

This presentation will impact the forensic science community by emphasizing the legal complications caused by mistaking normal variation of the pediatric skull for fracture and by aiding in better understanding of these pseudofractures of the skull in infants.

Introduction: Two cases of infants who died at home are reported. Both were previously healthy and had no history of trauma according to the parents. As in all suspected cases of SIDS, a complete autopsy was performed. For both cases, radiographic or computed tomography (CT) scan findings were initially interpreted as parietal fractures and raised the possibility of non accidental trauma.

Case reports: The first case was a 3-month-old female child who was found dead at home by her mother. An autopsy was performed the same day. A skeletal radiographic survey showed two linear radiolucencies in the parietal region mimicking a fracture of the right parietal bone. At autopsy there was an H-shaped abnormality of the right parietal bone with no associated soft tissue swelling. The brain was normal. There were severe pulmonary lesions and a test for the respiratory syncytial viral antigen was positive. Histological sections of the parietal bone showed two vertically unossified membranous strips linked by a horizontal membranous strip. Death was attributed to pulmonary infection. The second case was a 6-month-old male child who was found dead at home by his mother. An autopsy was performed. A bone window CT scan showed a linear defect in the left parietal bone. At autopsy, no scalp swelling or bruising was noted. The rest of the autopsy was normal. Microscopic sections of the decalcified parietal bone demonstrated neither inflammatory infiltrate nor periosteal reaction. The findings were consistent with an unossified membranous strip. Cause of death was not identified.

Discussion: According to the literature, the parietal bone is the most common fracture site in children, in both accidental and non-accidental trauma. However, an extensive study of the embryogenesis of the parietal bone was made by an author who discovered a variety of anomalous parietal suture, described as failure of ossification of a strip of membranous parietal tissue. These normal variations or pseudofractures are rare and may simulate skull fractures, especially in live infants when histological examination is not available. Overlooking

a fracture of the pediatric skull is a serious situation, but to mistake normal variation for a skull fracture may cause legal complications as well. Awareness of differential diagnosis such as vascular markings, sutures, and artifacts that may masquerade radiographically as skull fractures in infants is essential for the forensic pathologist.

Membranous Unossified Strip, Skull Fracture, Non-Accidental Trauma

G117 Methadone and Cocaine Related Death in A Young Boy: A Case Report

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After attending this presentation, attendees will learn of the possibility of cases where a synergic effect of cocaine and methadone could be assumed as the cause of death.

This presentation will impact the forensic science community by the discussion regarding pharmacokinetic and pharmacodynamic drug interactions between cocaine and methadone.

Background and Learning Objective: In recent years, a significant increase in the number of fatal intoxications with methadone has been reported in Italy. The abuse of methadone is most frequently seen in conjunction with the abuse of other drugs. Cocaine and methadone are rarely co-intoxicants in cases of combined drug toxicity. The interpretation of blood methadone concentrations alone or combined with other psychoactive drugs requires careful and accurate consideration of the subject's potential chronic use of and tolerance to the drug. Moreover, determining the cause of death in methadone and cocaine positive cases requires a strong correlation with autopsy results and investigative findings. The goal of this study is to discuss the possible mechanisms and eventually the synergic effect of cocaine and methadone in causing the death of a young boy.

Case Report: A 15-year-old young man was found dead during the early morning in his bed at home. Police investigations ordered by the public prosecutor revealed that the young boy, the night before, had used cocaine and methadone for the first time.

Results: At the autopsy, lungs were edematous and congested with absence of major diseases. Main findings at the histological investigation were widespread myocardial interstitial edema and focal vascular congestion. Toxicological analysis detected cocaine, methadone, and related metabolites at the following concentrations.

Blood: benzoyllecgonine = 50 nanograms/ml; cocaine=40 nanograms/ml; methadone=274 nanograms/ml; EDDP = 166 nanograms/ml. **Urine:** benzoyllecgonine = 9000 nanograms / ml, cocaine = 153 nanograms / ml methadone = 300 nanograms/ ml; EDDP = 200 nanograms/ml. Traces of cocaine were also found in the nasal mucosa.

Conclusions: It is well known in forensic field that it can be very difficult to determine what mechanism(s) are responsible for drug interactions especially in cases as such, where the deceased cannot be considered as habitual drug-user. Moreover, it should be taken into account that the presence of methadone is often an incidental finding during postmortem examination which is unrelated to the cause of death and that postmortem measurements of methadone or its metabolite cannot be used in isolation to identify which deaths are associated with methadone toxicity. Very little information is available from the literature regarding methadone-cocaine co-intoxications. In our case we can only hypothesize an interaction between these drugs on different organs, such as heart and central nervous system. Pharmacokinetic and

pharmacodynamic drug interactions mechanism and the possible explanation in determining the cause of death in this case will be discussed.

Methadone, Cocaine, Synergic Effect

G118 Sudden Death Due to Dengue Fever in an 8-Month-Old Baby

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The goal of this presentation is to present a case of postmortem diagnosis of dengue related death in a suspect sudden infant death syndrome.

This presentation will impact the forensic science community for the postmortem diagnosis of dengue fever like cause of death in a suspect case of SIDS.

Dengue virus (DENV) infection is caused by one of four antigenically distinct but related single stranded, positive-sense RNA viruses in the family Flaviviridae. This virus is transmitted by mosquito vectors, primarily *Aedes aegypti*. Four serotypes (DENV-1, DENV-2, DENV-3, and DENV-4) circulate worldwide. Dengue fever is one of the most significant re-emerging tropical diseases; it is now endemic in more than 100 countries in Africa, the Americas, the Eastern Mediterranean, South-East Asia, and the Western Pacific. South-East Asia and the Western Pacific are the most seriously affected. Dengue causes a severe flu-like illness and sometimes a potentially lethal complication called dengue hemorrhagic fever (DHF). Dengue hemorrhagic fever (DHF) is a potentially deadly complication that is characterized by high fever, often with enlargement of the liver, and in severe cases circulatory failure. The illness often begins with a sudden rise in temperature accompanied by facial flush, and other flu-like symptoms. The fever usually continues for two to seven days and can be as high as 41°C, possibly with convulsions and other complications. Frequently fatal cases of dengue death occur in the hospital. The clinical features of dengue fever vary according to the age of the patient. Infants and young children may have a fever with rash. Older children and adults may have either a mild fever or the classical incapacitating disease with abrupt onset and high fever, severe headache, pain behind the eyes, muscle and joint pains, and rash. Some cases develop much milder symptoms which can be misdiagnosed as influenza or other viral infection when no rash or retro-orbital pain is present. When dengue infections proceed to DHF symptoms, DHF causes vascular leak syndrome which includes fluid in the blood vessels leaking through the skin and into spaces around the lungs and belly. This fluid loss and severe bleeding can cause blood pressure to fall, then Dengue Shock Syndrome (DSS) sets in, which has a high mortality rate. In babies a pauci-symptomatic fatal case could be confused with a SIDS or a homicide. The case presented concerns an 8-month-old male infant was found unresponsive during a nap in his nursery school. The baby was quickly taken by ambulance but was declared dead on arrival at the hospital. Body was cold. The police took information by the nursery school teacher: three hours prior to death, the child was given plain water through a bottle before being put to sleep on a mattress on the floor, the baby frequently slept in prone position. The infant had been cared for by the nursery school since the age of three months. There was a history of mild fever illness for the previous weeks before the death and he was being treated with antipyretic drugs. The prosecutor began an investigation of the nursery school, arranged the autopsy on the body to clarify the exact mechanism of death: SIDS, accident, or homicide? The autopsy was performed six hours after death. The infant was well hydrated and well nourished, with body length of 68 cm and weighed 6920 g. He was pale with mild peripheral cyanosis

noted. Faint lividity was still noticeable at front part of body. There was blood-stained fluid oozing out of the nostrils and mouth on turning the body. There wasn't a rash or petechial hemorrhages on the skin. Fundal ophthalmoscopic examination didn't show retinal hemorrhage. No signs of external injury were detected, with the exception of puncture marks at the dorsum of both hands in a tentative of resuscitation. All the internal organs were congested. Pleural cavities contained 12 cc of yellow fluid. The lungs were edematous with areas of hemorrhage mainly seen on the right side. The upper airway was filled with froth and admixed with blood-stained fluid. Pericardial cavity contained 2 cc of yellow fluid. The heart showed few epicardial petechiae. Abdominal cavity contained 15 cc of yellow fluid. Stomach was empty. Liver was congested and had beefy appearance on cut sections. Other organs were unremarkable except of edema. Histopathologic examination showed in heart samples wide foci of early contraction bands necrosis, colliquative myocytolysis grade II, perivascular and interstitial infiltration of lymphocytes, monocytes and plasmacells. Lungs present alveolar septa mildly thickened by edema and capillary congestion, alveolar edema; lymphocytes, monocytes and plasma cells infiltrates septa and bronchial walls. In some fields, also numerous endoalveolar erythrocytes were observed. In liver, kidney, and spleen samples, there were perivascular mononuclear cells infiltration. An immunohistochemical study using antibody anti CD 3, CD4, CD 8, CD 20 and CD68 for the tipization of leucocytes infiltrations was performed. Serological dengue screening using captured ELISA was positive for IgM but negative for IgG. The case showed that dengue infection may be asymptomatic or paucisymptomatic before a sudden death, so dengue fever should be included in the differential when a forensic pathologist must discern between a SIDS a homicide or a death related-dengue, particularly in endemic areas for dengue, like Malaysia.

Dengue Fever, Histological Findings, Postmortem Diagnosis

G119 Sudden Death in the First Year of Life: The Importance of Pancreatic Histomorphological Analysis

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After attending this presentation, attendees will be able to better understand the importance of pancreatic histomorphological examination after a complete autopsy in sudden infant death, to discriminate between the explained natural sudden death and natural idiopathic sudden death (SIDS).

This presentation will impact the forensic science community by discussing the role of endocrine/metabolic pancreas disease as cause of sudden infant death, providing valid evaluation parameters to the diagnosis.

Material and Method: From 1990 to 2009, 175 autopsies (137 males and 43 females) were performed on infants suddenly dying of natural causes within the first year of life. The diagnosis of sudden natural death has been established through a complete autopsy and investigation including scene examination, review of family, social and medical history and toxicology studies. The age ranged between 2 and 273 days (median 42 days).

In 19 cases, death was unexplained (SIDS) while in 156 cases, it was due to congenital or acquired diseases (explained sudden infant death), primarily involving different systems: cardiovascular (121

cases); respiratory (15 cases); endocrine/ metabolic (12 cases); gastrointestinal (4 cases); central nervous system (4 cases).

Autopsy protocol were based on Perinatal Autopsy Manual. Washington, D.C.: Armed Forces Institute of Pathology, 1983, and on Paediatric Autopsy Techniques - Enid Gilbert-Barness and Diane E. Debich-Spicer in Handbook of Pediatric Autopsy Pathology, Humana Press pp.7-74, 2005. From a histological point of view, according to 2,875 fetal and pediatric autopsies, the following morphological pancreatic parameters were examined: (1) lobular architecture; (2) interstitial thickness; (3) number, branch and volume of ductular-acinar units; (4) number, size and cytology arrangement of islet (quantitative relation between α , β , and δ cells); (5) inflammatory infiltrates; and, (6) heterotopic erythropoiesis.

This analysis was performed on serial sections stained with hematoxylin-eosin, Alcian-PAS, Mallory's trichrome and Giemsa and partly investigated immunohistochemistry using antibodies anti-insulin and anti-glucagon.

Results: In the context of explained sudden natural death in the first year of life, pancreatic histological examination has allowed us to identify 11 cases related to endocrine/metabolic disease, of which, in nine cases, were interested the islets of Langerhans (endocrinous pancreas), and in two cases ductular-acinar units (exocrine pancreas).

The endocrine/metabolic diseases involving endocrinous pancreas were: glycogenosis (type 1b and 2)(five cases); maternal diabetes (2 cases); nesidioblastosis (2 cases (1 case in monochorionic twin)). The endocrine/metabolic diseases involving the exocrine pancreas were: cystic fibrosis (2 cases) macronesia and polynesia were observed in pancreas of both patients with glycogenosis and in children of diabetic mothers, these aspects were due to hyperplasia of the α -cells in patients with glycogenosis, and β -cell hyperplasia in children of diabetic mothers.

In these cases also present were cytoatipism of β -cell and eosinophilic granulocyte infiltration of the islets. In subjects with nesidioblastosis there was only a diffuse polynesia neoformation of islet from duct epithelium.

The cystic ectasia of the ductular-acinar structures associated with pink inspissated secretion was observed in cystic fibrosis.

Discussion and Conclusion: A complete autopsy is essential to establish the causes of sudden explained death in the first year of life. This approach allows to sample, for histomorphological examination, organs such as the pancreas that are almost always free of macroscopically visible changes.

The results of the study show that, in addition to the consolidated sampling of pancreas in autopsy, a complete and focused histomorphological study as suggested, allowing the identification of endocrine-metabolic anomalies, such as glycogenosis, nesidioblastosis, and cystic fibrosis, only rarely reported in the literature as a cause of sudden death in the first year of life.

This research demonstrated that, glucose postmortem levels in plasma and vitreous are not reliable for identifying potential endocrine-metabolic diseases, certainly the histomorphological data of the pancreas is the most reliable.

Glycogenosis, Nesidioblastosis, Sudden Infant Death

G120 Isolated Coronary Anomalies and Sudden Death in the Young

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After attending this presentation, attendees will be able to better understand the importance of coronary examination (origin, course, and lumen canalization) during autopsy of young people suddenly dead, to identify coronary artery anomalies.

This presentation will impact the forensic science community by improving knowledge of natural causes of juvenile sudden death (SD).

Background: Coronary artery anomalies (CAAs) had been some of the most confusing, neglected topics in cardiology. In the 1990s, the subject of CAAs underwent to profound evolution related to substantive methodological changes regarding the definition, incidence, morphology, clinical presentation, diagnostic work-up, prognosis, and treatment. CAAs are most frequently found in association with congenital heart diseases (great arteries transposition, tetralogy of Fallot, common artery trunk) and hypertrophic or dilated cardiomyopathy, but can also occur in the absence of other cardiovascular diseases ("isolated coronary artery anomalies"). Isolated CAAs are rare, found in: 0.2–2.2% of autopsies of all ages; 0.5% of pediatric autopsies; 0.6–1.3% of coronary angiograms in adults. CAAs represent common causes of exercise-related sudden death (SD) in young people (≤ 35 years of age). The mechanism of SD is believed to be episodic myocardial ischemia.

Objectives: The goal of the current study is to detect the frequency, type, and possible pathophysiology due to "isolated" CAAs in an autopsy population of the young, suddenly dead for cardiovascular diseases (CSD).

Methods: In the time interval from January 1990 to December 2009, 236 consecutive cases were collected of cardiovascular sudden death in young people. In all of the cases, the analysis of death circumstance (*most of the deaths analyzed were testified*), the complete autopsy and the toxicological essays let us establish that death was: natural, violent, sudden. The juvenile CSD was defined as unexpected death as a result of natural cardiovascular causes within one hour of initial symptoms in persons ≤ 35 years of age.

Results: Forty nine sudden deaths in young people were reported, identified solely at autopsy and due to: right coronary artery from the left sinus ($n = 15$); right coronary artery above anterior commissure ($n = 11$); left coronary artery from right coronary sinus ($n = 3$); intramyocardial course ($n = 10$); obstructive valve-like ridge in the Valsalva's sinus and intra-right coronary ostium ($n = 9$); left anterior descending artery from right coronary sinus ($n = 1$). The CAAs was either isolated ($n = 43$, 87.8%) and associated to hypertrophic cardiomyopathy ($n = 6$, 12.2%). In all patients (43 males and 6 female, age ranging from 13 months to 35 years; median, 22.6), sudden death was the first manifestation of the disease and familial history was negative. The fatal outcome occurred after physical effort ($n = 27$, 55%), at rest ($n = 16$, 32.6%), or after emotional stress ($n = 6$, 12.4%). Unquestionable ischemic damage within the related myocardium, in the absence of obstructive coronary atherosclerosis or other cardiac diseases, was observed in all cases: acute myocardial infarction ($n = 29$, 59.2%), healing myocardial infarction ($n = 4$, 8.2%), healed myocardial infarction ($n = 16$, 32.6%). In this study of Juvenile CSD, death was precipitated by isolated CAAs in 21% of cases.

Conclusion: Data from this collection confirms that isolated CAAs may account for juvenile CSD and that fatal event is frequently the

manifestation of the disease, it is precipitated by effort and depends on ischemic damage within the related myocardium. Recognition during life of these anomalies, by the use of non-invasive procedures, is mandatory to prevent the risk of SD and to plan the screening in competitive athletes.

Coronary Artery Anomalies, Juvenile Sudden Death, Forensic Pathology

G121 Pathologic and Anthropologic Manifestations of Documented Repetitive Blunt Trauma in a Child Abuse Case

Pramod Gumpeni, MD*, Jason M. Wiersema, PhD, and Luis A. Sanchez, MD, Harris County Institute of Forensic Sciences, 1885 Old Spanish Trail, Houston, TX 77054

After attending this presentation, attendees will see the pathologic and anthropologic manifestations of repetitive blunt trauma to the ribs of child.

This presentation will impact the forensic science community by illustrating the utility of a collaborative effort in the interpretation of repeated injury.

The child had been in the care of the birth mother for the first six years of his life and had reached all appropriate mental and physical developmental milestones. The mother placed the decedent in the care of the decedent's father (with whom the child had no prior contact) fifteen days prior to his death in the interest of fostering a paternal relationship.

The decedent presented to the Harris County Institute of Forensic Sciences (HCIFS) following his demise at a local hospital. The terminal history, provided to the HCIFS investigator by the father's girlfriend was that the decedent had been repeatedly beaten about the chest by the father for an approximate 8-hour-period. The beating was apparently precipitated by the child's refusal to go to sleep. The father reported that the child began exhibiting seizure-like activity after which emergency medical services were contacted. The unresponsive decedent was transported to the hospital, where he was pronounced six minutes after arrival.

The birth father and his female acquaintance ultimately confessed that the child was beaten in a similar manner for the duration of the two week period during which he was in their custody. They stated that the decedent would be made to sit on his knees, with his arms held up while the father would repeatedly punch him in the left axilla and chest. After several days, the child exhibited pain, and the father began punching the decedent in the right axilla and back. In addition, the female acquaintance admitted to the use of a belt to strike the decedent on the back. The father ultimately stated that he pushed the decedent forcibly into the shower, striking the back of the decedent's head against the wall immediately prior to the onset of his seizure-like symptoms.

Autopsy of the child showed numerous confluent contusions over the decedent's torso, predominantly in the left and right axilla extending down to the flank, the upper chest, and over the mid and lower back. There were numerous abrasions over the extremities. Several contusions were present over the scalp, with brain contusions identified on internal examination. A large fibrous mass lesion consisting of resolving hematoma, granulation tissue, and early callous formation was found in the left upper axilla involving the anterior bodies of left ribs 2-4. There were also bilateral pleural effusions, with 550 cc of serosanguinous fluid in the left pleural cavity, and lacerations of the liver and right adrenal, with marked retroperitoneal hemorrhage. Initial x-rays of the chest showed a heterogeneous mass lesion in the left upper chest.

Per HCIFS protocol, the decedent underwent a complete skeletal examination in search of skeletal injury. This process involved resection of the muscle and periosteum overlying the long bones, ribs, and

scapulae. Skeletal trauma was limited to the ribs, and the rib cage was recovered for anthropological analysis. There were multiple series of serial rib fractures displaying morphology consistent with direct impact(s) at the site(s) of the fractures. The fractures were in varied stages of healing, ranging from acute fractures with sharp margins and no visible callus formation to the presence of large, disorganized soft calluses overlying complete transverse fractures. The array of skeletal injuries was consistent with repeated impacts to the anterior and lateral chest.

This case provides a unique view of the effects of repetitive blunt injury directed to specific regions of the body over the span of two weeks, and the physiological consequences of such trauma to both bone and soft tissue. It also illustrates the utility of a detailed terminal history in the interpretation of blunt force injury.

Repetitive Injury, Blunt Trauma, Child Abuse

G122 Pregnancy, Caesarean, and Pheochromocytoma: A Case Report With a Fatal Outcome

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After attending this presentation, attendees will be aware of the clinical, physiological, diagnostic, and therapeutic features of pheochromocytoma during pregnancy.

This presentation will impact the forensic science community by explaining how pheochromocytoma can cause sudden death (maternal and fetal death) in pregnant women if the condition is undiagnosed and left untreated. From this case report, attendees will be able to identify the clinical milestones which can indicate medical malpractice and which can determine whether the fatal outcome was predictable.

The subject of this presentation is a 43-year-old full term pregnant woman who was scheduled for a cesarean delivery in October 2009. At the start of the C-section, she developed a sudden and malignant high blood pressure with hemoptysis, sweat, and tachycardia. The C-section delivered a dead newborn who was successfully resuscitated. The mother died after persistent cardiac arrest.

A judicial autopsy was requested. It revealed an acute pulmonary edema which explained the death and a voluminous tumor of the left adrenal gland which was necrotic and hemorrhagic suggesting a pheochromocytoma. The diagnosis of pheochromocytoma was confirmed by pathological analyses.

The magistrate requested the obstetrical records of the patient be studied. The patient's first pregnancy was in 2005-2006 and her last pregnancy was in 2009. According to these medical records, the woman had a no serious medical history:

- During her first pregnancy (2005-2006), the patient developed gestational diabetes mellitus which was successfully treated by controlling diet. Throughout the follow-up during the pregnancy, blood pressure and cardiac rhythm were stable. At 31 weeks of pregnancy + 5 days, the patient had an episode of malaise during a fetal ultrasound, which resolved spontaneously.
- The baby was delivered by C-section before labor in January 2006. C-section was performed because of low fetal heart rate and failure to induce labor. The newborn was healthy and the patient's diabetes mellitus disappeared after the delivery.
- During her second pregnancy (2009), the patient developed gestational diabetes mellitus which was treated by controlling her diet and insulin (16 weeks of pregnancy). In July 2009 (at 29 weeks of pregnancy + 6 days), the patient had a drop in blood pressure with hypoglycemia and a low fetal heart rate was detected. The patient was admitted to hospital for further

investigations and medical supervision for three days. All medical investigations were normal and all abnormalities disappeared spontaneously. A delivery by C-section was scheduled at 37 weeks of pregnancy because of previously scared uterus and gestational diabetes mellitus. The woman was admitted to the hospital one day before. The C-section delivered a dead newborn who was successfully resuscitated. The mother died after resistant cardiac arrest.

This case is interesting from both a medical and medico-legal point of view.

Pheochromocytoma is a rare tumor of the adrenal glands which secretes catecholamine. It can be diagnosed by the classic triad of symptoms —headache, sweating, and tachycardia— which result from arterial hypertension, paroxysmal high blood pressure, acute pulmonary edema, and fatal cardio-pulmonary failure. In pregnant women, the incidence of pheochromocytoma is very low, and its symptoms can mimic gestational hypertension, preeclampsia, or eclampsia. Diabetes mellitus can be due to pheochromocytoma in pregnancy, but is seldom the only symptom. Because of the low incidence of pheochromocytoma in pregnancy, any systematic/mass screening by urinary catecholamine measurement is not requested in pregnant women, except in cases of refractory hypertension.

From a medico legal point of view, we can presume, with hindsight, that the gestational diabetes mellitus was a symptom of the pheochromocytoma, as was the malaise and the low blood pressure which happened during the gestations. However these features are not specific to pheochromocytoma, and are frequent in pregnancy, which explains the difficulty in diagnosis.

Conclusion: This case is unusual. First, it led to maternal death; and, second, the diagnosis of the tumor was postmortem, being unnoticed during the management of pregnancy. It can also be presumed that the pheochromocytoma was asymptomatic between the two pregnancies of the patient since no medical history was reported in her medical records.

Pheochromocytoma, Cesarean, Maternal Death

G123 Infant Death Evaluation: What is the Constellation of Abusive Injuries?

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After attending this presentation, attendees will be able to identify components of a constellation of abusive injuries that can be used to reliably identify a subset of abusive injuries.

This presentation will impact the forensic science community by providing knowledge of components of a constellation of abusive injuries that can be used to reliably identify a subset of abusive injuries allowing them to more competently perform determinations of cause and manner of death.

Hypothesis: No single finding is pathognomonic of abusive injuries to infants and children. Findings suggestive of abusive injuries must be used in conjunction with other information to reliably determine that a death is the result of abusive injuries. Additional investigative information about the reliability or number of histories provided by caregivers has been described as useful in this regard. Investigative information about delays in seeking medical attention has been seen more commonly in abusive injuries.

Materials: Information about the circumstances surrounding collapse or death, medical treatment, past medical history, law enforcement investigation, and social service information (when available) was used in a prospective study of 169 child deaths with autopsy and postmortem ocular examinations to make cause and manner determinations. The patterns of ocular and systemic injuries in children

dying as the result of non-accidental injury were compared with those found in injuries from motor vehicle accidents, falls, asphyxia and in natural disease. The immediate causes of death included: 76 (45%) intentional injuries, 36 (21%) inadvertent injuries, 47 (28%) natural causes, and 10 (6%) undetermined causes.

Results: The triad of findings of subdural hemorrhage, brain edema, and retinal hemorrhages was seen in 47 of the total 76 (62%) non-accidental injury deaths and in eight inadvertent injury deaths of the total 36 (22%). The triad was not seen in any of the 46 natural deaths or any of the ten classified as undetermined deaths. Treating these three findings (the “triad”) as a “laboratory test” to identify abusive injuries did not meet criteria for reliability of diagnosis. The sensitivity of the presence of the triad was only 62% in detecting non-accidental injuries. The specificity of the absence of the triad in inadvertent injuries was 78%.

Histories of the circumstances of change of status have been important in identifying abusive injury. The original recognition of the “battered baby” followed inquiry into the phenomenon of absent or changing histories in the presence of subdural hemorrhages and extremity fractures. In this population, the sensitivity of finding inconsistent histories with the presence of the triad was 80%. The negative predictive value of finding a consistent history when the triad was absent was 88%. The relative risk of the triad being found with an inconsistent history was 4.56 with confidence limits of 2.53-8.20 and a value << 0.01.

Delay in seeking treatment has also been identified as a marker of abusive injuries. In this population information was available to identify the interval between onset of symptoms and presentation for medical attention in 127 deaths. This information was then used to look at the deaths with the triad of retinal hemorrhages, subdural bleeding, and brain swelling.

Triad	< 24 hours	24-72 hours	> 72 hours	Total
No triad	55	14	4	73
Triad	38	13	3	54
Total	93	27	7	127

Additional investigative information was used to determine the cause and manner of death to distinguish abusive injuries from accidental injuries. Among children having the triad, delay in seeking treatment was only seen with abusive injuries.

Manner	< 24 hours	24-72 hours	> 72 hours	Total
Abusive	30	13	3	46
Non-abusive	8	0	0	8
Total	38	13	3	54

Summary: Deaths with an inconsistent history, delay in seeking medical attention, and autopsy findings including the triad of subdural hemorrhage, brain edema, and retinal hemorrhages can be reliably used to identify deaths which are more likely to be the result of inflicted injury. Thorough investigation and complete autopsy findings must be used to establish whether or not a particular child’s death was caused by inflicted injuries.

Review of the findings and investigative information in this study allows identification of a constellation of reliable markers of abusive injuries, and components of the constellation needed to avoid wrongful accusations of injury. The components include: triad of retinal hemorrhages, subdural bleeding, and brain swelling; inconsistent or multiple histories; and delay in seeking medical attention.

Abusive Injuries, Wrongful Accusation, Child Deaths

G124 Utility of Whole Body Postmortem Computed Tomography Imaging in Detection of Elder Abuse: Comparison With and Potential Substitution for Standard Autopsy

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After attending this presentation, attendees will be familiar with the value of CT Imaging in the detection or exclusion of injuries associated with elder abuse.

This presentation will impact the forensic science community by demonstrating how whole body CT imaging can be an efficient triage tool that assists the medical examiner’s decision on whether to proceed to conventional autopsy in suspected cases of elder abuse.

Elder abuse (EA) contributing to death is a crime that is difficult to exclude without a full conventional autopsy (CA), even where allegations of abuse are limited to non-physical issues. The potential for use of whole-body postmortem CT (PMCT) as a triage tool to determine the need for CA based on detection of injuries suggestive of physical abuse was investigated.

Method and Materials: Fifty-two decedents (12 M, 40 F; mean age 76 y, range 52-93 y) with associated allegations of EA had PMCT and subsequent CA by state medical examiners within 24 hours of death. PMCT scans were interpreted by radiologists experienced in forensic imaging. Sensitivity of PMCT for injuries suspicious for abuse and other major findings were determined with CA as the standard of reference.

Results: PMCT was concordant with CA for evidence or absence of elder abuse in all cases. PMCT demonstrated multiple previously unreported fractures of varying age consistent with EA in only 1/52 cases. Recent fractures consistent with cardiac resuscitation (CPR) or typical accidental trauma were noted on PMCT in 18/52 (35%) and 5/52 (10%), respectively, but at CA were undetected in 7/18 (39%) and 4/5 (80%), respectively. PMCT misinterpreted an undisplaced cervical fracture in the setting of severe degenerative disease. Cause of death was determined by PMCT in 24/52(46%) and by CA in 50/52(96%) cases.

Conclusion: PMCT is reliable for the detection or exclusion of skeletal injuries suspicious for elder abuse and may be used in correlation with history and external examination to determine the need for CA where allegations or suspicion of abuse are raised. Acute upper anterior bilateral rib fractures were noted in all decedents who underwent full CPR, likely related to osteopenia/osteoporosis. PMCT was not reliable for determination of specific cause of death in this decedent group.

Elder Abuse, Computed Tomography, Autopsy

G125 Findings of the Examinations of Suspected Animal Cruelty Cases Submitted to the Birmingham Jefferson County Animal Control

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After attending this presentation, attendees will understand some of the basic principles of the elements necessary in the investigation of animal cruelty, including characteristic injury patterns and examples of the practical application of comparative forensic pathology.

This presentation will impact the forensic science community by shedding new light on an old technique by showing how both macroscopic and microscopic injuries are a key aspect of an animal cruelty or animal abuse investigation. The techniques developed in this project have the potential to be applied in crime profiling to track animal abuse, which may be a predictor for child abuse or domestic violence.

The objective of this project was to establish routine performance of medical examinations, necropsies, and histopathology as the first step in establishing a solid case of animal abuse.

Comparing the changes in the morphology of the lesions observed in this study with the ones that are in current forensic pathology provided a unique opportunity to record the differences between human pathology and animal pathology. The increase in knowledge in the field of forensic veterinary medicine gives this study merit, because those differences are currently underdeveloped in veterinary science.

In general pathology, it is assumed that humans and animals often exhibit similar physiopathology. For example, in gunshot cases, there are many similarities in the entrance and exit wounds in humans and animals. However, differences occur because of the animal's fur, which can hide a wound, and the structure of the blood vessels, which can change the bleeding patterns. In the case of a dog with an embedded collar, there will be edema in the cervical area above the collar. By combining the principles of general pathology with special veterinary pathology, animal abuse can be accurately documented.

As part of this project, medical examinations, necropsies, and histopathology were performed on more than 50 animals at Birmingham Jefferson County Animal Control during the summer of 2010.

Animal Abuse, Comparative Pathology, Necropsy

G126 Fatal Tiger Attack on a Zoo Patron: Patterns and Types of Injuries in Large Predatory Cats

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After attending this presentation, attendees will gain a better understanding of fatal attacks on humans by large predatory cats.

This presentation will impact the forensic science community by emphasizing the expected wound locations and patterns inflicted by large members of the cat and dog families.

On December 25, 2007, a four-year-old Siberian female tiger escaped its enclosure in the San Francisco Zoo and focused its attack on two young males. One of the males was fatally mauled while his companion was injured. Responding San Francisco Police Department officers came in contact with the escaped tiger and used their service pistols to subdue it.

The victim was autopsied at the San Francisco Medical Examiner's Office and showed evidence of large animal bites and crushing trauma typical for a large cat attack including biting of the posterior upper body/neck, fracturing of the neck, and "abrasion rings" surrounding the incisor wounds. Toxicology was positive for cannabinoids and ethanol.

A necropsy of the tiger was done by the San Francisco Zoo veterinarian, with pertinent body parts (head, paws, stomach contents, and tail) delivered to the San Francisco Medical Examiner's Office. The stomach contents contained no body parts, and the back claws showed evidence of shredding of the nails which most likely occurred as the tiger propelled itself up the textured cement wall of the enclosure. It was determined that the tiger was struck three times by gunfire (once in the left frontal sinus, twice in the thoracic cavity with one of the shots being the fatal strike to the heart and lung). The bullet in the frontal sinus was recovered at the San Francisco Medical Examiner's Office before impressions were taken of both the maxillary and mandibular jaws. Plaster casts of the jaws were made for metric comparison to the patterned injury of the deceased young man.

Large feline attacks on humans are quite rare, with the most common attacks by mountain lions in the western United States. This presentation will demonstrate features typical of large predatory cat attack, as well as techniques used in taking impressions of the tiger's jaws to fabricate study models. Also briefly compared will be large cat attacks to large dog attacks.

This is the first known attack by a captive large cat at a zoo in the United States on a zoo patron not in the animal's enclosure. A second documented large cat fatal mauling occurred in 2008 at the Denver Zoo on a trained keeper by a jaguar.

Fatal, Tiger, Attack

G127 The Utility of Skeletal Examination in Recognition of Occult Skeletal Injury

Jason M. Wiersema, PhD, Jennifer C. Love, PhD, Sharon M. Derrick, PhD, and Luis A. Sanchez, MD, Harris County Institute of Forensic Sciences, 1885 Old Spanish Trail, Houston, TX 77054*

The goal of this presentation is to illustrate the effectiveness of the skeletal examination method at locating otherwise obscure fractures in children.

This presentation will impact the forensic science community by illustrating particularly to forensic pathologists the effectiveness of the skeletal examination method in the recognition otherwise occult fractures in children.

The Harris County Institute of Forensic Sciences (HCIFS) has been conducting skeletal examination, an autopsy method for recognizing skeletal fractures in children, described by Love and Sanchez in 2009, since March of 2007. The method involves incising and reflecting the skeletal muscle and periosteum overlying the long bones, scapulae, and ribs of infants and children with medical history and/or soft tissue injuries that are suspicious for inflicted trauma. The current study is a retrospective analysis of the utility of this method in the recognition of subadult skeletal injury.

The method is intended to expose occult fractures typically not recognized during standard radiograph surveys and autopsy (Love and Sanchez 2009). The traditional autopsy protocol provides good visibility

* Presenting Author

of the skull and thoracic skeleton but not the appendicular skeleton. For this reason, an increase in the number of long bone fractures, particularly classic metaphyseal lesions, was expected in cases that have undergone this method, relative to those that predate it. However, a significant increase in the number of either skull or rib fractures was not expected.

Following HCIFS protocol, a skeletal examination is performed on all children with a history, or autopsy findings suspicious for inflicted injury aged three years and younger. Fifty-four total cases have undergone the procedure since March of 2007. This presentation considers only those cases that were ultimately classified as homicides with blunt injury included in the cause of death. HCIFS anthropologists have completed 41 such cases (experimental sample). These cases were compared to the same number of consecutive cases with the same criteria (41) that predate adoption of the method (control sample). All cases in the control sample underwent complete autopsies as defined in the National Association of Medical Examiners standards, but were not subjected to anthropological skeletal examinations.

Of the 41 cases that have undergone skeletal examination, skull fractures were noted in 22 (53%), compared to 20 (49%) in the control sample. Seventeen (41%) of the 41 cases in the experimental sample had thoracic fractures (ribs, vertebrae, clavicles or scapulae), compared to 16 (39%) of the 41 in the control sample. Both of these numbers are expectedly similar between the control and experimental samples. However, the number of long bone fractures recognized per case since the method was adopted has increased significantly. Long bone fractures were noted in 17 of the 41 (41%) cases in the experimental sample, as compared to 6 of the 41 (14%) in the control sample. Worth noting is the fact that the fractures noted in four of the six cases in the control sample were complete fractures mentioned in the medical records prior to autopsy. The fractures recognized in the experimental sample are predominantly classic metaphyseal lesions. In addition, both the number of cases with multiple fractures and the number of fractures per case is appreciably higher in the experimental sample than in the control sample. The average number of rib fractures identified in cases with multiple rib fractures is 13 for the control sample and 22 for the experimental sample. The average number of long bone fractures identified in cases with at least one long bone fracture is one for the control sample and four for the experimental sample.

These preliminary results indicate that skeletal examination affords the anthropologist or pathologist the means to better recognize fractures that are difficult to appreciate on radiographs, and has increased the degree to which fractures in infants and young children, particularly of the long bones can be recognized, described, and interpreted. An additional benefit of skeletal examination is that it also facilitates interpretation of the degree of healing and the forces associated with individual fractures.

Skeletal Examination, Child Abuse, Fractures

G128 Interpretation of Anogenital Findings in Forensic Autopsy: Problems and Challenges

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The goal of this presentation is to highlight the difficulties in anogenital examination during autopsy and in interpretation of sexual violence signs.

This presentation will impact the forensic science community by raising awareness of the difficulties in establishing the medical legal diagnosis of sexual crimes on deceased victims, and to outline the importance of scientific research in postmortem genital and anal changes.

* Presenting Author

Sexual violence is a current topic that has been thoroughly studied, leading to numerous publications. However, these papers deal, almost exclusively, with the study of living victims. The few publications about postmortem anogenital examination and related findings advocate that this expertise and related injuries interpretation should be similar to the one performed in living victims. However, in daily practice, the major difficulty for medical legal experts in the interpretation of sexual violence injuries, lies in the fact that currently there are no published studies allowing us to obtain a rigorous differential diagnosis between these injuries and anogenital tissues appearance in the postmortem interval caused by postmortem phenomena, like, cadaveric lividity, dehydration, and putrefaction which could lead to over or misinterpretation of macroscopic sexual violence signs in anogenital area.

Autopsy case reports of five female homicide victims, performed in the North Branch of the Portuguese National Institute of Legal Medicine between June 2009 and June 2010 are reported.

The victims' age ranged from 9 to 89 years old. In all of the cases, anogenital injuries with multiple severity degrees, from bruises to vaginal and uterus perforation, were found. Depending on the type and severity of the injuries:

- a) Two different postmortem technical approaches were performed: macroscopic anogenital examination (four cases); and abdominopelvic amputation (one case). The colposcope was not used in any of the cases and blue toluidine coloration was performed in one of the cases;
- b) Several complementary procedures were performed: toxicological, in five cases; genetic, in five cases; and histological, in three cases.

Photographic documentation was performed in all cases.

Complementary procedures results revealed drugs intoxication in two cases, a male profile in three cases and uterus and vaginal vital laceration in one case.

In autopsy daily practice, medical legal doctors have many difficulties, especially in technical, methodological, and interpretation areas.

Postmortem phenomena, as rigor mortis often make the cadaver manipulation and positioning difficult, not allowing adequate anogenital view. Cadaveric lividity, dehydration and putrefaction phenomena could mimic sexual violence injuries, as abrasions, bruises, hematomas, among others or even hide them, leading to over or misinterpretation of macroscopic sexual violence signs.

To overcome these difficulties, autopsy should be performed as soon as possible, before washing the corpse by a medical legal doctor with expertise in sexual violence in order to prevent loss of biological evidence.

The forensic examination must follow the methodology for the same type of examination in living victims, through: the use of suitable materials, such as the speculum and anoscope; techniques for image magnification macroscopic, such as colposcopy; staining techniques, such as blue toluidine, and photographic documentation.

There must be collected histological and biological samples, in order to exclude various disorders that can mimic signs of inflicted genital trauma or sexually transmitted infection and rule out postmortem artifact and to search for heterologous biological material (DNA profile).

If evidence of trauma is found, special dissection is necessary so that the rectum, anus and perianal tissues are removed *en bloc* with the perineum, uterus, vagina and vulva being included in the female.

Given the paucity information on the nature and appearance of the anogenital tissues in the postmortem interval, the opinion here is that scientific research is essential to improve knowledge about genital anatomy and variants, sexual violence physical indicators and their lesional mechanisms, differential diagnosis and, above all, interference of postmortem phenomena in these anatomical areas.

Sexual Violence, Medical Legal Autopsy, Postmortem Interval

G129 When Lightning Strikes: 17 Fatal Lightning Strikes in New Mexico

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The goals of this presentation are to describe the prevalence of fatal lightning strikes, familiarize attendees with the most frequent decedent and scene demographics identified in fatal lightning strike scenes and autopsies, and have attendees recognize the importance of thorough scene investigation and full autopsy examination with histology and specific examinations in lightning strike fatalities.

This presentation will impact the forensic science community by providing data identified in lightning strikes fatalities and suggesting investigative steps to provide the most thorough scene and autopsy examination.

Hypothesis: There are specific demographics with lightning fatalities in New Mexico that may help identify risk factors and target a population or region for preventative measures.

Methods: A retrospective review of all fatal lightning strikes in New Mexico between January 1979 and December 2009 was performed using an electronic database searching the key words “lightning” and “electrocution.” Cases of electrocution that were not from lightning were eliminated. Demographics evaluated included county of strike, underlying health conditions, month and time of day of strike, activities performed, toxicology, exam findings and the age, sex, and race of the decedent.

Results: During this 30-year time period, 17 lightning strike fatalities were identified. Full autopsies were performed on 14 cases and three were external only examinations. The cases were distributed over 14 different counties; with the highest number of cases in a single county being two. All (17/17) of the cases were male. The majority of cases (52%) of the cases fell between 31-50 years. 52.9% (9/17) of the cases had underlying health conditions. 56% percent of the cases occurred between 2:00 p.m. and 6:00 p.m. 62% of occurred in open spaces, roadways and parking lots. Exam findings included the classic arborizing Lichtenberg figures (35%), burns and singed hair (50%), and blunt force injuries (24%). Only four of the 14 full autopsies documented examination of the tympanic membranes. On cases where toxicology was performed (70.5%), no drugs of abuse or ethanol were detected.

Conclusions: Full scene investigation including weather reports, location of strike, time of day, month, activities performed, equipment used during the strike, and a thorough medical history should be collected when evaluating a fatal lightning strike. A full autopsy should include not only documentation of all external and internal injuries with evaluation of the tympanic membranes but identify natural disease. Intoxication does not appear to be a factor in the lightning deaths reviewed. To prevent lightning deaths, public service announcements in New Mexico for lightning warnings should be targeted towards males during spring and summer and emphasize the avoidance of open spaces.

The goal of this review was to compare the epidemiology of lightning strike fatalities in New Mexico to those previously described in national studies, and provide suggestions for the standardization of autopsy evaluation of lightning strike fatalities so that data may be used for prevention strategies.

Lightning, Autopsy, Prevention

G130 Drag Racing of Snowmobiles on Asphalt: A Novel Cause for Sudden Violent Death

Abraham T. Philip, MD*, Brian P. Ehret, and Robert Stoppacher, MD, Onondaga County Medical Examiner's Office, 100 Elizabeth Blackwell Street, Syracuse, NY 13210

After attending this presentation, attendees will learn about a summer activity, a variation on what was previously known to done exclusively during winter, and about the fatal consequences that it lead to.

This presentation will impact the forensic science community by providing insights on a topic about which there is almost no information in the forensic literature, as this case report details the sudden violent death of a participant in timed trials of a snowmobile which was used to race on asphalt.

Snowmobiles were initially developed to move people and supplies in regions where heavy snow prohibited the use of more conventional vehicles. Today snow-mobiling is a popular wintertime recreational lifestyle activity in several parts of the world. There are millions of registered snowmobiles users and the recreation/manufacturing complex generates billions of winter tourism dollars for the snow belt areas of North America.¹ More than 50% of snowmobile owners surveyed consider use of the vehicle as a family sport.¹ With the increasing popularity of this recreational activity, there has been an increasing incidence of injuries and deaths, the inevitable consequence of human interaction with high performance vehicles. Until the tail end of the last millennium, the snowmobile remained a stationary fixture in one's garage or side of the lawn during the months of May to November. A fact that unfortunately changed in the early 1990's with the introduction of asphalt drag strip racing for snowmobiles.

Drag racing traditionally has been an acceleration contest between two car drivers, to determine which vehicle has the better speed related performance. The vehicles start from a stationary position and takeoff usually after a signal from a set of “christmas tree lights,” and race on a track 1/8 or a 1/4 mile long. Drag racing started in the 1930s, when competitors raced along deserted stretches of roads to see who's vehicle was faster. The National Straightline Snowmobiling Racing (NSSR) is an organization started in 1986, to verify and certify results of dragstrip snowmobile races. In 1993, it included asphalt drag racing as one of the competitive classes that it arbitrated on.

The Empire State Timing Association has operated a Safety Park Dragstrip in the Central New York since the 1960s. It is a 1/4 mile racing strip, with a long stretch of road to allow cars to slow down. The time-slip booth provides the participants data about how long it took to get to various points down the track as well show data on how fast the vehicle was traveling at the half way point (1/8 mile) and at the finish line (1/4 mile) as well as who won the race, if it was a competition.

This case report is about a 24-year-old man who was operating a custom made asphalt snowmobile on a timed trial on the race track. He reportedly had been asphalt racing for the last four years. It was his first day of using his new sled, and he started his third trial run down the track. He was clocked at 161 mph at the 1/4th mile point. He unfortunately lost control of the vehicle, which struck a guardrail. He was ejected off the sled and his body came to rest in a wooded area approximately 300 feet from the initial collision point. The sled, after multiple ongoing collisions with the guardrails on either side, finally came to rest approximately 500 feet from where the body rested. The external examination, with full body x-rays, revealed devastating head injuries, despite the use of a helmet, traumatic avulsion of left forearm, open fractures of left proximal humerus, open fracture dislocation of the right ankle and closed dislocation of the left knee.

A search of the literature revealed no published information on this type of a sudden violent death.

References:

1. Pierz JL: Snowmobile injuries in North America; Clinical Orthopedics and Related Research; 2003; 409; p29 – 36.

Snowmobile Accidents, Drag Racing on Asphalt, Sudden Death

G131 Blast Overpressure After Tire Explosion: A Fatal Case

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The goal of this presentation is to present a rare case of fatal tire explosion, the rarity of the event and the typical histopathological findings make the case peculiar.

This presentation will impact the forensic science community by presenting an integrated study in association with engineers helping to investigate damaging effects of blast overpressure, in a world where tire-blast injuries are not so common and the injuries of the nature described are quite rare and are hardly reported in forensic literature.

Blast Overpressure (BOP) is defined as the increased pressure over atmospheric pressure which is associated with a blast from explosives or weapons. BOP may cause primary, secondary, tertiary, and quaternary injuries. Primary blast injury occurs from an interaction of the pressure wave and the body. Secondary blast injury results from other object invested by the pressure wave impact against the body surface. Tertiary blast injuries occur when the body is accelerated from the blast wave at first and is then abruptly decelerated on rigid objects. Quaternary blast injuries are defined as those injuries of victims of explosions that due to the collapse of a building where the explosion took place. Tire-blast injuries are not so common and the injuries of the nature described are quite rare and are hardly reported in forensic literature. A case of a fatal tire explosion occurred after tire repair and inflation will be presented. Explosion occurred suddenly, strictly close the man who was put five meters far from his site. Rescue maneuvers were unsuccessful and death was declared. Forensic pathologist's crew investigated the crime scene: a 44 cm in length tear was recorded on tire. Blood stains on the ground and environmental structures were also detected. A complete postmortem examination was performed the day after death. Large scalp laceration was detected at external examination. Bruises on face and chest were also recorded. At gross examination, cranium vault was unremarkable except for a mild hemorrhagic infiltration of the *galea capitis*. Brain was normal in size and volume with mild cerebral edema. Diffuse subarachnoid hemorrhage was observed in both hemispheres. Linear fracture of the skull base was detected. Multiple bilateral rib fractures with mild hemothorax were recorded. Lungs were increased in size and volume, reddish colored, both; hemorrhagic foam was detected on the main bronchi. Hemoperitoneum was also recorded; multiple lacerations of liver, kidney, and spleen, deeping into the parenchyma of the viscera were detected. At histological examination with H&E subarachnoid and intraparenchimal hemorrhage were detected on brain. Acute emphysema, pulmonary edema, and hemorrhages were also described with intense congestion of the septum vessel. Venous air embolism was also recorded and investigated by means of immunohistochemistry (antibodies anti-CD 61 and fibrinogen). Capsular multiple tears and subcapsular and intraparenchimal hemorrhages were also detected at liver, spleen and kidneys microscopic examination. Polivisceral stasis was recorded. Intoxication of alcohol or drugs of abuse was excluded at toxicological investigation. Acute respiratory failure was indicated as the cause of death. A

multidisciplinary approach with engineers let us to establish blast overpressure after tire explosion. After that, impact of blast wave on the thorax produced chest and pulmonary injuries (primary blast injuries). Also abdominal viscera injuries were also attributed to blast overpressure effect. The displacement of the body on the ground and environmental structures after explosion produced scalp laceration, subarachnoid hemorrhage, and cranium fractures (tertiary blast injuries).

Blast Injuries, Tire Explosion, Overpressure

G132 TASER® XREP™: A Case Study

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After attending this presentation, attendees will become familiar with the TASER® XREP™ device, a new less lethal tool for law enforcement.

This presentation will impact the forensic science community by alerting the community to the existence of a new TASER® weapon, and the need for caution in handling it.

TASER® XREP (eXternal Range Electronic Projectile) is a self-contained wireless electronic control device that deploys from a 12-gauge pump action shotgun. It delivers a neuromuscular incapacitation (NMI) bio-effect similar to that of the handheld TASER® X26™. The TASER® XREP™ can be delivered to a maximum effective range approaching 100 feet. The battery supply is incorporated into the main chassis and provides the power to propel the XREP projectile.

The TASER® XREP™ device consists of a triple-redundant incapacitation system, each part of the system generating a highly refined NMI waveform that incapacitates the subject. The system completes the circuit when the front probes make skin contact combined with the cholla electrodes, conductive hand trap, or rear facing barbs. The system is composed mainly of the following:

- a. Nose Assembly – the entire detachable nose section which includes the nose frame, frontal probes, fracture pins and reflex engagement electrodes
- b. Conductive Hand Trap Wire – connects the engine to the frontal probes (the insulated wire is wound with the conductive wire)
- c. Cholla Electrodes – electrodes attached to the chassis. The electrodes are constrained beneath the sheath during flight, extend after impact, and are conductive.

The nose assembly contains four forward-facing barbed electrodes. When the TASER® device is deployed, the nose assembly impacts the subject and the frontal probes make contact with the skin and are stuck to the body. The energy from the impact breaks a series of fracture pins that release the main chassis of the XREP projectile, which remains connected to the nose by a nonconductive tether. A conductive hand trap wire also connects the frontal probes to the TASER® XREP™ engine and has capacity to deliver NMI. The projectile autonomously generates NMI for 20 continuous seconds. As the chassis falls away, six cholla electrodes automatically deploy to deliver the NMI effect over a greater body mass. The subject instantly loses muscular control of the body and cannot perform coordinated action. The subject usually falls to the ground. After the signal stops, the subject typically regains all muscle control. Whereas other less-lethal weapons rely on pain compliance to stop the subject, with neuromuscular incapacitating weapons pain may be short-lived and may aggravate the subject even further or cause serious long-lasting injuries.

This case is that of an actor suspected of fatally stabbing a former coworker and wounding two others during a violent rampage about a week earlier. On discovering that he was a wanted suspect, the police tried to apprehend him. He fled to a nearby hill and stood on the cliff wielding a samurai sword. A 20-page handwritten suicide note was

discovered in the abandoned vehicle of the suspect. In the note he indicated sunset as the time he would end his life. A daylong standoff with police ensued with extensive news media coverage. Helicopters hovered over the scene most of the time. Crisis negotiators were called in. They joined in the efforts to get the suspect to surrender. For about eight hours (9:30 a.m. to 5:00 p.m.) he stayed on the edge of the cliff with his sword, taunting and threatening the police. With the approach of dusk, a decision was made to subdue him with a less than lethal weapon. The TASER® XREP™ device was deployed. He was hit and he plunged off the edge of the cliff to his death about 45 feet below.

Autopsy findings, mode, and health and safety issues will be reviewed.

Electronic Control Device, Neuromuscular Incapacitation, Police

G133 3D in Forensics: TIM Synthetic MRI and Virtobot – Forensic Imaging Workflow of the Future

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After attending this presentation, attendees will know the basic of virtual autopsy and the development in forensic 3D imaging of human corpses in the future.

This presentation will impact the forensic science community by covering new validated practical knowledge, and the professional practice gap in the area of virtual autopsy (CME/ACCME criteria).

Imaging has changed the world and greatly influenced modern medicine.

In the 2009 National Academy of Sciences Report, “*Medical Examiners and Coroners Systems: Current and Future Needs*” modern imaging technologies (Virtual autopsy, Virtopsy) was suggested as having a great potential to detect forensic relevant findings.

The advent of high resolution multi-detector row CT scanners and fast MRI scanners in the last decade has allowed the development of imaging techniques that have greatly enhanced the diagnostic potential of these two imaging modalities. While conventional radiographs have played a valuable role in forensic diagnosis and practice for over a century, recent investigations with both CT and MRI suggest that these imaging tools are capable of much greater contributions. A major innovation is the ability to display imaging findings in 2D and 3D planes that closely replicate the findings at conventional autopsy and make the interpretation of the studies more easily understood by non-radiologists. CT and MRI may be used to supplement traditional autopsy techniques, to provide a complete anatomic assessment prior to limited autopsy, or in certain circumstances to replace it, such as in blunt accidental trauma, or drowning deaths. These studies may also provide options in the setting of religious and cultural objections to conventional autopsy.

While CT has the advantage of providing rapid whole body imaging of great anatomic detail in a short time, the superior contrast resolution of MR provides soft tissue characterization that is not achievable by CT. MRI is less widely available and more time consuming but may be applied to the postmortem evaluation of specific body parts to aid in the diagnosis of specific causes of death that may be characterized by subtle soft tissue changes. Both CT and MRI provide a permanent pictorial record of anatomic findings that may be retained and analyzed for medical and legal purposes postmortem and offer advantages in quality assurance that may be difficult to replicate with conventional autopsy.

The forensic science and medical examiner communities have shown interest in the use of CT and MR autopsy imaging. However, while CT and MR imaging are widely available in the clinical care of the living, forensic facilities face problems of access to autopsy imaging due to financial, technical, transportation, interpretation, and related difficulties.

For the past 15 years, the Forensic Institute of the University of Bern has been concerned with imaging problems in forensics. In 2009 the robot-supported automated system integration of 3D surface scanning and multislice CT with postmortem biopsies was successful as a “Virtobot” developed. After what is now five years, the over 100 postmortem angiographies show impressive results from the research activities at the University Bern. In the early part of 2010, our Total Imaging Total Matrix TIM-MRI system that has been in operation since 2009 could be extended with the so-called synthetic MRI software. The advantage of this TIM synthetic MRI system lies in the fact that in one examination step various MRI sequences (such as T1-T2-PD, etc.) could be performed from tip to toe without any change of the surface traces. In the daily forensic service applications it has become evident that through applying this approach a increase in quality and a improvement in the forensic diagnostics can be achieved and the examination results based on the imaging are often quicker and, thanks to a more visual 3D reconstruction, can be displayed in a way that lay persons can understand and comprehend. Momentarily, in terms of workflow and process, this Virtopsy-system integration is the only forensic examination track in a forensic institute that has brought together all the modalities and technologies in this form for daily use and research. With “Axon Shadow,” the interdepartmental forensic IT structure, now being developed at our Institute, which comprises the functionalities of “ERP,” “LIMS” and document management, the forensic processes of all the IFM departments are displayed and supported in a workflow-oriented manner.

Virtopsy, Virtual Autopsy, CT and MRI

G134 Transition to Digital in the Forensic Morgue: Lessons Learned on the Pathway to Greater Efficiency

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After attending this presentation, attendees will have a better understanding of the advantages of and obstacles to the transition to digital technology in the forensic morgue.

This presentation will impact the forensic science community by illustrating the advantages and elucidating the difficulties of the transition to digital fingerprint, radiograph, and photographic technology.

Maximizing efficiency in the postmortem examination process is critical to the daily operations of a busy medical examiner’s office, and is also of particular importance to effective mass fatality preparedness planning. The Harris County Institute of Forensic Sciences (HCIFS) uses technology to maximize the efficiency and accuracy with which it can complete the autopsy process. These technological advancements include the acquisition of a digital radiograph system, a digital fingerprinting system, and digital photography. This presentation will detail the advantages of each of these technologies as well as the obstacles that complicated the transition to each. Generally, the most significant advantages of these technologies are increased efficiency, less waste, greater security, and enhanced user benefit. The most significant obstacles involve adaptation to the specific constraints and requirements of the medical examiner/morgue setting. There is little precedent for the use of some of these technologies in the medical examiners context, and this was reflected in our effort to adopt them.

The HCIFS completed its transition from conventional film radiography to digital computed radiography in December 2009. The digital system includes a central x-ray generator and digital processor, a dedicated server, and a web-based viewing software package that is accessible from each of seven autopsy suites, and from the doctors

(pathologists and anthropologists) office and laboratory computers. The advantages of the system include: greater image quality, more functional user interface (with contrast, brightness and annotation capabilities) multi-image split screen viewing, enhanced archival security, and the elimination of the expense, waste, and space requirements associated with film radiography. The most significant obstacles to the transition to digital x-ray technology were: the lack of an existing system that was appropriately configured for medical examiner use, the consequent development of user workflow, an unfamiliar user interface and image format, and training necessary for use of the software by non-radiologists/radiographers. Additionally, the HCIFS developed a means to copy, and label the images in a format that can be accessed by the Harris County District Attorney's Office.

Digital fingerprint technology has enhanced the efficiency of the decedent identification process. The HCIFS system is essentially an extension of the Harris County Sheriff's Office (HCSO) AFIS network, and includes six AFIS stations, each comprised of two types of fingerprint scanners and a 37" all-in-one touch screen computer. The fingerprints are transferred directly to the HCSO server rather than being stored at HCIFS, and HCIFS Investigations and Morgue staff utilize a custom web-based software interface to receive and search fingerprint results. The advantages of the digital fingerprint system include: increased print quality relative to the previous method; more efficient transfer of prints and receipt of results (five minute average turnaround); infinite upgrade-ability; and more secure archiving. The primary obstacles to the transition to digital fingerprint technology were: ensuring compatibility between the HCIFS system and the databases with which it communicates; lack of an existing system that is appropriately configured for medical examiner use, and; configuring and using a system that has not yet been tested elsewhere. The HCIFS is currently incorporating satellite based scanners into the system to facilitate use of the system by HCIFS Investigators in the field.

The HCIFS transitioned to exclusive use of digital photography at the both the scene and in the morgue in 2005. Conversion from film to digital photography has increased quality control and accessibility, while reducing processing and duplication costs. The system required the acquisition of digital cameras, a dedicated photo server and the infrastructure necessary to make use of the images in a variety of settings (the morgue, daily case triage meetings, case review sessions, and pre-trials). Secure remote access was provided to the district attorney's office eliminating time and supplies required for duplication. The most significant difficulty with the digital photography system is the ever increasing need for storage, and constant oversight is needed to ensure image security and reduce unnecessary image duplication.

The conversion to these digital systems has increased the efficiency of HCIFS daily operations and has resulted in a concomitant increase in its capacity to accommodate mass fatality investigations. Each of the systems was funded by preparedness grants awarded by the United States Department of Homeland Security and the transition process can serve as a template for other medical examiner jurisdictions.

Digital Fingerprint System, Digital Radiograph System, Digital Photography

G135 Postmortem Computed Tomography as a Valuable Tool for Diagnosing Trauma Prior to Medicolegal Autopsy

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After attending this presentation, attendees will understand the importance of computed tomography, which provide the detailed picture of trauma before a medicolegal autopsy in traumatic deaths.

This presentation will impact the forensic science community by increasing knowledge about the benefit of the combination of whole body postmortem computed tomography with a medicolegal autopsy. This procedure gives high quality and specificity in diagnosing fractures and other traumas in a deceased. The 3D reconstruction helps to assess the extent of damage and trauma mechanisms. It is also shown how a medico-legal autopsy on a deceased with many traumas is best performed with an ancillary computed tomography. The computed tomography without medico-legal autopsy cannot provide the sufficient diagnostic information.

A case of a traffic accident with two victims is presented. A car with four people was hit from the left side by a fast-moving car with two people inside. Driver and passenger sitting in the front of the car with four people were killed instantly. Whole-body computed tomography was performed before medico-legal autopsies were performed in the Department of Forensic Medicine, Aarhus. The driver suffered fatal traumas in the form of multiple fractures on the left side of thorax, laceration of diaphragm, fractures in cervical column, contusions in the left side of the brain, pelvic fractures, and fractures in the left ankle. The passenger on his right side suffered traumas in his thorax, in column and fractures of the pelvis. The two other passengers sitting in the back got minor traumas. Driver and passenger in the other car were practically without traumas.

With this case are shown photos of the two cars involved in this accident, 3D reconstructions made from the computed tomography scanning results and the subsequent clinical photos from the medicolegal autopsies. It is shown that with these documents the trauma mechanisms can be evaluated with high reliability. Some of the diagnosis of traumas in this case could have been lost without a postmortem computed tomography scanning. Also a computed tomography scanning before a medico-legal autopsy saves time and resources for the forensic examiner and the dissection of the deceased is not necessarily as comprehensive as it can be without an ancillary scanning.

This case will be presented as an example to highlight how with a whole-body postmortem computed tomography, it is possible to achieve comprehensive information about traumas and the trauma mechanisms. It improves the quality of a medico-legal autopsy and is recommended to be used in cases of fatal traumas.

Postmortem, Computed Tomography, Trauma

G136 Traumatic Injuries in Fatal Tire Explosions

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After attending this presentation, attendees will appreciate the patterns of injuries from tire explosions and the circumstances where fatal tire explosions can cause danger.

The presentation will impact the forensic science community by illustrating the nature and extent of explosion injuries that may result from burst tires.

Tire explosions during servicing may cause severe trauma. The severity of injury depends on the tire size, air pressure, and distance from the blast. The blast injury has been compared to that of a grenade or land mine, but without the chemical or thermal effects. Overall mortality is significant (19-29%), mostly attributed to head injuries. Two cases of truck tire blasts in which fatal injuries were sustained are reported.

Case 1: A 29-year-old male was inflating a large truck tire which was lying flat on the ground. He was leaning over the tire when it ruptured under his chest. He was projected against a garage wall four feet away with his shoulder striking the wall nine feet from the ground. He was pronounced dead at the scene.

At autopsy, there were multiple stippled abrasions and bruises on the face, trunk, and upper and lower extremities, typical of blast injury. The right arm was almost amputated. The rib cage and sternum were extensively fractured. Contusions were seen on the lungs and the left diaphragm was ruptured. The 3rd and 4th cervical vertebrae were dislocated. At the base of the skull, there was a hinge fracture with cerebellum protruding through the fracture site. The brain stem was transected in two places.

Case 2: A 28-year-old male was testing a large truck that had reports of a faulty speedometer. A jack was placed under the third axle of the vehicle and the engine was accelerated. At 40 mph, one of the rear tires exploded. The victim's proximity to the tire blast was not witnessed but he was ambulatory briefly before collapsing. In hospital, a lacerated spleen with hemoperitoneum was managed surgically. After hemodynamic stabilization, the patient suffered cardiovascular collapse. Resuscitation was not successful.

The autopsy revealed primarily left sided trauma with left elbow, left hip, and rib cage fractures. Bilateral hemothoraces were documented. The left lower lobe of the lung was contused and the left hemidiaphragm was bruised. The left ventricle epicardial surface was bruised and traumatic rupture of the anterior papillary muscle had occurred. Subsequent examination of the spleen post-splenectomy confirmed the presence of lacerations. Lacerations were seen in the left kidney with bleeding into the perinephric fat.

Conclusion: The cause of death in both cases was attributed to multiple injuries. In case one, the brain stem transection would have been immediately fatal. In case two, acute papillary muscle rupture led to cardiovascular collapse. Tire explosions show similar injuries to bomb blasts with typical blast injuries seen. Fatalities are common; however, postmortem findings are infrequently reported in the literature.

Tire, Explosion, Fatal



PATHOLOGY/BIOLOGY



G1 Retinal and Optic Nerve Sheath Hemorrhages Are Not Pathognomonic of Abusive Head Injury

Evan Matsches, MD, Southwestern Institute of Forensic Sciences, 5230 Southwestern Medical Avenue, Dallas, TX 75235*

After attending this presentation, attendees will understand the limited value of eye evaluation in child death investigation.

This presentation will impact the forensic science community by bringing clarity to the controversial topic of retinal and optic nerve sheath hemorrhages.

For many years, the dogma of pediatric forensic pathology was “retinal and optic nerve sheath hemorrhages are pathognomonic of abusive head injury”, including especially, the Shaken Baby Syndrome (SBS). Growing controversy surrounding the existence of SBS has lead to questioning of that dogma. A retrospective review of all child deaths (≤ 36 months of age) at a metropolitan medical examiner (ME) department was undertaken to establish the spectrum of retinal (RH) and optic nerve sheath hemorrhages (ONSH) encountered in a medical examiner’s population. In this office, pediatric eye removal is routine, and all eyes are evaluated by consultant ophthalmologic pathologists. The medical Examiner’s database had 137 cases that met age criteria over a five year period; complete case files were available on 123 cases. Of those 123 cases, 18 cases (15%) had RH and/or ONSH; eight cases had both RH and ONSH, seven had only RH, and three had only ONSH. Of these 18 cases, two were certified as natural deaths, eight were certified as accidents, and eight were certified as homicides. Evaluation of the data demonstrated statistically significant relationships between RH/ONSH and: restitution of a perfusing cardiac rhythm following advanced cardiac life support (with short term survival); and cerebral edema (regardless of etiology). Of those children who died without head trauma, but with eye pathology, 6 of 7 received advanced cardiac life support. Qualitative assessment of hemorrhage severity suggests slightly more severe retinal hemorrhages in children whose deaths were ruled homicides; these children were also more likely to have more lengthy post-injury survival periods and brain swelling. In conclusion, RH/ONSH are not limited to children who die of inflicted head injuries; instead, they may be seen in a wide variety of situations, and may be linked to cerebral edema, and sequelae of advanced cardiac life support. **Retinal Hemorrhages, Shaken Baby Syndrome, Pediatric Forensic Pathology**

G2 Child Abuse vs. Accidental Falls: Judicial Outcomes in Alleged Child Abuse

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After attending this presentation, attendees will learn that the incidence of accidental head injuries in infants and children is greater than previously accepted.

This presentation will impact the forensic science community by demonstrating how accidental short distance falls may simulate child abuse.

This presentation will review the trial outcomes in 14 cases from personal case files of alleged child abuse in which the defense claimed

that the head injuries were as a result of short distance accidental falls (40-120cm) or relatively minor head impact trauma.

The nature and extent of the pathology will be presented and the incidence of subdural and retinal hemorrhage will be presented. Twelve cases were found to have unilateral subdural hemorrhage and in two cases the subdural hemorrhage was bilateral. Eight cases had bilateral retinal hemorrhages and four cases had ipse-lateral retinal hemorrhages. There were three cases of skull fracture but in one case with bilateral skull fractures no retinal hemorrhages were described. In four cases there was evidence of a prior head injury.

Cerebral edema or raised intracranial pressure was documented in 12 cases. However, in one case, a six-week-old infant born seven weeks premature with several documented hypoxic episodes, who had apparently fallen 60 cm from a bed, had unilateral subdural hematoma, bilateral retinal hemorrhages and no evidence of increased intracranial pressure.

The evidential basis for the respective arguments by the prosecution and defense will be presented and the possible reasons for the verdicts will be analyzed. It may be significant to note that in two cases there was a history of minor shaking as attempt at resuscitation after the infant had exhibited signs of collapse and seizing. The defense council decided to plead his client guilty to shaking as he was afraid to expose the accused to a jury because of the widespread adverse publicity related to Shaken Baby Syndrome.

The problems relating to the presentation in court of the controversies relating to the pathogenesis and interaction of hypoxia and raised intracranial pressure on the development of subdural hemorrhage and retinal hemorrhages will be discussed.

The influence of these current controversies, particularly relating to Shaken Baby Syndrome, had on the outcome of each case will be discussed.

Child Abuse, Head Injury, Accidental Falls

G3 Pediatric Deaths in Harris County

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After attending this presentation, attendees will gain a better understanding of the types of pediatric deaths investigated in Harris County, Texas and will be exposed to the extensive pediatric death investigation and autopsy procedures employed in our office.

This presentation will impact the forensic community through the documentation and discussion of almost 900 pediatric deaths.

Pediatric deaths pose a unique and sometimes complex set of challenges for forensic investigators. As is typical in other cases, information is gathered from family members regarding the events leading up to the death. In infant deaths, the parents must be interviewed with as much detail as possible in order to document the correct set of circumstances. This is often very difficult to do when the parents are extremely distraught and when they are the potential suspects. Because babies and small children may have injuries that aren’t apparent at the scene or emergency room, all deaths need to be thoroughly investigated beginning as soon as proper officials are notified. This can sometimes cause emotional duress and resistance to talk on the part of the parents. With experience, understanding, and a standard infant death investigation procedure, these obstacles can be overcome.

The Harris County Medical Examiner's Office (HCMEO) is located in Houston, Texas, serving a population of 3.9 million (per 2008 data from the Office of the State Demographer, Texas State Data Center). Additionally, contract services are provided to seven counties in the surrounding area. Approximately 16,000 deaths are reported each year and an average of one-fourth are brought in for either an external examination or a full autopsy. Discussed in this presentation will be the extensive investigative and autopsy procedures, including photographic documentation of the scene, special techniques and consultant assistance.

Over a four year period beginning January 2005, the HCMEO assumed jurisdiction of 870 deaths involving children 10 years of age or younger, 12.3% of which were homicides. Deaths in which an infant is found dead or unresponsive while sleeping with an adult are classified as undetermined (co-sleeping) in our office, allowing for tracking of this risky behavior. Documented wedging or overlays are classified as accidents. The diagnosis of Sudden Infant Death Syndrome (SIDS) is utilized when all investigative and autopsy findings fail to reveal a cause of death in a child under the age of one. The average rate of SIDS deaths over the four year study period is 12% (104). As expected, non-motor vehicle related accidents account for the majority of the deaths, with an average of 21.6% (188).

Statistics will be reviewed in detail for each year of the study and discuss the significance of the trends with regards to co-sleeping, asphyxial deaths, drowning, and child abuse. An unfortunate occurrence in our hot climate is the yearly cluster of heat related deaths due to children being left in motor vehicles and the increasing number of drownings. An alarming statistic discovered from this study is that the number of child deaths due to homicide is higher than those due to motor vehicles. Preventable deaths need to be targeted and all reasonable attempts need to be made to educate parents and caregivers of the dangers of leaving children in hot cars, unsupervised in swimming pools, co-sleeping with small infants, and other inappropriate sleeping conditions that may result in a child's death.

Pediatric Deaths, Homicides, Co-Sleeping

G4 What Is the Frequency of Finding Lethal Injury When a SIDS-Like Death Is Reported?

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After attending this presentation, attendees will understand how frequently lethal injuries were found in a group of infants less than one year of age initially reported to have been found dead after sleep. Attendees will also understand how important it is to thoroughly investigate infant deaths.

This presentation will impact the forensic science community by providing a scientific basis for the need to perform an autopsy, even if there is parental objection in infant deaths. Attendees will have scientific support for thorough law enforcement investigation of unexpected deaths in infancy.

Sudden unexpected deaths of infants less than a year of age are concerning to families and law enforcement. The frequency of finding evidence of lethal injury when the history is that of Sudden Infant Death Syndrome – child found unresponsive after sleep – is important in determining the extent of investigative effort required.

Method: Examination of a database of prospectively studied child death investigations from the Southwestern Institute of Forensic Sciences in Dallas, Texas from 1981-1989 identified 84 infants less than one year of age. These infants were part of a larger study of 169 children less than ten years of age. The deaths were from Dallas city and county

as well as adjacent Justice of the Peace jurisdictions in north central Texas. Investigations included: scene circumstances, medical records, investigative information from law enforcement and social services, autopsies with ocular examinations, toxicologic studies, and radiographs when indicated.

Results: SIDS-like histories were reported in 36 of the 84 infants, 42.9% of the total group. Infants with SIDS-like histories were found to have injuries playing a role or causing their deaths in eight cases of this group, 22.2%. Seven of these were attributed to non-accidental injuries when no adequate explanation was provided once internal lethal injuries were found at autopsy. Three of these non-accidentally injured infants had no external injuries. Three others had only small facial or scalp injuries which were concerning in the context of a SIDS-like history. The seventh infant of the non-accidental death group was slightly decomposed and had visible injuries in spite of the SIDS-like initial history. The accidental death occurred in an infant who had sustained a simple skull fracture when his stroller rolled down hill and crashed into a wall three days prior to death. He was treated and released and found unresponsive in the morning. He had a healing small head abrasion. Laryngeotracheobronchitis was considered a significant contributing factor in his death.

Seven of the infants' deaths in the SIDS-like history group were ruled undetermined, 19.4%. None of them had external injuries or internal injuries sufficient to cause death and none had sufficient natural disease to account for death.

Sufficient gross and/or microscopic findings to attribute death to natural diseases were found in eight infant deaths. Six died of respiratory tract illnesses and two died of other illnesses for a total of 22.2% of the total group.

The diagnosis of exclusion, SIDS, was reserved for 13 of the infants, 36.1%. None of these infants had any external injuries. At the time of the study the SIDS definition did not include extensive metabolic and radiologic studies. Scene circumstances, medical and social services information, complete autopsy, and toxicologic studies for child deaths between one month and one year of age were used to define SIDS in this study. As has been found in most studies of SIDS deaths, ten of the infants were three months old or less, 76.9%.

	Accidental	Non-accidental	Natural	Undetermined	TOTAL
Head Injury	1	7	0	0	8
Undetermined	0	0	0	7	7
Respiratory	0	0	6	0	6
Other Natural	0	0	2	0	2
SIDS	0	0	1	0	13
	1	7	21	7	36

Conclusion: Although more than half of sudden unexpected deaths of infants less than one year of age were attributed to natural causes 15 of the 36 deaths this study (41.7%) required additional law enforcement activity. Non-accidental injuries were found in 19.4% of deaths and a similar percentage could not be attributed to natural causes (undetermined cause and manner). Sudden unexpected infant deaths must be thoroughly investigated; many will be the result of natural causes, but a significant number will be unnatural deaths. Any external injury is an indication that an autopsy must be performed. The absence of external injuries did not accurately predict natural deaths. Autopsies are still necessary to exclude trauma. This study did not address high-resolution radiographic virtual autopsy techniques to allow examination in the face of parental objection to autopsy.

SIDS, Non-Accidental Injury, Infant Deaths

G5 Cardiac Channelopathies Linked to Sudden Infant Death Syndrome/Sudden Unexplained Death Syndrome

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The goal of this presentation is to describe the use of genetic testing to assist medical examiners in determining cause of death in undetermined cases. After attending the presentation, attendees will understand the definition of sudden infant death syndrome (SIDS) and sudden unexplained death syndrome (SUDS), the procedures of SIDS/SUDS investigations, and the SIDS/SUDS genetic testing method. An example of a SUDS case investigation will be presented.

This presentation will impact the forensic science community by emphasizing the need for and use of genetic testing in the determination of unexplained deaths. Discovery of the new mutations presented here will also enrich cardiac ion channel mutation databases and hopefully lead to better understanding of the pathogenesis of these diseases, their diagnosis and treatment.

SIDS is defined as sudden unexplained death under the age of one year. SUDS is defined as sudden unexplained death from one year of age through adulthood. In both syndromes a thorough scene investigation, complete autopsy, and review of the circumstances of death and clinical history are required.

Both environmental risk factors and genetic risk factors are believed to contribute to SIDS and SUDS. Environmental factors involved in SIDS include bedding, bed sharing, and sleeping in the prone position. SUDS can be triggered by vigorous exercise, swimming, emotional stress, and auditory stimuli. Genetic risk factors of SIDS and SUDS include genes that can contribute to arrhythmias. Studies have shown that cardiac arrhythmia may constitute up to fifteen percent or more of SIDS/SUDS cases. Since mutations on six cardiac ion channel genes- KCNQ1, KCNH2, KCNE1, KCNE2, SCN5A, and RyR2 are major causes of cardiac arrhythmias, current genetic testing for SIDS/SUDS is to sequence all exons of these six genes.

Testing of SIDS and SUDS cases in the New York City Office of Chief Medical Examiner has identified genetic variants that are consistent with a cause of death due to cardiac arrhythmias. Fifty-one SIDS cases and thirty-four SUDS cases have been tested. Thirty percent of tested SIDS cases and twenty two percent of tested SUDS cases carry possible disease causing mutations on one of the six cardiac ion channel genes described above. Among the fifty-one SIDS cases, twelve percent carry mutations on SCN5A, 8% of cases carry mutations on each KCNQ1 and KCNH2, and two percent of cases carry mutations on RyR2. Among thirty-four SUDS cases, eleven percent of cases carry mutations on SCN5A, five percent of cases carry mutations on KCNQ1, and three percent of cases carry mutations on each KCNH2 and RyR2. These results appear to confirm a link between cardiac channelopathies and SIDS/SUDS deaths.

A SUDS case investigation will be presented as an example how genetic testing could help medical examiners determine cause of death when autopsy findings are negative. It is recommended that SIDS/SUDS genetic testing become a routine procedure in undetermined death investigations.

Sudden Unexplained Deaths, Genetics, Arrhythmias

G6 Fatal Acute Intracranial Injury With Subdural Hematoma and Retinal Hemorrhages in an Infant Due to Stairway Fall

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The goals of this presentation are to discuss the significance of retinal hemorrhages in an infant with a traumatic brain injury and an acute subdural hematoma and the discordance of published articles about serious injuries or fatalities in infants and young children associated with stairway or short falls.

This presentation will impact the forensic science community by emphasizing the importance of a meticulous investigation required when an infant or young child dies following a history of a short fall coupled with a critical examination of the current literature on short fall fatalities.

Mistaking a fatal accidental head injury in a young child for abusive head trauma can cause serious and protracted consequences. A case of an infant with an acute subdural hematoma (SDH) and severe hemorrhagic retinopathy due to a fatal accidental head injury from a short fall down carpeted steps will be described. The clinical, autopsy, and investigative findings of this case refute the pervasive belief of many physicians that a short fall down stairs by infants and young children are invariably trivial events and cannot cause serious intracranial injuries and extensive retinal hemorrhages.

According to the mother, her 7½-months-old son had been active, playful, and crawling on the floor when she heard a loud thud and found him supine on the basement steps' landing. He was transported by ambulance to the medical center's emergency department. The child was *in extremis* and cranial computed tomography revealed a left-sided acute SDH with a midline shift. He was taken immediately to the operating room; however, in the surgical suite he became asystolic. The neurosurgeon evacuated the blood but resuscitative efforts were unsuccessful.

Neuropathological examination verified the radiological findings of an acute intracranial injury with compressive effects from a left-sided acute SDH. He had bilateral multilayered retinal hemorrhages (left > right), optic nerve sheath hemorrhages, macular edema and microscopic retinal detachments.

The upper half of the stairway from the hallway to the landing was a flight of six carpeted steps with a carpet over hardwood landing (total units of rise = 7). The stairway pitch was 37° and the rise of each step was 0.2032 m with a total rise of 1.42 meters. The oak runners and landing were 2.0 cm thick and the synthetic carpet and pad over the steps and landing measured 1.9 cm in thickness.

The accounts of the incident by the mother were repeatedly consistent and unchanging as provided to the emergency dispatcher, paramedics, emergency department physicians and nurses, neurosurgeon, detectives, and medical examiner. A multidisciplinary team of medical professionals and law enforcement personnel reviewed the investigative reports, scene images plus clinical and autopsy findings. All concurred that his injuries were due exclusively to the stairway fall.

Published studies on stairway falls and serious injuries or fatalities from short falls involving young children are discordant. Joffe and Ludwig (1988) maintained that falls down stairs seldom result in serious injury. In contrast, Chiaviello et al. (1994) concluded that while most stairway-related injuries in young children are minor, severe head injury can occur. Hall et al. (1988) reported that falls accounted for 5.9% of childhood deaths due to trauma and 41% of the falls were minor.

Williams (1991) reported that falls witnessed by two or more people or by a non-related person were associated with less severe injuries suggesting alternate mechanisms in the unwitnessed group. Chadwick et al. (1991) described seven children who died in short falls and had other injuries (5/7 with retinal hemorrhages). They concluded that when children incur fatal injuries in falls of < 4 ft, the history is false. Reiber (1993) reviewed coroner's records (1983-1991) and analyzed relevant articles. He concluded that while children on occasion suffer fatal head injuries from short falls, such events are rare. Plunkett (2001) described 18 head injury deaths resulting from playground falls in the National Electronic Injury Surveillance System database over 12 years (1988-1999). He concluded that an infant or child can sustain a fatal head injury with retinal hemorrhages from a fall of less than three meters. Wang et al. (2001) reported on low and high-level falls in a pediatric population and found a mortality rate of 1% for low-level (<15 feet) falls. Chadwick et al. (2008) reviewed the current literature plus a statewide injury database and asserted that the best current estimate of short fall mortality rate for infants and young children was <0.48 deaths per one million young children per year.

The clinical, radiographic, autopsy and investigative findings of this case will be presented followed by a critical examination of published articles on stairway-related injuries and fatalities from short falls involving young children. Lastly, caution is urged in attributing an acute SDH and traumatic brain injury with extensive retinal hemorrhages solely to abusive head trauma in an infant or young child following a stairway or short fall based on the current medical literature.

Short Fall, Subdural Hematoma, Retinal Hemorrhages

G7 Morbidity and Mortalities Related to TV Tip Over

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The goals of this presentation is to increase awareness of incidence of injuries from TV tip over, provide guidelines for distinguishing these injuries from abusive head trauma, and emphasize risk factors and need for prevention.

This presentation will impact the forensic science community by demonstrating how the incidence of injuries related to TV tip over is increasing.

This presentation will emphasize how the incidence of injuries related to TV tip over is increasing. It will present the scene investigation and autopsy findings from three fatal cases and demonstrate how a forensic pathologist can distinguish them from abusive head injury. Recent literature of this phenomenon will also be presented.

The San Diego County Medical Examiner's Office investigated three fatal cases within a nine month interval from December 2007 to September 2008. Rady Children's Hospital in San Diego treated an additional twenty-six children with non fatal injuries from the same mechanism in the two years prior to September 2008. The workup of each case will illustrate how it was distinguished from abusive head trauma (AHT).

In the first case a 3-year-old girl attempted to reach for items on a TV and/or the dresser on which the TV was positioned. The dresser and TV tipped over impacting her face. She had a fractured orbit and subarachnoid hemorrhage as a result of a probable vertebral artery injury when her neck was hyperextended. She had a brief period of consciousness prior to transport to a hospital where she was diagnosed with nonsurvivable head injuries. The second case involved the death of a 21-month-old child in which a TV on a shelf held up by three unsecured wooden dowels in an entertainment cabinet was dislodged by

a sibling playing in the room. The TV fell on the decedent and caused multiple fractures of the calvarium and base of the skull. One posterior fracture intersected with the foramen magnum and caused atlanto-occipital hemorrhage and cerebral injuries resulting in rapid death. In the third case an 11-month-old infant was struck by a falling TV when her older siblings tried to climb a dresser serving as a TV stand. She sustained massive skull fractures, destruction of her right frontal lobe and basal ganglia, and impaired perfusion of her left cerebrum. These cases were distinguished from AHT by comparing the data obtained from the scene investigation and interviewing the parties at the scene and matching the patterns of injury with the characteristics of the TV sets and their stands and positions, and noting the absence of any prior injuries at the postmortem examination and on x-rays.

A review of the literature for the past ten years indicated that crushing head injuries and fatalities from falling TV's and standup appliances are increasing while the manufacture of larger TV's with inadequate support appliances is also increasing. However, there is a need to critically examine the reporting methods of these cases since the data may not be complete or accurate. There is also a need for better public education about this problem and for the development of standards so as to prevent these injuries. One may consider requiring manufacturers to give notice to purchasers of the dangers of TV-stand tip-over by placing warning notices on the products, developing more stable TV support appliances, and consider better ways to anchor TV's on their stands.

Television Injuries, Head Injuries, Children

G8 Hanging Deaths in Children: An Investigation of Manner of Death

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After attending this presentation, attendees will understand that investigations into pediatric hanging deaths require a very thorough scene investigation, research into the decedent's psychiatric, medical, and social history, and a complete forensic postmortem examination in order to determine the manner of death. Clearly, the determination of the manner of death in these cases can be controversial and can have a tremendous impact on the child's family. Our research supports the hypothesis that hanging deaths in children aged eight to twelve years of age are less likely to have suicide as the manner of death compared to hanging deaths in those aged thirteen to eighteen years of age.

This presentation will impact the forensic science community by helping medical examiners and forensic investigators elucidate information which will help determine the manner of death in these difficult cases.

Background: Suicide in children unfortunately is not an uncommon phenomenon. Suicide is the fourth most common overall cause of death of children aged ten through nineteen years of age in the United States. However, suicide attempts and completions are rare in pre-pubertal children. The rate of suicide deaths increases with increasing age after the onset of puberty.

The number of suicide deaths in the United States for those aged fifteen through nineteen has doubled in the past 40 years, and has tripled for those in the ten to fourteen year age group. However, not all deaths by hanging in children are suicides. Asphyxial "contests" such as the "choking game" have emerged in the past few years as increasing concern with hanging deaths involving children. Additionally, many of the children whose hanging deaths are deemed accidental have histories of attention deficit disorder and impulsive behavior.

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manner of death in these cases can be controversial and can have a tremendous impact on the child's family. Our hypothesis is that hanging deaths in children aged eight to twelve years of age are less likely to have suicide as the manner of death compared to hanging deaths in those aged thirteen to eighteen years of age.

Design: Using the medical examiner's computer registry, all hanging deaths from the past ten years involving children aged 18 years of age and younger will be identified. This will include all applicable deaths in St. Louis City and surrounding counties. All the aspects surrounding the deaths, will be analyzed including the decedent's medical, social, and psychiatric history. The results will then be compiled and presented in two groups divided by age, 8-12 and 13-18. Data will then be analyzed to show whether our hypothesis is supported.

Results and Conclusion: These findings support the hypothesis that hanging deaths ultimately ruled suicides in children aged 8-12 years of age is an unusual phenomenon and is more likely to be accidental in nature compared to hanging deaths in children aged 13-18. Since research in this area of hanging deaths in children is lacking, our goal in this retrospective review is to help elucidate information which will help medical examiners determine the manner of death in these cases. Further research will help to illuminate the issues surrounding these deaths and will assist forensic pathologists in determining the manner of death in these cases.

Hanging, Child Deaths, Asphyxial Deaths

G9 Does a Draft Really Influence Postmortem Body Cooling?

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After attending this presentation, attendees will become familiar with the process of body cooling after death in various body sites, conditions which could influence this process, and the estimation of the Time Of Death (TOD).

This presentation will impact the forensic science community by showing the possibility of estimation of the TOD by measuring the *postmortem* temperature of the eye together with the analysis of the body cooling process in different environmental conditions, including still air and the presence of draft in the experimental room.

The *postmortem* body temperature decrease is a key factor in determining the time of death in humans and temperature-based methods of the TOD estimation are deemed to be most precise during the first several hours after death. The study focused on verification of the significance of the effects of airflow (draft) present in the room where the corpse is found, on the cooling process of specific body sites, and hence on determination of the TOD. The study was carried out in pigs. The investigations were commenced 75 min after the pigs had been killed and involved computerized recording of the cooling process of the eyeball interior (the vitreous humour), soft tissues of the orbit, muscles, and the recta, measured with thermal pin probes. The first part of the study was performed in still air; the second, with airflow generated by air conditioners and a fan.

The data was processed with Matlab® Software version 7.0. The estimation was done via the least squares method implemented in Matlab's *nlinfit* function. The precision of the parameters estimated was assessed by calculating the coefficient of variation (% CV) using the *nlpaci* function. The influence of air flow on the cooling rate and the initial temperature was tested comparing the individual estimates of the cooling rate in the first and the second part of the study. A t-test was performed to test the hypothesis that individual estimates of cooling rate with and without air flow are independent random samples from the same normal distribution with equal mean and variance. Additionally, the relative difference (RD) was calculated as a difference between the mean individual estimates of both parts of the study divided by the value

of the first part of the study to assess the magnitude of the difference between the parameters. It was demonstrated that the moderate airflow (draft) present in the experimental conditions did not significantly affect the course of cooling of the investigated body sites. Despite moderate wind generated in the room, it appeared that the air movement close to the pigs bodies was in fact minimal. Therefore, in order to evaluate the TOD most precisely, one should first have reliable data on the actual velocity of air in the direct vicinity of the body rather than relying on the subjective sensation of the air velocity and using various unnecessary corrective factors.

Time of Death (TOD), Postmortem Body Cooling, Draft

G10 Forensic Medicine in Dubai, United Arab Emirates

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The goal of this presentation is to present the medicolegal features of the United Arab Emirates with different culture and spectrum. Interest to the audience would include the type of cases examined compared to that of their own countries, and this presentation will contain some interesting statistical information.

This presentation will impact the forensic science community by presenting information on a topic where little information is published about this region of the world, as far as forensic science is concerned.

Various characteristics of the medicolegal scene in Dubai are described, along with an overview of all cases examined over a period of six years. During the period of study, a total of 17,683 cases were examined in the Department of Forensic Medicine of Dubai Police General Headquarters. This constituted a yearly average of (2,947). The average annual increment was 11.13%, the percentage of increase between 2002 and 2007 being 68.96%. This rate of increase represents the actual increase of referral by the prosecution and the police, as well as the increase due to population growth of 7% to 8% annually. Clinical cases of injuries were found in 10,165 (57.48%), 5,404 (30.56%) postmortem examinations, 1,525 (8.62%) clinical cases of sexual crimes, 409 (2.3%) age estimations, 58 (0.32%) medical responsibility, 20 (0.11%) criminal abortion, 61 (0.34%) civil actions, and 38 (0.21%) miscellaneous cases. Males represented 4,846 (89.7%) of postmortem examination; females 558 (10.3%). The age ranged from (0-90) years, with a mean age of 40.5 years. The peak incidence was in the age group (20-50) years, where the extremes of age were least represented. Only in 361 cases (6.68% of the grand total) the deceased was a local citizen. Autopsies amounted to 394 cases, which constituted 7.29% of the total deaths examined. The four manners of death in descending order of frequency were natural 3003 (55.57%), accidental 1,727 (32%), suicidal 498 (9.2%), homicidal 164 (3%). The manner was undetermined in 12 (0.22%) of the cases over the six-year period.

As anywhere else, interesting cases have been seen occasionally. These include all manners of death, even a natural manner of death that occurs in circumstances that puzzle the crime scene investigators. Unusual cases previously reported include a case of homicidal strangulation that was staged by the perpetrators to simulate suicidal hanging; masking and bondage in suicidal hanging; accidental death due to inhalation of sulfuric acid fumes; postmortem sole incisions in a morphine overdose; an unusual case of accidental positional asphyxia; and, accidental sand inhalation which was misdiagnosed by the doctor in the hospital. Unpublished cases of note are several: a man was found dead in the passenger seat of his own car, which was locked and his trousers and pants were half way down his thighs, which was found later to be due to massive cardiac infarction; a man alleged by his family to have been found dead in his bed was discovered later to have committed suicide by hanging and the family cut him down and put him in bed to avoid loss of life insurance policy if the fact of suicide death was known;

and in the drug scene arena, during 2008 three accidental fatalities from misuse of Tramadol (Ultram) tablets were reported for the first time. Bloody death scenes are often found when the police suspect homicide, but the forensic evidence confirmed that the death was suicidal. In one case self mutilation was so extensive that it really took some courage from the forensic medical examiner to face the suspicious and skeptical crime scene officers.

Forensic Medicine, Dubai, United Arab Emirates

G11 Injuries to Abdominal Organs in Fatal Road Traffic Crash Victims

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After attending this presentation, attendees will have learned about the types and distribution of abdominal injuries detected in a study of fatal road traffic crash victims at a large department of forensic medicine. The types of injuries, their incidence, distribution, and relationship to the mode of transportation will be presented and the relevance to the forensic community will be discussed.

This presentation will impact the forensic science community by augmenting future forensic studies and supplying forensic scientific data for the purpose of improving traffic safety, injury prevention, and clinical management.

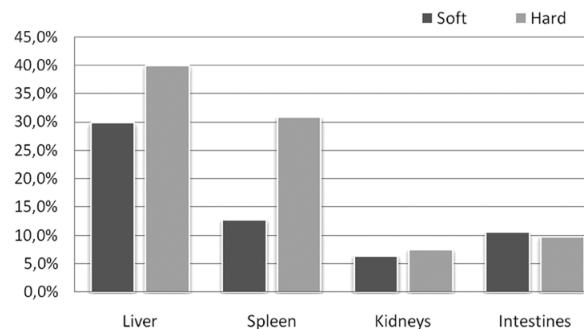
Introduction: In clinical settings, abdominal injuries can be challenging and knowledge of common topographic distribution of injuries may be helpful. There is literature suggesting that injuries to the abdominal organs are common following automobile accidents, and that the symptomatology of these injuries may range from significant to more occult clinical presentation. Abdominal injuries have been found to be common among people killed in road traffic crashes. The characteristics of fatal and non-fatal abdominal injuries are both correlated with the use of safety belts and the direction of impact. This study examined the impact of factors such as mode of transportation and type of crash scenario on abdominal injury in a group of people killed in road traffic crashes who subsequently underwent autopsy.

Methods: Autopsies performed during the period 2000-2004, involving road traffic crash victims were included. Data from autopsy and police records were retrieved from an internal database and evaluated with regard to the mode of transportation, the type of crash (i.e., passenger car, motorcycle, moped, and bicycles), and presence of injury to abdominal organs (i.e., liver, spleen, kidneys, and intestines/mesentery). Details concerning age, gender, influence of alcohol, and drugs/medication were retrieved.

Results: A total of 180 road traffic crash fatalities (133 passenger car occupants, 5 motorcycle, 19 moped, and 23 bicycles) were included. Overall, 53% of the subjects had injury to one or more abdominal organ, the liver being the most commonly affected, followed by the spleen, intestines, and kidneys. After grouping into "hard" (passenger car) and "soft" (MC, moped, and bicycle) victims, a significantly higher risk of injury to the spleen was found among car passengers *(RR=2.41 [1.10-5.32], p<0.05), whereas no statistically significant differences were found for other types of injury in relation to this grouping (Table 1). Frontal collision was the most common crash vector in passenger car crashes. For all types of abdominal organ injury lateral impact increased the likelihood of injury in passenger car victims. Injuries were more common among passenger car victims compared with other road users. Safety belt use was positively identified in 20 (36%) of a total of 55 recorded cases. Among the safety belt users, there was a higher risk of intestinal/mesentery injury, but a tendency towards a reduced risk of all

other types of abdominal injury. Alcohol test was positive in 38% of 146 tested subjects (55/146), and 39% of 46 tested subjects (18/46) were positive for drugs/medication.

Table 1 Incidence of abdominal injuries according to mode of transportation by grouping "Soft group"; MC, moped and bicycles, "Hard group"; passenger car, n=180



Discussion: Injuries to the liver and spleen were found to be the most common abdominal injuries following fatal road traffic crashes. Interestingly, only minor differences were observed in the incidence of abdominal injury in car passengers versus less protected road users (motorcycle, moped and bicycle). The significantly higher risk of injury to the spleen among passengers in motor vehicles is probably due to the generally higher energy transfer to occupants in passenger car crashes. Similarly, the increased risk of injury in lateral impact is in agreement with previous studies. The high number of positive tests for alcohol and drugs/medication in this population is similar to figures reported in the literature. Although abdominal injuries are not necessarily fatal by definition, they often contribute significantly to the cause of death. The presence, location, and severity of these injuries therefore remain of importance to the medicolegal investigation.

Conclusions: This study showed that injuries to the abdominal organs are very common following fatal road traffic crashes. Injuries to the liver and spleen were the most common types of injury affecting about a third of the deceased. The incidence rates and distribution of abdominal injuries were found to correlate to the direction of impact and mode of transportation. Future investigations into the mechanisms and pathology of abdominal injury are needed in order to improve traffic safety issues, injury prevention and clinical management.

Abdominal Injury, Fatal Road Traffic Crash, Postmortem Investigation

G12 Case Example: Cerebral Dural Venous Sinus Thrombosis Following a Motor Vehicle Accident

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After attending this presentation, attendees will understand general principles related to cerebral dural venous sinus thrombosis, especially those impacting the forensic science community, including presenting signs and symptoms, risk factors, clinical diagnostic tests, potential autopsy findings, and pathophysiology. Additionally, a specific case example from the Jackson County Medical Examiner's office illustrating many of the above principles will be presented.

This presentation will impact the forensic science community by reviewing findings related to cerebral dural venous sinus thrombosis that

could easily be overlooked by medicolegal investigators, clinicians, and/or forensic pathologists unfamiliar with this potentially fatal condition.

Once familiar with this condition, medicolegal professionals will be less likely to overlook subtle diagnostic clues in a decedent's medical history and/or postmortem examination.

Among the information presented in this presentation will be anatomical diagrams and images illustrating the cerebral dural venous sinus system and potential areas of thrombosis. The potential for cerebral dural venous sinus thrombosis to cause a fatal cerebral infarct will be discussed. Risk factors including traumatic head injury and hypercoagulability from various medical conditions including dehydration from diabetes mellitus will be discussed. Images from a case example will be used to show petechial hemorrhages in the brain, a common autopsy finding in cerebral dural venous sinus thrombosis. Additional images from the case example will show scattered pulmonary thromboemboli; pulmonary thromboembolism is a rare and serious potential complication of cerebral dural venous sinus thrombosis of which many medicolegal professionals are undoubtedly unaware.

A complete case example from the Jackson County Medical Examiner's Office will be presented, including scene investigation findings, medical history including CT and MRI radiologic findings, and gross autopsy findings as described above.

Sinus, Thrombosis, Thromboembolism

G13 A Death Due to Subinvolution of the Uteroplacental Arteries: A Case Report and Literature Review

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After attending this presentation, attendees will be educated on subinvolution of the uteroplacental arteries, the risk of delayed postpartum hemorrhage with subinvolution, associated morbidity with subinvolution, and pathophysiology of subinvolution.

This presentation will impact the forensic science community by providing education as to the morbidity and mortality of the postpartum patient with subinvolution of the uteroplacental arteries.

Postpartum hemorrhage remains one of the major causes of postpartum morbidity and mortality and is defined as blood loss > 500 mL in vaginal deliveries and > 1000 mL for cesarean births. Hemorrhage within the first twenty four hours after the birth is more common, and referred to as primary or early postpartum hemorrhage. Primary and secondary postpartum hemorrhage share many of the same causes and can include uterine atony, retained placenta, placental accrete or percreta, endometrial infection, inherited coagulation disorders, consumptive coagulopathy, and lacerations of the perineum. Secondary postpartum hemorrhage, however, has received less attention, most likely because it complicates only about one percent of all pregnancies and is more frequently associated with maternal morbidity rather than mortality. However, secondary postpartum bleeding may be fatal, as is the case in this individual, and because the increase uterine bleeding occurs between one to two weeks after delivery and the patient is often home and unaware that the hemorrhage is significant.

The etiology of secondary postpartum bleeding often remains unknown if the patient can be treated conservatively; however, if bleeding is severe, a hysterectomy may be performed or the individual may not survive and require an autopsy to determine the cause of the bleeding. In subinvolution of the placental site, the uterus is grossly enlarged and boggy. Multiple microscopic sections of the placental implantation site should be taken to determine the cause of the hemorrhage and to rule out other causes of secondary postpartum

bleeding such as gestational trophoblastic disease, retained placenta, placenta accreta, and endometritis. Subinvolution of the placental site is an important cause of secondary postpartum bleeding and is defined by either a partial or complete lack of the normal involution of the superficial modified spiral arteries at the placental implantation site. Microscopically, the spiral arteries in the superficial myometrium are large and dilated and are partially occluded with thrombi. In addition, cytotoxophoblasts are identified within and surrounding the vessels and can be highlighted using low molecular cytochrome staining.

The physiologic and anatomic changes that occur in the uterine vessels during pregnancy and in the postpartum period are complex. In the beginning of pregnancy, the cytotoxophoblasts derived from the placenta invade and surround the maternal spiral arteries, transforming them into large vessels that accommodate the increased blood flow needed by the placenta and fetus. The findings are most striking at the site where the placenta has inserted into the uterus. In the normal postpartum period, involution of the arteries occurs. Involution involves the modification of the arteries back to the non-gestational state and eventual removal of the arteries from the uterus. The changes in the arteries include fibrointimal thickening, endarteritis, thrombosis, replacement of the cytotoxophoblasts within the vessels by maternal endothelial cells and regeneration of the internal elastic lamina. There is also a disappearance of the cytotoxophoblasts from the myometrium interstitium. This process, in addition to the sloughing of the decidua in the superficial endometrium and the uterine smooth muscle contraction, is necessary to avoid abnormal postpartum bleeding.

The clinical symptoms are delayed postpartum bleeding usually within two weeks of delivery. There is an abrupt onset of increased uterine bleeding that may require a hysterectomy in some cases.

The exact pathophysiology of subinvolution is not known. Some suspect an immune component leading to abnormal interaction between the maternal and fetal tissues.

Subinvolution of the uterine arteries at the placental implantation site is the result of the modified spiral arteries refusing to convert to a non pregnant state. This can lead to significant postpartum bleeding, and if not suspected, may result in death as in our case. The pathophysiology behind subinvolution is unknown but speculated that an immune etiology with miscommunication between the maternal and fetal tissues. Although it is a common suspect in delayed postpartum bleeding and can cause significant morbidity, the mortality rate due to subinvolution is unknown.

Postpartum Hemorrhage, Subinvolution, Uteroplacental Arteries

G14 Case Studies of Cranial Trepanation in Apulia (Southern Italy) Through Forensic Imaging

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After attending this presentation, attendees will have a greater understanding and interpretation of trepanated skulls.

This presentation will impact the forensic science community by allowing a differential diagnosis between traumatic and intentional ante or postmortem trepanation.

Cranial trepanation is a practice known since prehistory in various, often geographically distant populations, from Europe to Peru. It seems to have been mainly spread during the Bronze Age and underwent a partial decline during the Iron Age. Also during the Roman Era this

practice is well attested by detailed description of specific surgical techniques and tools. It consists of several surgical treatments performed with various tools with the aim of opening a hole in the cranial vault for therapeutic purposes on living individuals. It is believed that this surgery was intended to cure cerebral disturbances related to vascular pathologies, migraines caused by intracranial pressure, or edema drainage after a severe skull trauma or as a religious ritual to drive out the evil spirit, to obtain bone powder to be used in curative potions, to obtain a bone disc as an amulet against disease, to fill the skull with incorruptible substances, or as a victory sign on dead enemies.

Differential diagnosis and the interpretation of trepanated skulls can be particularly difficult. It is necessary to distinguish between traumatic or intentional and ante or postmortem trepanation.

In case studies two early trepanated skulls who are being evaluated through radiological imaging are presented. Both skulls were found in Apulia (Italy). The first skull comes from Canosa (6th-7th AD) and the second is from Vieste (3rd BC). Both skulls present perforation, although at different stage of healing. The radiological analysis confirmed that the skull perforation was a consequence of a therapeutic operation following trauma in the Vieste skull, while the perforation was a pathologic process in the Canosa skull.

The radiological analysis was performed with a portable X-ray device (Nomad) combined with a digital sensor and computerized axial tomography with 3D reconstruction. Signs of healing reaction and bone apposition around the perforations were recognized in the Vieste skull, but not in the Canosa skull. The Vieste skull perforation can therefore be referred to as a therapeutic operation following trauma, while the lesions of the Canosa skull suggest a pathological process or a postmortem ritual practice.

The case study indicates the value of a forensic imaging approach in order to improve data analysis for a complete osteological evaluation of skulls.

Forensic Science, Cranial Trepanation, Forensic Imaging

G15 Systemic Lupus Erythematosus and Fatal Cardiac Failure Due to Pancarditis in a Young Man

Irene Riezzo, MD*, Stefania Bello, MD, Margherita Neri, PhD, and Cristoforo Pomara, PhD, Department of Forensic Pathology University of Foggia, Viale degli Aviatori 1, Foggia, 71100, ITALY

The goal of this presentation is to present a case of sudden cardiac failure and death in a 28-year-old Caucasian male, with reactivation of Systemic Lupus Erythematosus (SLE). A complete methodological forensic approach by means of autopsy, histological, and immunohistochemical examinations lead investigators to conclude an acute congestive heart failure due to pancarditis as cause of death.

This presentation will impact the forensic science community by discussing a definitive diagnosis of acute congestive heart failure with dilated cardiomyopathy after pancarditis was made, as a fatal and rare complication of Systemic Lupus Erythematosus.

SLE is an inflammatory, autoimmune disease of unknown etiology, characterized by the production of autoantibodies and the deposition of immune complexes in various organs. Cardiac involvement occurs frequently, although it is often mild enough not to cause clinical concern. Pericarditis is most commonly seen, with a reported prevalence of 60%. Myocardial involvement is present in only a minority of patients and valvular abnormalities can be demonstrated in an increasing number of patients. Although most of the valvular lesions will be present without any symptoms, valve incompetence can result in congestive heart failure. Myocardial involvement usually accompanies other cardiac lesions. Isolated myocarditis, or dilated cardiomyopathy, is a rare and usually late

clinical manifestation of SLE. Autopsy series in diagnosed SLE patients showed 62% pericardial involvement, 50% valvular involvement (Libman-Sacks lesions and infective endocarditis) and 40% myocarditis, but all have been underdiagnosed clinically.

A 28-year-old Caucasian man, with systemic lupus erythematosus (SLE) treated with hydroxychloroquine and systemic glucocorticoids, was admitted to the emergency department for an arm-ache after an accidental fall. Admission radiographs revealed a spiroid diaphyseal humeral fracture at the mid-distal third, which was treated by surgical internal fixation with a locked antegrade intramedullary nail, and then it was replaced by an external fixation. An ECG showed sinus bradycardia (58/min), QRS axial left deviation in the frontal plane, incomplete right bundle branch block, marked ST-T segment elevation.

After few days he was discharged to continue anticoagulant and antibiotic therapy at home, but three days later he was admitted again to the same hospital for high fever (39.5–40.5°C). The clinical examination revealed pharyngeal hyperaemia, cervical lymphadenopathy and the classical “butterfly” erythematous rash on the face and on the neck. Hematologic studies revealed anaemia, neutropenia, lymphopenia and thrombocytopenia; the morphological examination of peripheral blood and the research for viruses with cardiac and lung tropism were negative. On the eighth day the diagnosis of reactivation of SLE was made and higher doses of glucocorticoid, antipyretic, and antibiotic therapy were administered.

On the fourteenth day, an echocardiography was performed showing normal atrioventricular and semilunar valves, the ventricles were dilated and hypocontractile, with a 33% ejection fraction; the Doppler examination revealed the mitral valve regurgitation. He was transferred to the Department of Cardiology but few hours later he suddenly collapsed; blood gas analysis revealed metabolic acidosis. Vasoactive drugs (dopamine and noradrenaline), bicarbonate, and fluids were administered. The next morning he collapsed again but cardiopulmonary resuscitation was unsuccessful and the man was pronounced dead.

A postmortem examination was performed 48 hours after death. The external examination revealed only malar erythematous cutaneous rash. Internal examination was unremarkable except for heavy lungs and reddish colored foam on trachea and the main bronchi and a cerebral edema.

The heart had a normal shape (15x13x5cm) and a weight of 495g. The left ventricular wall thickness was 1.9cm and the right ventricular wall thickness was 0.8cm. The atrial chambers were normal, the ventricles ones were dilated, and the myocardium was flaccid. Cross sectioning of extramural coronary arteries showed no significant stenosis or thrombotic occlusion. The atrioventricular and semilunar valves were normal except for mitral valve, which showed abnormal leaflet thickening with a decreased mobility.

The histological examination of the heart was performed using haematoxylin-eosin (H&E) and revealed pericardial spots (lymphocytic infiltrates); the myocardium showed focal and rare lymphocytic infiltration in perivascular areas, patchy fibrosis, rare foci of irreversible hypercontraction with myofibrillar break and anomalous cross band formation, and focal interstitial hemorrhages in subendocardial layers (reflow areas). The mitral cusps showed diffuse fibrosis and lymphocytic infiltrates.

The immunohistochemical examination of the heart specimens revealed a positive reaction in cardiac myocytes for antibodies anti-TNF- α and IL-8, and a stronger positive reaction for antibodies anti-IL-15 and IL-10.

Furthermore, the expression of CD-4 and CD-8 showed a strong positive reaction in pericardium, valvular endocardium, and less positive in myocardial specimens.

Examination of the other organs was unremarkable except for cytotoxic cerebral edema, massive pulmonary edema and polyvisceral stasis.

A definitive diagnosis of acute congestive heart failure with dilated cardiomyopathy after pancarditis was made, as a fatal and rare complication of Systemic Lupus Erythematosus.

Lupus, Pancarditis, Dilated Cardiomyopathy

G16 Autopsy Investigation and Bayesian Approach to Coronary Artery Disease (CAD) in Victims of Motor Vehicle Accidents

Antonio Oliva, PhD, and Sara Meriglioli, PhD, Institute of Forensic Medicine, Catholic University, School of Medicine, Largo Francesco Vito 1, Rome, ITALY; Jose Flores, MD, Montreal Heart Institute, University, Montreal, Quebec, Canada, Montreal, CANADA; Francesca Cittadini, PhD, Sara Partemi, MD, and Vincenzo L. Pascali, PhD, Institute of Forensic Medicine, Catholic University, largo Francesco Vito 1, Rome, ITALY; and Ramon Brugada, MD, Montreal Heart Institute, Montreal Quebec, Canada, Montreal, CANADA*

After attending this presentation, attendees will understand the importance of coronary artery disease in causing motor vehicle accidents. Each year 1.2 million people die world-wide as a result of motor-vehicle accidents and the prevalence of injuries is estimated at 50 million, representing a tremendous burden to health. The objective of this study was to define the prevalence of coronary disease and its possible role in motor-vehicle accidents.

This presentation will impact the forensic science community by discussing the data regarding the important percentage of evidence of acute myocardial ischemia in traffic accidents.

Consecutive cases of non-hospital sudden death autopsies between 2002 – 2006 were examined. The research focused on those individuals victims of motor vehicle accidents. A total group of 1,260 individuals in the area of West Quebec were identified. Severe coronary artery disease (CAD) was defined as a narrowing of $\geq 75\%$ cross-sectional area or acute plaque events in major epicardial coronary arteries. In order to evaluate the probability of fatal accidents caused by the presence of significant coronary disease, a *Probabilistic Expert System* (PES) was applied.

Motor-vehicle accidents were responsible for a total of 123 deaths (63%); 100 (81.3%) were males and 23 (18.7%) were females. In individuals over 40 there was significant coronary artery disease in 64.1%, with evidence of acute myocardial ischemia in 12%. In decedents older than 60 years, the prevalence of significant coronary disease and ischemia were 84.6% and 18.18% respectively. Two-thirds of the coronary patients were identified as having erratic driving behavior by bystanders before the accident. ETOH was detected in 11.8% and drugs in 4.9% of the drivers. Statistical analysis showed that an individual affected by coronary artery disease has an accident with a probability of 0.09 (9%).

This research data shows that there is a very high prevalence of severe coronary artery disease in individuals who have suffered a motor-vehicle accident. In an important percentage there is evidence of acute myocardial ischemia. In contrast with previous statements, a large group of the coronary drivers who died, had no time to control and stop the car before the accident. This evidence has important implications for driving safety.

Motor Vehicle Accident, Coronary Artery Disease, Autopsy Investigation

G17 An Unusual “In-Custody” Death

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After attending this presentation, attendees will have learned possible symptoms related to pheochromocytomas and learn basic guidelines for investigating in-custody deaths.

This presentation will impact the forensic science community by providing basic information required by the medical examiner or coroner for deaths that occur in the presence of law enforcement officials. The presentation will also provide information of symptoms related to an adrenal gland tumor.

In-custody deaths or deaths that occur in the presence of police officers are usually high-profile cases that have the potential to become politically charged events. Scene investigation is vital to these types of deaths and should include acquisition of any video of the event, eyewitness' statements, investigation of the event by an independent agency, and autopsy of the decedent. Because of the potential for rumors of foul-play or police misconduct to be propagated within a community, an autopsy should be performed on individuals who die while interacting with law enforcement officials even if the deaths seem “straight forward.”

This presentation presents the sudden death of a woman with long-standing hypertension during detainment by a peace officer for a traffic violation. During her detainment, which caused her considerable stress, she complained of having a “panic attack,” chest pains, and shortness of breath. She became increasingly confused and would not respond to the peace officer's questions. She became unresponsive shortly after emergency medical services arrived at the scene. According to the peace officer, at no point was the woman physically restrained. Autopsy findings were remarkable for lack of trauma, cardiomegaly with left ventricular hypertrophy, hypertensive changes in the kidneys, and a tumor in the left adrenal gland that was diagnosed as a pheochromocytoma. Pheochromocytomas can produce a variety of symptoms including hypertension and have been associated with sudden death. Physical and emotional stress may precipitate hypertensive crises in individuals with these tumors. In this case, the woman's unfortunate death happened to be in the presence of a police officer. Although the death was regarded as a probable natural manner of death from the onset, an autopsy was mandated to confirm this initial impression by establishing an exact cause of death and to quell any possible accusations of misconduct by the peace officer.

In-Custody Deaths, Investigation, Pheochromocytoma

G18 Analysis of Female Firearm Homicides in King County, Washington 2000 - 2007

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After attending this presentation, attendees will be able to describe distinctive features of female homicides due to firearm injuries.

This presentation will impact the forensic science community by delineating the demographics, modalities, circumstances, and motivations that characterize female homicides.

Materials and Methods: The records of the King County Medical Examiner's Office (KCMEO) in Seattle, Washington, were searched to locate homicide victims from 2000 through 2007. These records were analyzed with respect to demographics and cause of death to compare male and female homicide victims. Those cases in which the decedent

was female and the cause of death was firearm injury were analyzed in more detail and were used to construct a database comprising essential medical examiner information. Investigative records from the Homicide Investigation Tracking System (HITS) of the Washington Attorney General's Office were incorporated into this same database to include details regarding the victim, circumstances, and perpetrator of her death. Analysis of this database was the basis of the results of this study.

Results: From 2000 through 2007, there were a total of 618 homicides investigated by KCMEO; 490 were male and 128 were female. Asphyxia, blunt force injuries, sharp force injuries, firearm injuries, and mixed modalities were identified as causes of death. Considering deaths due to firearm injuries only, 334 (68.2%) of the male homicides were due to firearm injuries, compared to 52 (40.6%) of the female homicides. This difference is highly statistically significant ($p<0.0001$). In the group of 52 female firearm homicides, ages ranged from 5 to 93 years with an average of 41.7 years; 23 were married, 17 single, 8 divorced, 2 widowed, and 2 of unknown marital status; 21 were employed outside the home, 7 were homemakers, 5 students, 5 retired, and 2 unemployed. Blood alcohol levels in the decedents were positive in 21 cases and ranged from 3 to 24 mg/dL. In 34 cases, the shooting occurred inside a residence, 2 in unspecified buildings other than a residence, 8 on the street, 3 in vehicles, 2 at worksites, and 1 in a tavern. In 27 cases, the homicide was a consequence of domestic violence. Other motivations and/or circumstances included 6 reckless or unintentional shootings, 4 for financial gain, 2 in "heat of anger", 2 "mercy killings", 2 police officer involved shootings, 1 gang-related, 1 "recreational", 1 child abuse, and 1 due to ethnic hatred. Sexual assault did not appear to be a motivation in any case. Seven of the decedents were from incidents involving multiple homicides. Perpetrators were identified as 15 husbands; 17 boyfriends, ex-boyfriends, male roommates or male acquaintances; 8 family members (child, parent, or other family member); 9 strangers, unknown assailants or unspecified male; and 1 female acquaintance. In 20 cases the perpetrator shot himself immediately after killing the female.

Conclusions: In this study, firearm injuries accounted for less than half of all female homicides and occurred most commonly in a setting of domestic or intimate partner violence. Typically the decedent was a mature woman and had stable employment. Perpetrators were nearly all males with a close or intimate relationship with his victim. Most instances occurred in homes, but it was not unusual for an ex-partner to make a deliberate attack elsewhere, such as at a worksite. Although attacks were often directed at intimate partners or ex-partners, sexual assault was not a factor in any case. Nevertheless, the emotional context of these homicides was evident in that nearly forty percent of the perpetrators shot themselves after killing the female. These findings support the conclusion that domestic violence and firearms are a dangerous combination.

Firearm Injuries, Female Homicides, Domestic Violence

G19 Genetic Aspects of Sudden Death in Youth: A Retrospective Study of Familial Hypercholesterolemia

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After attending this presentation, attendees will understand some principles of genetic heart disease and the advantage of genetic examination in selected forensic autopsies of sudden death. Preliminary results of premature ischemic heart disease will be presented as an example.

This presentation will impact the forensic science community by serving as a key aspect of sudden cardiac death investigation as it can augment traditional means of investigation by including postmortem genetic examination in order to reveal familial hypercholesterolemia (FH) in young people dying from coronary athero-thrombotic disease.

Several cases of sudden death due to basis of genetic heart disease have inspired this newly started retrospective study. The goal of the study is to examine inherited heart disease from selected forensic autopsies.

Purified DNA from blood of approximately 230 selected autopsies; aged 0-40 will be examined. The following genetic heart diseases will be emphasized: Ischemic heart disease due to FH caused by defects in the low density lipoprotein receptor (LDLR) and apo – lipoprotein B (ApoB) gene; Long QT-syndrome and Brugada syndrome due to defects in cardiac ion channel proteins; catecholaminergic polymorph ventricular tachycardia due to defects in the ryanodine receptor; arrhythmogenic right ventricular cardiomyopathy due to defects in the desmosome proteins; hypertrophic, and dilated and restrictive cardiomyopathies due to defects in the contractile proteins.

Preliminary results of the study concerning premature ischemic heart disease will be presented. Examination of approximately forty cases of death in youth due to ischemic heart disease is being examined for defects in the LDLR and ApoB gene.

Mutations in the genes of the above mentioned proteins are known to present as arrhythmia or sudden death. Diagnosed cases of sudden cardiac death in the Danish population are few, despite the estimated higher number of cases in the literature. The perspective of the study is to determine the molecular cause of sudden cardiac death in order to intervene and prevent sudden cardiac death in relatives to cases with proven genetic heart disease.

Sudden Cardiac Death in Youth, Genetic Heart Disease, Familial Hypercholesterolemia

G20 An Unusual Death of a Masochist: Accident or Suicide?

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The goal of this presentation is to describe a very unusual case of the death of a masochist resulting from autoerotic behavior.

This presentation will impact the forensic science community by bringing attention to the unusual practice of compressing the neck and chest during masochistic activities, along with other information related to basic crime scene investigation, reconstruction of events, and autopsy findings in these type cases.

Fatal masochistic asphyxia is a relatively rare phenomenon secondary to the malfunction of apparatus used to provide sexual pleasure. The basic mechanism of sexual asphyxia is the creation of cerebral hypoxia which, according to the literature, is generally brought about by constriction of the neck by use of a ligature. In a small percentage of cases, less typical methods of sexual asphyxia involving chest and abdominal compression are also employed. In all such cases, hypotheses of suicide and homicide must not be ruled out.

A case of a 52-year-old man found dead in the house where he lived alone is reported here. The corpse was found in his study, lying supine on the floor, underneath an open chair bed with a 1.3 x 3.2 meter mattress. The victim's head protruded from under the mattress and was partially covered by two blankets. One of the legs of the chair-bed was discovered pressing perpendicularly into his throat, between which a rubber slipper was positioned, and whose sole was facing the anterior portion of his neck in midline. An iron support bar, which made up part of the bed frame, was pressed against the chest and upper abdomen, causing the bed frame to be elevated off floor. He was wearing typical men's pajamas, underneath which he wore boxer shorts with the fly open. Autopsy revealed the clear imprint of the slipper's sole on the anterior side of the neck. There was no fracture of the hyoid bone or thyroid cartilage, but several deep muscle bruises of the neck were identified. Histological analysis revealed a hemorrhage of the jugular vein and injury to the vagus nerve. An examination of the lungs revealed a large solid mass (7 cm in diameter) occupying the inferior lobe of the right lung; nodules and sclerotical patches involving the omentum were observed, along with the presence of very large adhesions of the peritoneum together with sub-obstructions of the bowel. Toxicological examination revealed no substances of abuse in the blood or urine. The cause of death was attributed to asphyxia by external compression of breathing apparatus.

Further investigation of the victims' history revealed that he was under the care of a psychologist, due to the fact that he had habit of placing heavy objects (especially books and chairs) onto his chest or abdomen with the purpose of engaging in masochistic sexual gratification. This practice interfered with his ability to become intimately involved with women, and so he sought out psychological help to free him from this behavior. The victims' medical history is unknown, including the fact that he had cancer. As far as is known, no suicidal ideation was ever expressed by the victim.

These findings suggest that the manner of death should be classified as accidental. However, the unusual circumstances involved in this case,

including the presence of cancer, does not rule out that the death may have indeed been suicidal.

Masochism, Asphyxia, Autoerotic

G21 Numerous Rhabdomyomata and Cortical Tubers in a Possible Case of SIDS

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After attending this presentation, attendees will exercise different difficult possible manners of death in cases of SIDS.

This presentation will impact the forensic science community by the importance of fact findings through detailed investigations; medical, interviews with family members, etc.

Sudden Infant Death Syndrome (SIDS) is the leading cause of death for infants between the ages of one month to one year. This position has remained unchanged despite risk reduction campaigns and the resulting decline in prevalence in the past two decades. The rate of SIDS in the United States is 0.539 per 1000 livebirths in 2005, accounting for 7.8 % of all infant death. SIDS is defined as the "sudden death of an infant less than one year of age, with onset of the fatal episode apparently occurring during sleep that remains unexplained after a thorough investigation, including performance of a complete autopsy, review of the circumstances of death, and the clinical history. SIDS, a diagnosis of exclusion, can only be made after other explanations for unexpected death have been ruled out. Such explanations include Tuberous sclerosis and infantile asphyxia.

Tuberous sclerosis complex is an autosomal dominant syndrome that is occasionally the findings in these patients with unexpected infant death. Infantile asphyxiation is an important condition that results from unsafe sleeping conditions and must be ruled out before a diagnosis of SIDS can be made. Unsafe sleeping conditions include excess soft beddings, adult beds, chairs, sofas, waterbeds etc.

A case of an unexpected infant death during sleep with multiple factors that confound the cause of death will be discussed. Factors and attempts to delineate their contributions to arrive at a cause and mechanism of death will also be discussed.

Cerebral Tuberous Sclerosis Cardiac Rhabdomyomata, Undetermined Manner of Death, Final Fatal Mechanism of Death

G22 Fatal Subarachnoid Hemorrhage During Sexual Activity: A Case Report

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After attending this presentation, attendees will have learned about a case of sudden death immediately after coitus.

This presentation will impact the forensic science community by explaining that sexual activity, in susceptible subjects may be a trigger of medical emergencies with a real risk of sudden death.

Particularly, the anatomical and physiological responses to coitus may determine many acute and severe complications. Among these, cardiovascular, neurological and urological diseases, soft tissue and immunological consequences may arise in patients with predisposing risk factors, even if asymptomatic (A. Banerjee, 1996).

Many cases of sudden and unexpected death during autoerotic activity have been reported in literature; the majority of these may be considered accidental deaths, especially by asphyxial mechanism. Only few cases are reported as due to natural causes (*N. Beahrendt et al., 2002*).

Studies on sexual related deaths show that cardiovascular diseases and cerebral hemorrhages are the most important causes of death connected to sexual activity.

Coronary artery disease (CAD), myocardial infarction and reinfarction, dissection of aortic aneurysms along with cardiomyopathy – with or without heart failure – are more frequently associated with coital death.

Even if intracerebral bleeding during sexual activity is rare, coitus has also been considered to trigger subarachnoidal bleeding, because of the transient rise in blood-pressure.

As any form of physical exercise, sexual intercourse increases heart rate and blood-pressure. In the majority of cases of natural death combined with sexual activity, the victims are generally male (*W. Janssen et al., 2005*).

Although the gender differences in the incidence of CAD and SAH are statistically not significative, the male dominance of CAD has been showed. On the contrary, the female dominance of SAH has been demonstrated (*S. Lee et al., 2006*).

Many authors described a “malignant coital headache,” so that it can be considered a common feature of cerebral vascular accident (*M. Sutton Brown et al., 2006*).

A case of sudden and unexpected death of a homeless 45-year-old woman is described. During the questioning of the circumstances of death, the partner reported that they were on the beach, lying under a boat, around 1:00 p.m. The woman suddenly presented severe dyspnea and rigidity of the body just after sexual intercourse. Medical assistance was immediately called but the woman died despite attempts at resuscitation. According to the antemortem data obtained from the police report and relatives, it showed that the deceased was apparently healthy and did not show any prior symptoms of cardiovascular disease. No signs of serious headache were present at all in the clinical history. Because the cause of death remained unknown in order to investigate the partner’s report, a complete medicolegal autopsy was performed. The external examination was unremarkable and no signs of injuries or trauma were observed. The internal examination revealed pulmonary edema and lung congestion. There was massive subarachnoid hemorrhage due to a basilar artery aneurysm rupture. No other important pathological findings were observed. In conclusion, subarachnoid hemorrhage secondary to a cerebral aneurysm rupture is still an important cause of death despite steady advances in diagnosis and treatment. Although transient hemodynamic changes associated with sexual activity seem to play some role in the pathogenesis of subarachnoid hemorrhage, the mechanism of physical activity induced subarachnoid hemorrhage is still not completely known.

Sexual Activity, Subarachnoid Hemorrhage, Sudden Death

G23 Occurrence of MRSA in the Peritoneal Cavity Following PEG Tube Insertion

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After attending this presentation, attendees will become familiar with the means of transmission of methicillin-resistant staphylococcus aureus (MRSA) to the peritoneal cavity, proper percutaneous endoscopic gastrostomy (PEG) tube insertion procedures, and potential pitfalls, peritonitis, and a situation that links all previously mentioned aspects.

This presentation will impact the forensic science community by explaining that the occurrence of MRSA as an isolate in bacterial

peritonitis does not increase the significant mortality for the patient to a greater extent than from mixed aerobic gram negative organisms or from anaerobic infection. It is nonetheless important for the forensic pathologist to appreciate the potential for nosocomial spread of MRSA to both the respiratory tract as well as into the peritoneal cavity, with the skin often colonized by MRSA when internal isolates of this microorganism are detected. Proper understanding of the mode of transmission will hopefully facilitate the development of guidelines to help prevent peritoneal nosocomial spread of Methicillin-resistant *Staphylococcus aureus*.

This presentation will examine the transition of MRSA as a skin commensal both to the respiratory tract of an immunologically compromised individual as well as to the peritoneal cavity following the insertion of a percutaneous endoscopic gastrostomy tube. This is the case of a 46-year-old white male who had a history of severe mental retardation/Down Syndrome and upper respiratory problems including dysphagia, being discharged from a regional hospital on January 20, 2009 after having a percutaneous endoscopic gastrostomy tube inserted for feeding. Upon returning to his place of residence, he suffered respiratory arrest, with resuscitative efforts to no avail. The decedent was pronounced dead at 9:15 p.m. on January 20, 2009, only several hours after being discharged from the hospital. Autopsy examination demonstrated a peritonitis that tested positive for Methicillin-resistant *Staphylococcus aureus*, with an excess of 300 ml of purulent tan fluid within the peritoneal cavity as well as coating visceral surfaces, and with fibrinous adhesions extending between bowel loops. Present as well was a gastrostomy tube inserted within the pyloric region of the stomach that readily slipped out of the insertion point upon removal of the viscera from the abdominal cavity. Other significant findings included chronic pancreatitis, with an extensively sclerotic pancreas, cortical contusions of the inferior orbital gyri of the left cerebral hemisphere, and extensive fenestrations of all aortic valve cusps, with extensive epicardial scarring of the surface of the heart. The cause of death was determined to be acute pneumonitis, with aspiration complicated by Methicillin-resistant *Staphylococcus aureus*-positive acute peritonitis, with significant contributing factors being inanition and dehydration, history of severe mental retardation/Down Syndrome, dysphagia, and chronic pancreatitis. The manner of death was rendered undetermined. Percutaneous endoscopic gastrostomy tubes are used to provide long term hydration and nutrition to patients who are no longer capable of receiving nutrition through oral means. Infections such as peritonitis may arise upon gastrointestinal perforation, but may also develop after percutaneous placement of gastrostomy feeding tubes in patients afflicted with commensal skin involvement by pathogenic bacteria. Typical bacteria cultured from the peritoneal cavity in circumstances of gastrointestinal perforation (e.g.,perforated diverticuli, gastric ulcerations, etc.) include mainly a mix of aerobic gram negative bacteria (primary) and anaerobes (secondary). Isolation of a pure culture of MRSA is no longer an uncommon event in cases of bacterial peritonitis, however, likely a consequence of percutaneous nosocomial transfer of these organisms. Prior MRSA infections in an individual increase the likelihood of developing future such events. The insertion of a PEG tube facilitates MRSA spread into the peritoneal cavity, presumably through nosocomial spread from the skin. Bacterial peritonitis is always a life-threatening event; MRSA as the source of bacterial peritonitis underscores both the ubiquity of this microorganism and the dangers associated with introduction of catheters into the peritoneal cavity within this context. The occurrence of MRSA as an isolate in bacterial peritonitis does not increase the significant mortality for the patient to a greater extent than from mixed aerobic gram negative organisms or from anaerobic infection. It is nonetheless important for the forensic pathologist to appreciate the potential for nosocomial spread of MRSA to both the respiratory tract as well as into the peritoneal cavity, with the skin often colonized by MRSA when internal isolates of this microorganism are detected. Proper understanding of the mode of transmission will hopefully facilitate the development of guidelines to

help prevent peritoneal nosocomial spread of Methicillin-resistant Staphylococcus aureus.

PEG Tube, Peritonitis, MRSA

G24 Two Cases of Generalized Myxedema

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After attending this presentation, attendees will be able to summarize the clinical manifestations of hypothyroidism, recognize various autopsy findings associated with the hypothyroid state, appropriately utilize ancillary testing to support their diagnosis, and discuss pathophysiologic aberrancies which may lead to death in this type of case.

This presentation will impact the forensic science community by providing education about this medical condition and photographic representation of several autopsy findings, as well as underscore the diagnostic importance of performing a complete medicolegal autopsy with ancillary studies.

Hypothyroidism is rarely diagnosed in the forensic setting. Two cases of hypothyroidism with generalized myxedema were diagnosed at the SWIFS between 2006-2009 and will be discussed in the presentation.

Generalized myxedema is also known as Gull disease, as it was first linked to the hypothyroid state in 1873 by Sir William Gull. The clinical manifestations of hypothyroidism varies with age of onset. Children present with cretinism. Adults; however, suffer from relatively nonspecific manifestations such as generalized fatigue, apathy, and mental sluggishness, slowing of speech and intellectual function. Constipation, decreased sweating, cold intolerance, and weight gain are common. Skin involved by myxedema takes on a thickened and waxy appearance. The skin may become cool and pale due to decreased blood flow and/or an anemic state. Reduced cardiac output contributes to symptomatology of shortness of breath and decreased exercise capacity. The hair often becomes thinned, coarse, and dry-appearing.

There are two forms of myxedema – generalized and pretibial. Generalized myxedema is often seen in persons with hypothyroidism, whereas pretibial myxedema is associated with a hyperthyroid state. Histologic changes are similar in both forms, as the affected skin shows accumulation of matrix substances (glycosaminoglycans and hyaluronic acid), with the separation of collagen bundles in the reticular dermis. In generalized myxedema, matrix accumulation occurs in deeper subcutaneous tissues and visceral sites, therefore involvement of the heart may directly lead to death in some cases.

In cases of generalized myxedema, a thorough scene investigation and medical history should be obtained. In addition, a full medicolegal autopsy to include toxicologic and ancillary serologic analyzes should be performed. Thyroid stimulating hormone (TSH) is the most sensitive screening method for the diagnosis of hypothyroidism, and TSH levels in the serum of both adults and children are reliable up to twenty four hours after death. It is important to note that in cases of secondary or tertiary hypothyroidism (i.e., pituitary or hypothalamic disease), the TSH level will not be increased. Thyroxine (T4) levels will be decreased in all cases of hypothyroidism. Hypothyroidism is easily treatable and carries a low mortality if one is given timely and sufficient hormone therapy.

Although a diagnosis of generalized myxedema is rare in the forensic setting, it is critical for the forensic pathologist to be able to correctly identify this disease. There are many variations and subtle findings which may easily be missed by the uneducated pathologist. One must be able to recognize the various abnormalities at the time of autopsy, critically examine tissue by light microscopy, and select the

appropriate serologic studies in order to correctly determine cause of death.

Forensic Pathology, Myxedema, Hypothyroid

G25 Adipositas Cordis and Iatrogenic Death: Fatal Complication or Medical Error?

Guido Viel, MD*, and Giovanni Cecchetto, MD, University of Padua, Via Falloppio 50, Padova, 35121, ITALY; Ann S. Schroder, MD, and Nadine Wilke, MD, Eppendorf - Hamburg, Hamburg, GERMANY; Massimo Montisci, PhD, Via Falloppio 50, Padova, ITALY; and Klaus Pueschel, PhD, Eppendorf - Hamburg, Hamburg, GERMANY

After attending this presentation, attendees will learn some basic information regarding the risk of pacing maneuvers, and the role of fatty infiltration of the right ventricle in causing delayed cardiac laceration.

This presentation will impact the forensic science community by discussing the utility of an integrated analysis of clinical, radiological and histological data for identifying any eventual medical error during pacing maneuvers.

It is well-known that the hearts of most adults in western countries contain varying physiological amounts of fat, found mainly in the subepicardial region of the anterolateral wall of the right ventricle. In the normal heart the boundary between the inner myocardium and the outer subepicardial fat is usually distinct, although a slight fuzzy border may be observed. On the contrary, in the fatty infiltration of the right ventricle irregular islands of adipose tissue may extend from the epicardium to the endocardium with the interposition of only few muscle fibers.

In such cases the risk of cardiac rupture after myocardial infarction as well as the risk of ventricular laceration after cardiac surgery is notably increased.

The case of a 70-year-old woman who died of an acute pericardial tamponade due to a delayed laceration of the right ventricle after pacemaker implantation is reported. The autopsy finding of a severe fatty infiltration of the right ventricle, its causal role in determining the fatal pericardial effusion and the legal responsibilities of the physicians who performed the implantation are critically discussed under a forensic point of view.

Myocardial perforation by pacing electrodes or Implantable Cardioverter-Defibrillator (ICD) leads is a well-known and documented complication, occurring at a rate of about 0.4-2.0%. The largest part of the injuries are clearly related to the impacting maneuvers peculiar to the manipulation of pacing catheters and are recognized intraoperatively or in the early postoperative period. Even if the complication is misdiagnosed or the rupture is delayed, due to the "self-sealing" properties of the myocardium and to the fact that generally the lead closes up the ventricular perforation (avoiding a massive bleeding), life-threatening pericardial or pleural effusions are rare.

In our case, the presence of an extended fatty infiltration of the lateral wall of the right ventricle (35% of the myocardium was displaced by adipose tissue) forced the operator to move the implantation lead back and forth to obtain a valid electric signal. In that manner, because of the enhanced fragility of the right ventricle, the surgeon produced three micro-perforations, one of them localized on the lateral wall above the insertion of the anterior papillary muscle, and two of them localized near the apex. All the perforations were of small dimensions and had "self-sealed" soon after the lead damage because the echocardiography performed thirty minutes after the implantation did not reveal pericardial effusion and the patient was totally asymptomatic during the afternoon and the evening of the operative day.

Clinical and radiological data suggest that the fatal ventricular laceration has formed during the late evening or night. Indeed, the

granulocyte infiltration along the margins of the tear dates the lesion between four and six hours before death.

Considering the size and morphology of the injury as well as the extensive transmural fatty infiltration observed in that point of the ventricle, the most probable explanation is that the micro-perforation, produced by the lead, progressively enlarged due to the presence of multiple adipose cells that reduced the adhesion forces between the myocytes. Therefore, the fatty infiltration not only favored the lead-related injuries, but also played a key-role in causing the rapid and fatal pericardial bleeding.

Regarding the site and method of pacemaker implantation as well as the post-operative clinical monitoring, it is believed that several questionable choices have been made.

Attempting multiple maneuvers (i.e., making several punctures) to find a site to place an active fixation lead at the apex is extremely dangerous, above all if the patient suffers from a fatty infiltration of the right ventricle.

Moreover, even if the echocardiography performed thirty minutes after the intervention did not reveal any pericardial effusion, considering the complicated implant procedure, the patient should have been cautiously monitored in a coronary unit, instead of being transferred to an internistic department. A proper postoperative surveillance would have prevented the fatal outcome with a high degree of probability.

Fatty Infiltration of the Right Ventricle, Delayed Cardiac Rupture, Hemopericardium

G26 Public Death From Orally Ingested Drugs During a One Year Period in Louisiana as Analyzed by a Single Forensic Toxicology Laboratory

Gilbert E. Corrigan, PhD*, 11801 Hidden Lake, Saint Louis, MO 63138

After attending this presentation, attendees will learn about a population-based timed study of death by oral ingestion of drugs.

This presentation will impact the forensic science community by teaching the necessity of scientific precision in all aspects of a forensic study.

Monday, July 28 (HealthDay News) – Researchers have discovered a soaring increase in the number of fatal medication errors that occur in people's homes.

The report incidentally follows the death earlier this year of Heath Ledger, the 28-year-old actor who died from an accidental overdose of prescription drugs in his apartment in New York City.

"[There was] large-scale evidence that the death rate from prescription errors was going up very fast, but I didn't know until this paper that they were going up extremely fast in particular circumstances, namely at home and when alcohol and/or street drugs are involved," said study author David P. Phillips, a professor of sociology at the University of California at San Diego.

"I also didn't know from this paper that the number of years of potential life lost from potential medication errors are greater than the number of years of potential life lost from all accidents combined, including falls and drowning," he said.

According to background information in the paper, published in the July 28 issue of the *Archives of Internal Medicine*, there has recently been a dramatic shift in fatal overdoses away from inpatient settings to outpatient settings. More and more medications are taken outside of the hospital or clinic, with far less oversight from health-care professionals, the researchers said.

At the same time, more medications that once were available only by prescription are now bought over-the-counter, and more people are taking more than one medication.

All of this makes it easier for individuals to combine medications with alcohol and/or street drugs. But despite this shift, few if any studies have looked at drug errors outside clinical settings. Almost 50 million death certificates were filed in the United States between January 1, 1983 and December 31, 2004, with 224,355 of them involving fatal medication errors (FMEs). After examining all of these documents, it was discovered that the overall death rate from fatal medical errors increased by 360.5 percent during that time period.

The surge in FMEs differed by type. FMEs occurring at home and combined with alcohol and/or street drugs increased the most, by 3,196 percent. FMEs not happening at home and not involving alcohol and/or street drugs showed the smallest increase, at 5 percent.

Meanwhile, at-home FMEs not involving alcohol and/or street drugs increased by 564 percent, while at-home FMEs involving alcohol or street drugs increased by 555 percent.

Overall, the increase in FMEs was particularly pronounced among people aged 40 to 59, where the increase was 890.8 percent. "People should no longer just focus on medication errors in clinical settings and caused by clinical staff," Phillips said. "There's a whole new world out there that needs to be investigated, that is to say, fatal medication errors occurring at home and not in clinical settings, and apparently influenced by patients and not by staff."

Another expert agreed.

"Most of the information we have about medication errors and their effect take place within the hospital setting," noted Lisa Killam-Worrall, director of drug information and assistant professor of pharmacy practice at Texas A&M Health Science Center Irma Lerma Rangel College of Pharmacy.

But she said there's a real challenge in finding out exactly what substances people might be taking along with their prescription medications.

"As pharmacists, we always try to counsel people when medications could interact with alcohol or other medications, but there aren't that many studies looking at interactions with street drugs," Killam-Worrall said. "We normally don't ask people, 'Are you using street drugs and which ones are you using?' We normally try to ask people, 'What other medications are you taking, prescription, over-the-counter, herbal supplements?' But usually with illicit drug use, you're not going to garner a lot of information."

The findings also have policy implications in terms of patient care , Phillips added.

"Asking patients to be part of the quality-control team is not something you can just automatically do," he said. "It's true that keeping shorter times in hospitals saves money, but it apparently loses lives, and a way to try to ameliorate that would be to spend more time in educating the patient about the risks of taking these powerful medicines and the risks, particularly, of taking these powerful medicines in conjunction with alcohol and/or street drugs."

Public death as a studied scientific phenomenon provides a unique opportunity for the understanding of the human condition and its attributes. This study of the death during the year 2008 of a small cluster of Louisianians whose death became public as determined by their willful consumption of controlled substances and drugs will provide the reader with a privileged insight into these actions. The study has defined boundaries.

The deaths are in single geopolitical area, under a single authority, had no pre-established descriptors save that the deaths are secondary to drug use investigation, were in a precise timeframe of one year, had a uniform management in all details, and most importantly had professional scientific establishment of the cause and the nature of the death through detailed pathological and toxicological studies. The expenses of the study are secondary to the established budgetary standards of this government. These high standards are dictated by the important and constant use of the data and the conclusions derived therefrom to maintain the order of a complicated modern society.

More information

The U.S. Food and Drug Administration has more on medication errors. SOURCES: David P. Phillips, Ph.D., professor, sociology, University of California at San Diego, La Jolla; Lisa Killam-Worrall, Pharm.D., BCPS, director, drug information and assistant professor, pharmacy practice, Texas A&M Health Science Center, Irma Lerma Rangel College of Pharmacy, Kingsville, Tex; July 28, 2008, *Archives of Internal Medicine* Copyright © 2008 ScoutNews, LLC. All rights reserved.

2008-07-28 16:00:00

Public Death, Fatal Oral Ingestion, Population Studies

G27 Complex Suicide: A Case Report

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After attending this presentation, attendees will appreciate the need of a high index of suspicion for the diagnosis of a complex suicide and the importance of a full and careful autopsy.

This presentation will impact the forensic science community by describing the diagnosis of complex suicides.

In 1974, Marcinkowski had proposed a general division of suicide. In this classification, suicides are first divided into simple versus complex. The term "complex suicide" refers to suicides in which more than one suicide method is applied and usually a distinction is made between planned and unplanned complex suicides. In planned complex suicides, the combination of two or more methods of suicide are previously planned and employed simultaneously in order to make sure that death will occur even if one method fails. On the other hand, in unplanned complex suicides, several other methods of suicide are tried after the first method chosen failed, if death occurs too slowly or when it proves to be too painful.

In planned complex suicides, typically two of the common methods of suicide (e.g., ingestion of hypnotics or other medicaments, hanging, drowning, use of firearms, jumping from a height) are combined. In unplanned complex suicides, injuries by sharp force, especially cutting the wrists, are often found as the primary act of suicide and then an appropriated method of suicide is used, more frequently hanging or jumping from a height.

A case of a complex suicide is presented where the victim shot himself in the head and hanged himself. The death scene investigation associated with the findings at the autopsy was very important to classify this complex suicide as an unplanned one.

The need, in some situations, of a high index of suspicion for the diagnosis of this entity is emphasized. So, a full and careful autopsy, including toxicological analysis, combined with the investigation of the death scene is mandatory in these cases. First, to exclude the possibility of intervention of another person in the death; and second, to allow a distinction between planned and unplanned complex suicide.

Suicide, Complex, Autopsy

G28 Fire Death of Two Lovers: An Immunohistochemical and Toxicological Study

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After attending this presentation, attendees will understand investigation of deaths due to phosgene intoxication and the importance

of an integrated analysis of histological and toxicological data to determine the manner and the cause of death in such cases.

This presentation will impact the forensic science community by underlining the importance of sampling and analyzing burned materials when phosgene intoxication is suspected. This compound is not detectable in body fluids and tissues due to its rapid conversion to hydrochloric acid.

The rate of annual deaths related to fire is about 13 per million inhabitants in the United States and Canada. These are mostly accidents followed by suicides. Homicides with subsequent burning of the victim or killings by burning are comparatively rare in Europe just as in the United States and Japan and are reported more often from India or South Africa.

The morphological findings in burned bodies may cover a broad spectrum. They can range from minor, local, superficial burns of the skin to calcined skeletal remains without any soft tissue left and total incineration. In most cases the effects of heat on the body continue beyond death, consequently, the changes found are largely of postmortem origin. The forensic investigation of deaths related to fire is important in order to determine the manner and cause of death and the vitality of the findings. The issues of vitality and cause of death are closely linked: the basis of the assessment is a careful evaluation of autopsy findings to distinguish morphological consequences of the effects of heat during life and after death.

A case will be presented where two burned bodies found early in the morning inside a joust (largely made of polyvinyl chloride – PVC and named "Wrestling labyrinth"), that burned in a town square after a festival. The victims were reportedly lovers (the boy 20 and the girl 16-years-old).

At external examination the corpses showed a typical boxer's attitude with general incineration, exposure of body cavities, bone fractures and partial amputation of extremities. To analyze the morphology of the fractures and their location a high-resolution computed tomography (CT) was performed, indicating that all fractures were a result of thermal effect.

Major internal findings consisted of hemorrhagic pulmonary edema and "puppet organs." Foam and soot particle deposits were detected inside the respiratory tract of both victims.

At histological examination of the lungs, ninety-five percent of the alveoli were flooded with edema and erythrocytes. There was no evidence of fibrin and inflammatory infiltrates. Immunohistochemistry, using epithelial (epithelial membrane antigen and cytokeratin) and endothelial (CD-34 and F-VIII) markers, revealed severe alveolar necrosis without endothelial damage of the vessels.

Systematic toxicological analyzes, performed on postmortem blood and urine, excluded alcohol and drugs intoxication. Monoxide-hemoglobin (CO-Hb) and cyanides concentrations were well below lethal values.

The presence of soot deposits and mucus inside the respiratory tract (not occluding the airways) along with a heat damage of the mucosa of the upper respiratory tract (edema, mucosal bleeding and vesicular detachment) suggest that the victims were alive during the fire and breathed fire-fumes.

The combined analysis of histological and immunohistochemical findings led us to identify the origin of the lung damage in the inhalation of an irritative gas. Laboratory tests, performed on burned samples of the joust (collected at death scene) and on samples of a similar undamaged joust, demonstrated an extensive production of phosgene during experimental burning.

Phosgene is a combustion, thermal decomposition or photodecomposition product of certain volatile chlorinated hydrocarbons (for example, trichloroethylene or perchloroethylene). These chlorinated hydrocarbon compounds can evolve phosgene if they come into contact with very hot metal, flame, or ultraviolet light. Phosgene is a colorless, extremely volatile gas which, at low concentrations, smells sweet, like freshly mown hay, whereas at high concentration has a pungent and

objectionable odor. When aspirated, it combines with the water of the mucous membranes being rapidly converted to hydrochloric acid, with subsequent injury to the lungs (hemorrhagic pulmonary edema).

In this cases, even in the presence of extensive direct thermal injuries, the integration of histological and immunohistochemical findings suggests as principal mechanism of death an asphyxia by airway submersion related to the inhalation of phosgene (called "dry land drowning"). Indeed, the detected hemorrhagic pulmonary edema was of such an extension (involving more than ninety five percent of the alveolar space) to be clearly incompatible with life, and capable of causing a rapid death.

In conclusion, the reported cases highlight the following teaching messages:

1. Histological and immunohistochemical investigations may enhance the identification of the real cause and mechanism of death in fire accidents.
2. Sampling and analyzing burned materials may be of valuable importance when dealing with phosgene intoxications. This compound is not detectable in body fluids and tissues due to its rapid conversion to hydrochloric acid.

Phosgene Intoxications, Fire Deaths, Immunohistochemistry

G29 Non-Traumatic Subdural Hematoma in Adults

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The goal of this presentation is to provide attendees with knowledge of the range of causes of subdural hematoma in adults and the key clinical and anatomic features that distinguish nontraumatic from traumatic subdural bleeding.

This presentation will impact the forensic science community by enhancing the efficiency and accuracy of investigation and certification of deaths from subdural bleeding.

While head trauma is the commonest cause of subdural hematoma both in hospital and in medicolegal autopsy settings, some patients presenting with subdural hemorrhage have a non-traumatic etiology. Because rapid demise may preclude angiography and other procedures to establish the source of subdural blood, these cases often come to the attention of the medical examiner. Distinguishing such "spontaneous" subdural hemorrhage from the more common traumatic subdural hematoma rapidly and with confidence can be a challenge to the forensic and neuropathologist. Complete radiologic reports often are not available at the time of the report of death, allegations of head impact during collapse may complicate the investigation, and neuropathologic examination of the brain at autopsy is best preceded by fixation of the brain prior to dissection. Certain historical and gross autopsy findings should prompt a heightened index of suspicion of nontraumatic etiology in subdural hemorrhage. The entities most often associated with spontaneous subdural bleeding include subdural extension of intracerebral hemorrhage, cerebral arteriovenous malformations and aneurysms, and metastatic tumors. Impaired coagulation from medications or from natural conditions such as hematologic or hepatic disorders also can result in subdural hemorrhage. In cases of nontraumatic subdural hemorrhage, the face and scalp will lack abrasions or contusions. When the brain is examined grossly on removal, focal, thick subarachnoid hemorrhage, especially if located other than in the parasagittal cerebrum, is suggestive of a source of subdural hemorrhage within the brain rather than from rupture of bridging veins as is usual in trauma. Five cases of non-traumatic subdural hemorrhage in adults are presented with case histories,

radiologic data when available, autopsy findings and a review of the literature. The information presented will enhance the efficiency and accuracy of investigation and certification of deaths from subdural bleeding.

Subdural Hematoma, Death Investigation, Neuropathology

G30 Accidental Carbon Monoxide Poisoning: A Review of Environmental and Cultural Risk Factors of Fatal Cases in King County

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After attending the presentation, the attendees will be able to identify certain environmental and cultural factors that may increase accidental death by carbon monoxide inhalation.

This presentation will impact the forensic science community by increasing awareness of environmental and cultural factors that influence the misuse of carbon monoxide producing devices and will suggest ways to decrease the incidence of accidental deaths.

Introduction: Carbon monoxide (CO) is an odorless, colorless gas that forms as a result of incomplete combustion of carbon-containing fuels. While trace levels of CO are found in the atmosphere, fatal levels are found in exhaust from multiple sources including automobiles, generators, propane heaters and charcoal burning grills. Accidental carbon monoxide poisoning is responsible for up to fifty percent of the yearly carbon monoxide related fatalities in King County (five accidental deaths in ten total carbon monoxide deaths in 2007).

Purpose: Risk factors of accidental CO related deaths in King County from 1996 to 2008 were reviewed in an attempt to reveal preventable causes.

Methods and materials: Between 1995 and 2008, 221 cases of carbon monoxide poisoning were identified between 1995 and 2008 within the King County Medical Examiner's information database. Forty-three of which were results of accidental CO poisoning between 1996 and 2008. These cases were analyzed with respect to scene investigation reports and circumstances surrounding fatality.

Findings: CO producing devices were found placed within single family residences in 19 of the 43 accidental deaths. Eleven cases involved CO producing products within vehicles used for residence including trailers, RVs, campers, and vans. Seven of the deceased were found in their cars in their garage, four died from house fires, and the exact location of the source of CO was unclear in two cases (outside versus inside the home). Further review indicated generator exhaust as the most common source of accidental CO poisoning, with 18 of 43 total accidental deaths. Other sources of CO in decreasing incidence included exhaust from vehicles (7), heaters (6), charcoal burning (6), house fires (4), furnaces (2), a hot water heater (1), and an engine from an industrial carpet-cleaning machine. Nine deaths were due to generator exhaust or charcoal burning during power outages, including eight during a windstorm during December 2006. Four incidents included deaths of more than one individual with three paired deaths (6 total deaths) and one Vietnamese family (5 total deaths). 69% (30) of the CO victims during this time were White, 7% (3) were Black, 7% (3) were Hispanic and 16% (7) were Asian/Pacific Islander. The majority of these cases involve people who are unfamiliar with the proper use of generators or charcoal products, either due to inexperience or inability to gain information about certain products in their native language. No carbon monoxide monitors were identified in any scene investigation reports.

Discussion: The most significant environmental and cultural risk factors identified were unfamiliarity with CO producing products and the inability to receive information about these products in various

languages. Preventing accidental deaths in cities with multiple ethnic groups begins with increased availability of educational information in several languages. Many of these products are purchased directly before power outages in a rush to provide heat and power and the proper educational information is not exchanged. The Vietnamese family mentioned earlier, had a receipt for their generator, which was purchased one day prior to death.

After identifying these products in stores, many of the instructions and warning labels are written in English and Spanish, however, warning labels in less frequently spoken languages may help prevent CO poisoning. Ways to educate consumers include increasing awareness via television, the internet through downloadable brochures available in multiple languages and product education including the additional or paired purchase of carbon monoxide monitors, especially prior to anticipated power outages. While the most important time to discuss product education occurs during the purchase of the product, education about CO producing products should occur through multiple methods.

Carbon Monoxide, Poisoning, Accidental Death

G31 Differences in Scene Reenactment of Pediatric Death: Homicide Versus Others

Marianna Sandomirsky, MD, and Jane W. Turner, PhD, MD, St. Louis City Medical Examiner's Office, 1300 Clark Street, St. Louis, MO 63103*

After attending this presentation, attendees will be able to critically apply information gathered from the experience of the City of St. Louis Medical Examiner's office. The main goal is to help differentiate homicide from other manners of death such as accident and undetermined when dealing with pediatric death. Scene reenactment as part of the investigation is an invaluable tool in assessing these difficult cases.

This presentation will impact the forensic science community by discussing key differences observed while investigating pediatric deaths with the aid of scene reenactment.

Pediatric deaths can be complicated cases for the medicolegal system, not to mention the families involved. Determination of cause and manner of death is the driving principle behind the investigation. Key parts of the investigation consist of scene investigation, postmortem studies including autopsy, radiographs, ancillary studies such as toxicology, and if pertinent, microbiology testing. Thorough photographic documentation during the initial visit to the scene as well as at the time of the autopsy is vital to assessing pediatric deaths. Scene investigation is usually performed by medicolegal death investigators who may conduct their inquiry either via telephone or actual visit to the scene.

All pediatric cases (ages 0-5) referred to the St. Louis City Medical Examiner's office during a five-year period, from January 2003 to December 2008 were analyzed. The cases were stratified according to the manner of death of either homicide, accident, or undetermined. The differences in cases that underwent scene reenactments and correlated them with the postmortem studies were compared. Some of the cases were investigated with phone interviews, usually due to traveling or jurisdictional constraints. Telephone interview investigation findings will also be discussed.

One of the most difficult aspects of pediatric deaths for the family is that the event is generally unexpected, unless there is history of natural disease. SIDS (Sudden Infant Death Syndrome) is a diagnosis of exclusion, reserved for cases for which no cause of death is found after a thorough investigation. The scene reenactments conducted in our office frequently demonstrate bed sharing or positional asphyxia as a cause of the child's death. These cases are no longer classified as SIDS as a result of this investigative tool. Additionally, our investigators use a standardized questionnaire published by Missouri Department of

Social Services titled Death Scene Investigative Checklist for Child Fatalities. The form covers minimum necessary information which maybe used later on in the death certification process. It covers key points such as prenatal history, events surrounding death, condition and position of the child, as well as social and environmental conditions.

While natural, accidental and undetermined manner of death is distressing to the family, homicide has its own caveats. The perpetrator is frequently known to the family and is usually not biologically related to the deceased. Most pediatric homicides are crimes of spontaneous impulsive behavior. The killing is not usually premeditated, but rather a reaction to the child's behavior such as loud crying or poor feeding. Most frequently the assailant uses their own body (i.e., hands, feet, torso) to inflict the fatal injuries onto the child. The troubling aspect of pediatric death for medicolegal investigators, law enforcement and forensic pathologists is that homicide within this population does not always exhibit overt trauma. In instances of mechanical asphyxia and unusual poisoning, even a diligent postmortem examination and standard toxicology panel may not reveal the cause and manner of death. Therefore, we must rely on either keen investigative techniques or await perpetrator's confession. While in most sudden infant deaths, the parents or caretakers appear distressed, the stories and reenactments of in cases of homicide frequently shift during the investigation. Investigations in these deaths often reveal an inconsistency or improbability during the scene reenactment.

Scene Reenactment, Pediatric Death Investigation, Manner of Death

G32 Suicide by Multiple Gunshots From Automatic Weapons

Paul Uribe, MD, 7807 Mineral Springs Drive, Gaithersburg, MD 20877*

After attending this presentation, attendees will be able to describe the characteristics of selective fire and "full-auto" weapons and become familiar with the patterns of injury associated with self-inflicted injuries using these types of weapons.

This presentation will impact the forensic science community by providing a case series of a self-inflicted pattern of injury that has rarely been discussed in the forensic literature.

Eight cases of suicide from multiple gunshot wounds by use of automatic weapons will be discussed. Automatic weapons are either solely automatic or have selective fire mechanisms. Selective fire mechanisms include settings for semi-automatic, three round burst, and "full-auto" modes of fire. Weapons with either selective fire settings or that are solely automatic can rapidly discharge multiple rounds in immediate succession when the trigger is pulled. In this case series, there was a strong predilection for wounds of the head (7/8) and only one (1/8) had recovery of the projectile fragments. The recoil produced from firing an automatic weapon can produce considerable distance between entrance wounds. In all of the cases studied, two or more rounds discharged and each had at least two entrance wounds; however, in two cases the number of rounds discharged could not be determined due to the extent of the injuries, co-mingling of trajectory paths, and shared entrance and exit wounds. Thorough scene investigation is essential in these cases to in an effort to determine how many shots were fired, what type weapon was used, and if a selective fire setting was used. Reconstructive computed tomography can also be useful in illustrating wound paths and assisting the determination of how many shots were fired.

Suicide, Gunshots, Automatic

G33 EBV (+) T-Cell Lymphoproliferative Disorder of Childhood Causing Sudden Death: A Case Report

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After attending this presentation, attendees will become familiar with this unusual disorder that can have a rapid course with high mortality such that medical examiner/coroners (ME/Cs) are involved in the investigation. Attendees will learn the value of special testing in autopsy cases, such as immunohistochemistry, EBER-ISH, and T-cell receptor gene rearrangement studies.

This presentation will impact the forensic science community by stressing the need for access by medical examiner/coroner's offices of good immunohistochemistry testing, in-situ hybridization testing, and gene rearrangement studies. Lack of access to these modern techniques can lead to many death investigations remaining unsolved, or misdiagnosed.

Systemic Epstein-Barr virus (EBV) positive T-cell Lymphoproliferative disorder (LPD) of childhood is a life-threatening illness of children that may be associated with chronic active EBV infection or following a primary acute EBV infection. This entity is most prevalent in Asia and rarely reported in the West. Common sites of involvement include the liver, spleen, lymph nodes, bone marrow, skin and lungs. It has a fulminant clinical course with development of hepatosplenomegaly, liver failure, lymphadenopathy, rapidly progressing to multiorgan failure. Other complications such as hemophagocytic syndrome and sepsis can occur. The prognosis in most cases is dismal with death resulting in days to weeks.

We present a case of a 3½-year-old, previously healthy, Hmong girl who presented with to a hospital ER with nausea and vomiting. Initial CBC revealed leukocytosis with an absolute neutrophilia and lymphocytosis. Over the next twenty-four hours, the decedent developed rapidly progressive hepatic failure, became lethargic and unresponsive. Her hematological parameters were as follows: Fibrinogen=152, PTT=41.8, PT=32.1, INR=3, D-dimers: 1869 (n<250ng/ml). Her liver function tests were markedly elevated AST: 4770, ALT: 5030, Ammonia: 421. Mushroom poisoning was strongly considered. Immunoassays for RSV, Influenza A & B, Adenovirus and Hepatitis A & B were negative. EBV serology showed antibodies to EBV (EBV VCA IgG: 1185 (Normal<100) and EBVNA IgG: 1392 (Normal <100). On day two of admission, a CT scan of the head showed cerebral edema with tonsilar herniation. Due to the extremely poor prognosis of the critically ill patient, care was ultimately withdrawn.

Significant findings at autopsy were cerebral edema with tonsilar herniation, hepatic necrosis, splenomegaly (96.9 grams) and massive mesenteric lymphadenopathy. Multiple matted mesenteric lymph nodes were noted; the largest measuring 3 cm in greatest dimension. Sections revealed homogenous tan-pink cut surfaces.

Microscopic examination of the liver showed moderate portal acute and chronic inflammation with hepatocellular necrosis. Sections of spleen showed atypical lymphoid cell infiltrates. Histological examination of an enlarged mesenteric lymph node revealed complete effacement of nodal architecture by medium to large, atypical lymphocytes with irregular nuclear contours and occasional nucleoli, and abundant mitoses. Immunohistochemical stains performed on the lymph node showed a predominant T-cell population (CD3+/CD5+ cells) with high proliferation index (MIB-1: 70-80%) and a small population of scattered B-cells (CD20+). EBV encoded RNA (EBER) was positive by in-situ hybridization (ISH) in the mesenteric lymph node and spleen. A T-cell receptor gene rearrangement study was performed confirming a clonal population of T-cells.

Neuropathologic examination performed after brain fixation revealed hypoxic encephalopathy with marked swelling and cerebellar tonsillar herniation. Alzheimer type II astrocytes were noted in globus pallidus, neostriatum, thalamus, medulla and cerebellar dentate nucleus consistent with hepatic encephalopathy.

In the work-up of sudden unexpected deaths in children and young adults with similar presentations, especially in Asians, EBV positive T-cell lymphoproliferative disorder should be considered. Since the clinical course is usually rapid and the mortality rate is high, medical examiner/coroners are often involved in investigating the cause of death. Antemortem EBV serology and relevant histological evaluation of liver, spleen, lymph nodes, and bone marrow aid in the initial diagnostic work-up. Immunohistochemistry, EBER-ISH & T-cell receptor gene rearrangement studies that can all be performed on paraffin embedded blocks are additional valuable tools in clinching the diagnosis.

Epstein-Barr Virus, T-cell Lymphoproliferative Disorder, EBER-ISH

G34 Temporal Variation of Ethanol Related Firearm Deaths

Rameen S. Starling-Roney, MD*, Anna Rubio, MD, Donna M. Vincenti, MD, and David R. Fowler, MD, State of Maryland Office of the Chief Medical Examiner, 111 Penn Street, Baltimore, MD 21201

After attending this presentation, attendees will understand the potential risk of ethanol use and subsequent homicidal death by firearms (gunshot and shotgun), and the seasonal temporal variation in homicides in which the decedent was under the influence of ethanol.

This presentation will impact the forensic community by examining the association between ethanol intoxication and firearm related homicides. Previous reports have shown a direct correlation between ethanol intoxication and suicides and accidental deaths (specifically motor-vehicle accidents). However, a definitive association between ethanol intoxication and homicides has not been established.

A review of all homicides in the State of Maryland between 2003 and 2007 was performed for cases in which death was due to firearms and in which heart blood was available and evaluated for toxicology (cases in which complications occurred were omitted). Cases were classified by whether the decedent's heart blood ethanol level was above or below the legal limit of intoxication (0.08 g/dl). Predictors of elevated blood ethanol were examined by logistic regression analysis with multiple independent variables including age, gender, week of the year, day of the week, month, and season. Statistical significance was determined by likelihood ratio tests. The numbers of total homicides were compared for different days of the week and month of the year by Poisson regression analysis, aggregating the five years of the study period.

A total of 1,571 cases were identified using the above criteria. The median age for the cases was 26-years-old, 91.4% of the decedents were male and 86.4% were African-American. Statistically significant temporal variation was noted in the aggregate number of homicides by day of the week (greater on Saturday) and month of the year (greater in July and January). Of all cases, 271 (17.3 percent) had a blood ethanol level of 0.08% g/dl or greater. There was statistically significant temporal variation in ethanol related homicides by day of week (increased on Saturday and Sunday) and month of the year (increased between May and August with peaks in June and July). In addition there was a significant increase in ethanol related homicides in the summer when compared to the remaining seasons. No temporal variation was seen in non-alcohol related homicides. A direct relationship was not seen between increased ethanol related homicides and increased total homicides when compared to month of the year and season, however a trend was seen when compared to the day of the week (increased on Saturday).

In conclusion this study shows temporal variations in overall firearm homicides and ethanol related firearm homicides. However a direct association in terms of increased ethanol consumption was not established.

Ethanol, Firearm, Temporal Variation

G35 Axonal Injury in Pediatric Head Trauma: A Study of the Interpretation of β -Amyloid Precursor Protein (β -APP) Expression in Trauma and Non-Trauma Cases

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After attending this presentation, attendees will understand that although beta amyloid precursor protein expression (β -APP) can be useful in confirming axonal injury, its presence or absence cannot in and of itself, prove or disprove traumatic injury.

This presentation will impact the forensic community by illustrating the complexities of interpretation of amyloid precursor protein expression as evidence of axonal injury.

The purpose of this presentation is to illustrate the utility of β -APP immunohistochemistry as morphologic evidence of traumatic brain injury. Often special studies are suggested and/or warranted to rule out the possibility of occult trauma in cases of sudden unexpected death of young children. A number of reports, over the past decade, have described various patterns of β -APP expression in axonal injury. Brain material from a group of twenty-seven young children in order to test the application and interpretation of β -APP immunohistochemical staining were examined.

In 1999, the State of Maryland Office of the Chief Medical Examiner (OCME) investigated 153 deaths of subjects three years of age or younger. Of these, 97 deaths were natural [including 56 cases attributed to Sudden Infant Death Syndrome (SIDS)], 24 were accidental, 18 were homicides, and 14 were undetermined. Among the homicides, seven children sustained blunt force injuries to the head. The staining pattern of β -APP in multiple brain regions (frontal, temporal, and parietal cortices, cingulate cortex/corpus callosum, and the cervicomedullary junction) was evaluated. Compared, in a blinded fashion, the β -APP staining of the homicide cases to similar brain regions from seven age matched cases, in which death was due to a non-traumatic disease (other than SIDS), and ten cases with similar ages, from the same calendar year in which death was attributed to SIDS.

Three reviewers achieved consensus regarding the β -APP staining by using a simplified semi-quantitative scoring method based on 1) staining density per high power microscopic field and 2) the presence or absence of multifocal staining within a single microscopic slide from a single brain region. Upon consensus interpretation, the reviewers agreed that significant β -APP axonal expression was present in five of the seven homicides (71%). Subsequent unblinded review of autopsy records demonstrated that in these cases there was gross evidence of intracranial hemorrhage at the time of autopsy. In the other two homicide cases, the reviewers agreed there was not evidence of axonal injury by immunohistochemistry. These two homicide cases had superficial cranial injuries with significant traumatic injury only to the thoracic spinal cord, determined at autopsy. Two (2) of the SIDS cases and one of the non-trauma cases displayed axonal immunostaining with density and pattern similar to that in the traumatic cases, and the reviewers could

not, with certainty, differentiate these cases from the five homicides by immunohistochemical staining alone.

The specifics of the cases to illustrate the complexities involved in interpreting β -APP deposition in cerebral tissues and to make recommendations regarding the use of adjunct immunohistochemical studies in suspicious infantile deaths will be discussed. Perspective of trends, since 1999, in the evaluation of SIDS versus sudden unexplained death of an infant (SUDI)—especially with regards to co-sleeping factors that might result in asphyxia and hypoxic ischemic injury will also be discussed. Data confirms that while β -APP staining can be useful and corroborative, immunohistochemistry cannot be used independently to determine the presence or absence of traumatic injury

Amyloid Precursor Protein, Axonal Injury, Trauma

G36 Association of Retinal Hemorrhages With Fatal Head Injuries in Infant Monkeys

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After attending this presentation, attendees will gain familiarity with the use of animal models for shaking injuries and appreciate the potential for further study of retinal hemorrhages using accidental head injuries in infant monkeys.

This presentation will impact the forensic science community by providing objective scientific data about the natural history of retinal hemorrhages, which will assist forensic pathologists, pediatricians, ophthalmologists, and emergency medicine physicians by offering a better understanding of the pathogenesis of retinal hemorrhages.

Published studies about the specificity of retinal hemorrhages for Abusive Head Trauma (Shaken Baby Syndrome) are controversial. A diagnosis of child abuse based on the presence, number and distribution of retinal hemorrhages has serious consequences, and thus deserves unbiased scientific investigation. Some authors claim that retinal hemorrhages are virtually pathognomonic of a shaking (acceleration-deceleration) injury, but for such a purportedly specific finding, this claim has never been scientifically proven. Many papers have been written on the subject; however, disproportionately few have had significant substantive value. To date, no reasonably scientific, reliable and ethical animal model for retinal hemorrhages has been identified. Consequently, an exhaustive list of situations and conditions in which retinal hemorrhages can be seen has not been established. Based on the experience of this institution, observational data suggests that retinal hemorrhages occur fairly commonly in the absence of shaking or other non-accidental injury. The goal of this study is to help elucidate these situations though the use of a natural animal model for retinal hemorrhages. This study is intended to serve as a pilot study to evaluate the possibility of using baby monkeys that have died as a result of trauma to demonstrate the presence of retinal hemorrhages in the absence of shaking.

Trauma is a well-documented cause of neonatal and infant mortality in certain non-human primate breeding colonies. One mechanism of trauma is related to changes in the carrying behavior of captive dams, including more frequent cradling of the infant monkeys. Cradling of the infants has resulted in an increased number of fatal accidental head

injuries in these monkeys. The injury occurs when the mother's chest touches the ground as she jumps and lands, thus allowing the infant's head to hit the ground with significant force. Previously published necropsy data for infant squirrel monkeys (*Saimiri sciureus*) has revealed both open and closed skull fractures. No non-lethal or incidental skull fractures have been reported in any captive monkey populations. Unfortunately, none of these studies examined the eyes of the infant monkeys for the presence of retinal hemorrhages.

The heads of seventeen infant monkeys (*Callithrix jacchus* or *Saguinus oedipus*) who died from either trauma or natural disease were provided by the New England Primate Center following necropsy and selective histological examination (KGM). Information initially provided to the primary investigators (CHS, PEL, CAS, KAS and JHB) included the species, animal number and necropsy number. All monkey heads received CT scans (KAS, JHB) using the Siemens MicroCT [Resolution: Bin x 4 = .0732 (73 micron)] followed by pathological examination (CHS, PEL, CAS) including external examination, gross dissection and microscopic examination of the brains and eyes. Findings were digitally photographed including all brains and retinas. The examinations demonstrated eleven animals with apparent head injuries. Nine monkeys had skull fractures; five fractures were identified both radiographically and grossly, three fractures were only identified grossly and one fracture was only identified radiographically. Microscopically evident retinal hemorrhages were present in at least one eye in all specimens with skull fractures and were unilaterally present in one specimen without evidence of a head injury. Because of poor preservation, several of the retinas were fragmented, thus hindering interpretation. Following completion of the examinations, the age, date of birth, date of death, dam and sire numbers, type of postmortem examinations originally performed, postmortem interval, and cause of death for each animal was revealed. All animals were born and died in 2002, with a mean and median age of 1.88 and 2 days at death, respectively. The majority of animals (13/17) died or were euthanized (5) as a result of suspected parental neglect and inanition. Of the remainder, two died of infection, one was stillborn and one died of unspecified cause(s). Postmortem interval was less than twelve hours with the exception of the euthanized animals, which were examined with in two hours. Based on the above information, this study demonstrates a possible association between skull fractures and retinal hemorrhages. Although more studies are necessary to identify a causal relationship between accidental head injuries and retinal hemorrhages, these results suggest that this type of animal model may be of use in studying retinal hemorrhages not associated with alleged shaking incidents.

Retinal Hemorrhages, Abusive Head Trauma, Animal Model

G37 Postmortem Pulmonary Findings by Computed Tomography Compared With Conventional Autopsy

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After attending this presentation, attendees will improve their knowledge about interpretation of postmortem CT scanning images of the lungs and to distinguish them from pathological changes developed before death.

The presentation will impact the forensic science community by demonstrating an important contribution to the new practical knowledge that the forensic pathologist should know regarding the role of CT scanning in autopsy (virtopsy) with reference to the new ACCME criteria.

Postmortem CT scanning (PMCT) is becoming an increasingly important supplement to the medicolegal autopsy. It contributes significantly to the description of skeletal lesions, thereby clarifying the mechanisms of trauma. Gas and foreign bodies are readily identified, and it provides insight in the process of decomposition, in case of which visualization of organs such as the brain is also improved. Interpretation of the CT images acquired from dead people is in many ways different as compared to living people. Evidently, the circulation stopped, resulting in reduced blood filling in the arterial system and sedimentation of blood and other body fluids in the soft tissues. Decomposition of the body begins and is clearly visible as air formation in the soft tissues at a very early stage. It can be difficult to discern the various postmortem changes from pathological conditions in the organs and other soft tissues, especially because experience with PMCT is very limited in contrast to the widespread knowledge in clinical CT scanning.

The purpose of this study was to compare the findings in the lungs by PMCT with the findings and diagnosis made by conventional autopsy, and to learn how to identify common postmortem changes in the lungs in PMCT and to distinguish them from pathological changes developed before death. Internal lividity can be present in all organs, but they are easier to recognize in the lungs both at the autopsy table as well as on PMCT images, because the presence of air in the lung tissue acts as a contrast to the denser appearance of blood and tissue. Internal lividity of the lungs is often seen in the posterior parts due to the frequently supine positioning of the body. In many cases, internal lividity is easily recognized as such. However, differential diagnoses should always be considered, e.g. pneumonia, edema, contusion, and infarction.

The material consisted of 100 forensic cases which were autopsied in 2008-2009 at the Institute of Forensic Medicine, preceded by PMCT by using an in-house Siemens Definition 64 slice scanner. Whole-body scanning was performed in all cases. The torso scanning was obtained with 140 kV and 500 mAs; a beam collimation of 1 mm and pitch 0.75. From the PMCT data axial images were made using different algorithms (H20S smooth and H60S sharp) provided by the manufacturer. Evaluation of the axial images was supplemented by secondary multiplanar reconstructions obtained with available software at the workstation. The PMCT images were initially evaluated by an experienced forensic pathologist and in selected cases a senior radiologist with postmortem radiology experience also evaluated the images. Following the initial evaluation all thoracic axial slices obtained in each of the cases were reviewed by the authors in order to complete a detailed description of the lungs with respect to internal lividity and pathological findings, using the standard settings for viewing of the lungs (window width 1200 HU, center -600 HU) and the mediastinum (window width 400 HU, center 40 HU). The results of the PMCT were compared with the macro- and microscopic findings at autopsy.

The results will be presented and discussed.

Postmortem CT Scanning, Virtopsy, Lung Pathology

G38 Forensic Imaging: Yes, We Scan! New Challenges for a Radiographer

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After attending this presentation, attendees will be able to understand the role of radiographers in forensic imaging regarding CT (computed tomography) angiography and will know the different responsibilities of forensic radiographers such as sample collection for toxicological analyzes (postmortem liquid puncture), sample collection for additional analysis such as histology or bacteriology (postmortem biopsy), and the performance of postmortem angiography including the use of a perfusion machine.

This presentation will impact the forensic science community by displaying the first experiences and future possibilities of this new opportunity. It will also introduce the radiographer and his skills to the medicolegal public.

It is a logical fact, that the implication of a radiographer into a team of forensic radiologist and pathologists can increase the radiological quality of examinations. With the application of postmortem angiography in forensic cases, the importance of such a specialist is again increasing, because this examination is complex and needs experience in handling a CT-scan. Additionally, it brings other needs with it, such as the necessity to perform sample collection for toxicological analysis, before injecting a contrast agent into the corpse. These responsibilities can be fulfilled by the radiographer. His technical knowledge facilitates also the control of the perfusion machine, which is necessary for postmortem angiography.

Sample collection for toxicological analyzes: During the process of postmortem angiography, a contrast agent is injected into the corpse and the blood is rinsed out of the vascular system. Such treatment could eventually alter the findings in toxicological analysis. To avoid this problem, samples of liquids used for these analyzes are collected before angiography. To get samples of vitreous humour, bile, urine, cardiac blood and peripheral blood, punctures are done manually by the radiographer.

Postmortem biopsy: For some additional analyzes such as histology (especially search for fatty embolism) or bacteriology, samples can be collected already before performing angiography in order to avoid contamination of the tissue of interest. For this purpose, postmortem biopsies can be performed by the radiographer.

Performance of postmortem angiography: After sample collection, the radiographer performs the postmortem angiography. He prepares the perfusion machine and the body. The body-preparation includes the correct positioning on the CT-table as well as preparation of the femoral vessels and inserting cannulas into them. After connecting the perfusion machine with those cannulas, the postmortem angiography is performed. Hereby, CT-acquisition and the perfusion machine have to be well synchronized.

For a radiographer, the switch from living patients to dead bodies might be difficult in the beginning. With skills in technology (imaging acquisition, reconstruction of 2D and 3D images, etc.) and anatomical knowledge, (vascular anatomy, positioning of the body, etc.) the radiographer is predisposed to become a member of a forensic team.

The radiographer represents a profession that is necessary to guarantee good quality of radiological examinations and allows a rapid investigation, which is important to implement biopsies and angiography in the daily routine of forensic medicine. This collaboration is well accepted in the forensic team. The interdisciplinary exchange of forensic pathologists, radiologist and radiographers leads to fructuous discussions and successful collaborations between those specialists. Regarding the increase of radiological exams in forensic departments, this new radiographer allows to save much time in the daily routine.

Radiographer, Forensic Imaging, Postmortem Angiography

G39 Benefits and Limitations of Postmortem Multislice Computed Tomography as Adjunct to the Perinatal and Pediatric Autopsy

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After attending this presentation, attendees will understand the basics of the radiologic investigation of perinatal and pediatric death by Multislice Computed Tomography (MSCT) as well as the advantages and the limitations of this method.

This presentation will impact the forensic science community by serving as an introduction of postmortem MSCT as a useful noninvasive adjunct to classic autopsy or even as a potential replacement in cases when autopsy is refused by the next of kin.

Perinatal and pediatric autopsy provides essential diagnostic information not only for parents but also for medical audit and clinical trials. The autopsy rate is decreasing throughout the world for numerous reasons. Medical imaging has always been part of the autopsy process, but in the last decade there has been increased interest in imaging as additional to or a replacement for autopsy. A retrospective data analysis of thirty child autopsies will be presented with correlation in all cases with previously performed MSCT. Postmortem whole body six slice CT imaging was performed on average of twenty-three hours after death. Reconstructions in 1.25mm thickness (soft tissue and lung kernel). Radiological diagnosis was carried out by two radiologists, each with three years experience in postmortem/pediatric radiology. The comparison between autopsy and cross sectional imaging showed a high diagnostic accuracy for intracranial hemorrhage, pulmonary pathologies, the visualization of other (partly) gas containing structures like the intestines and bony pathologies like fractures or tumor caused erosions of bony structures. Obvious weaknesses of the unenhanced CT imaging lied in the detection of cardiovascular vascular pathologies and subtle pathologies of the central nervous system. CT imaging does not provide a histological diagnosis, although histopathologic examination contributes often important information regarding the cause of death. This is clearly a crucial issue if CT is to be used to replace autopsy. A possible solution is the application of CT-guided biopsies to gain histological specimens. The emerging field of postmortem CT angiography could help to close the gap in vascular imaging. This study shows that postmortem CT imaging alone is not a sufficient complete replacement of classic autopsy in the perinatal and pediatric death. Despite the drawbacks, we are convinced of the potential of this method as a planning tool and complement to the classical pediatric autopsy and as the method of choice when autopsy is refused by the next of kin.

Postmortem CT, Perinatal Autopsy, Pediatric Autopsy

G40 Multidetector Computed Tomographic (MDCT) Autopsy in Suicide by Gunshot to the Head

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After attending this presentation, attendees will be able to discuss the ability of MDCT to identify critical forensic elements in suicide by gunshot to the head. The discussion will include both strengths and limitations of MDCT imaging.

This presentation will impact the forensic science community by showing the potential for postmortem MDCT imaging to simplify cause of death determination in selected cases of suicide.

Postmortem MDCT has been shown to be accurate in the evaluation of gunshot wounds with regard to presence of ballistic fragments, entry and exit wound determination, and determination of wound track. Two-dimensional and three-dimensional CT images from a consecutive series of ten cases (nine male, one female; age range 19-32 years) with history of self-inflicted gunshot wound(s) to the head by small arms were studied retrospectively by a radiologist and forensic pathologist. Neither individual had knowledge of the autopsy findings. Using a computer workstation to view axial images and 2D/3D computer reconstructions, determinations of number of shots, entry and exit wounds, soot/stippling, beveling, and wound direction were ascertained. The results were compared to the autopsy findings. All autopsies were performed by board certified medical examiners with access to 2D radiographic images.

The radiographic conclusion that all cases were single shot perforating wounds (one with residual metal fragments) agreed with autopsy reports. There was agreement in designation of all entry and exit wounds (20); entry wounds were submental (1), glabellar area (3), right temporal region (5) and intraoral (1). Three-dimensional surface rendering of scalp wounds was not as helpful as skull findings in classifying wounds. Presence of soot was not mentioned in any of the radiographic assessments but was described at autopsy in all cases. Stippling was not noted in either the MDCT or autopsy findings. Presence of beveling was agreed upon at 9/18 sites, in 8/18 sites MDCT was positive for beveling but not mentioned or called negative in the autopsy report. At one entry site, the autopsy noted beveling whereas the radiology review did not call it (intraoral and submental entry sites are often not subject to beveling).

There was agreement in 10/10 cases regarding the track direction (anterior vs posterior, left vs right, up vs down) with only a minor variance in one case (horizontal track by MDCT vs downward by autopsy measure from vertex). The internal description of brain injury reflected some differences in terminology. While the MDCT tended to describe direction and distribution of bone fragments and pathway, autopsy was more descriptive of hemorrhage and brain anatomy but overall the pathways were in agreement.

Self inflicted, perforating GSW's of the head were correctly described by MDCT in regard to number of shots, entry and exit wound determination and description of wound direction and track. Significant limitations of MDCT are its inability to assess the external soft tissue findings at entry and exit sites and in particular to determine the presence of soot. This study shows that MDCT adds objective information to the invasive part of the cranial autopsy in cause of death determination for cases of suicide with perforating GSW's; however, it cannot replace external assessment of wounds.

However, the combination of hands-on external/internal autopsy assessments and non-invasive internal evaluation by MDCT are not enough. The knowledge of the circumstances leading up to the death and laboratory tests are required to strengthen the medical examiner's ability

to objectively establish the cause and manner of death in cases involving self inflicted, perforating GSW of the head.

Suicide, MCDT Autopsy, GSW to Head

G41 Classification of Asphyxia: The Need for Standardization

Anny Sauvageau, MD*, Office of the Chief Medical Examiner, 7007, 116 Street, Edmonton, AB T6H 5R8, CANADA

After attending this presentation, attendees will better understand the lack of uniformity in the classification of asphyxia and the need for standardization.

This presentation will impact the forensic science community by proposing a unified system of classification of asphyxia.

Introduction: Asphyxial deaths are common in forensic practice. Unfortunately, the classification of asphyxia and the definition of its subtypes are far from being uniform, varying widely from one textbook to another and from one paper to the next. This presentation will begin by summarizing the definitions that are currently described in the literature and highlighting their discrepancies. An attempt will then be made to draw on the mainstream definitions to create a unified system of classification.

Classification and definition of types of asphyxia in the literature: A comprehensive review of the different classifications of asphyxia found in the literature will be presented as well as a thorough compilation of definitions of each term. From this complete review, the most widely accepted views will be drawn. The following recommendations will be discussed, with their underlying rationale:

a) *Unified classification model:* It is proposed that asphyxia should be classified into four main categories: suffocation, strangulation, mechanical asphyxia, and drowning. Suffocation subdivides into smothering, choking and confined spaces/ entrapment/ vitiated atmosphere. Strangulation includes three separate forms: manual, ligature and hanging. Mechanical asphyxia encompasses positional as well as traumatic asphyxia.

b) *Suffocation:* Some authors confusingly use this term synonymously with smothering. Considering the lack of specificity of this term, its use is strongly discouraged in death certificates and requires replacement with a more precise descriptor.

c) *Smothering and choking:* There is no consensus as to the anatomical landmark serving as a boundary between these entities. The epiglottis is proposed as a standardized anatomical landmark. If confronted with an obstruction extending above as well as below the epiglottis, it is recommended to use the lowest level of airway obstruction in classifying the case.

d) *Mechanical asphyxia:* Mechanical asphyxia has been defined by different authors as either a specific entity characterized by restriction of respiratory movements by external pressure on the chest or abdomen or as a broad term encompassing several types of asphyxia caused by various mechanical means. To avoid confusion, it is recommended to keep the phrase mechanical asphyxia as a specific term to designate asphyxia by restriction of respiratory movements.

e) *Strangulation and hanging:* The classification of hanging is controversial: several authors consider hanging to be a type of strangulation or a subtype of ligature strangulation, whereas other authors consider strangulation and hanging as different entities. It is recommended that hanging should be regarded as a type of strangulation, along with manual and ligature strangulation. Some authors believe that accidental hanging can also occur without a ligature: it is however recommended to restrict the appellation of hanging for cases involving some type of ligature tightened by the weight of the body. Furthermore, it is recommended that all asphyxial deaths caused by external pressure on the neck structures should be labeled strangulation and terms such as

positional asphyxia should be avoided in these circumstances. If a strangulation does not fall into the category of manual, ligature or hanging it should be labeled as strangulation NOS (not otherwise specified).

f) **Drowning:** It is recommended that drowning should be included in the forensic classification of asphyxia. However, this inclusion does not necessarily mean that the entity should be discussed in the chapter of asphyxia in textbooks or formal teaching. A better approach would be to include drowning in the classification of asphyxia but discuss it further in the context of the investigation of bodies recovered in water.

Conclusion: At this point in time, there is so much variation in the classification and definitions of terms that research and practice are inevitably tainted by confusion. Unfortunately, similar research designs can lead to totally different results depending on the definitions used. Closely comparable cases are called differently by equally competent forensic pathologists. The proposed unified model in this study was designed in an effort to standardize the classification of asphyxia in the forensic context.

Forensic Pathology, Asphyxia, Classification

G42 Discrimination of Falls and Blows in Blunt Head Trauma: A Multi-Criteria Approach

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After attending this presentation, attendees will have better knowledge of the criteria pointing towards blows or falls in blunt head trauma.

This presentation will impact the forensic science community by providing tools to improve the discrimination between falls and blows.

The distinction between accidental falls and homicidal blows is an important one in forensic pathology as it occurs frequently, but most importantly, because of the legal branching related to a homicide. Indeed, autopsy findings are often used to corroborate or complement investigative information. In the discrimination of falls versus blows, the hat brim line (HBL) rule is mentioned in several textbooks as the most useful single criterion. According to this rule, an injury located at the level where the brim of a hat would lie is more likely the result of a fall, while a blow would generally produce a wound above this line. Recent studies however have found that the HBL rule is only moderately valid and that its use on its own is not recommended. The HBL rule should instead be used in conjunction with other tested criteria, such as the side lateralization and number of lacerations and the length of lacerations. The purpose of this research is first to find additional individually useful criteria in the distinction of falls from blows, and second to construct a decision tree by selecting and combining criteria with the highest predictability rates.

Materials and Methods: This retrospective study used autopsy cases from the Montreal Laboratoire de sciences judiciaires et de médecine légale spanning a six-year period (2000-2005). The selected cases represented falls downstairs, falls from one's own height and homicidal blows to the head by a blunt weapon. Designation of cases as falls or blows was not solely based on head examination but on a thorough case review, including scene investigation, witness testimony, perpetrators confession and other autopsy findings. The cases where a victim was struck while lying on the ground were excluded from the sample. For each case, the following features were compiled: the number of lacerations, the location of lacerations and fractures in relation to the HBL, the side lateralization of lacerations and fractures, scalp laceration length; calvaria fracture type; number of facial abrasions, contusions, and lacerations (including mouth lesions); presence of lacerations on the ear; presence of facial fractures; pattern of post-crani

osseous and visceral trauma; and the quantity of alcohol (mg/100ml) when toxicology reports were available. The HBL definition used in this study is the following: the area located between two lines parallel to a line inspired by the Frankfort horizontal plane (horizontal plane passing through right and left porion points and the left orbitale), the superior margin passing through the glabella (G line) and the inferior margin passing through the center of the external auditory meatus (EAM line).

Results and Conclusion: A total of 113 cases were studied: 29 cases of falls from one's own height, 21 cases of falls downstairs, and 63 cases of homicidal blows. Cases of falls downstairs revealed a male:female ratio of 6:1 with an average age of 50 (\pm 14.3 years ranging from 26 to 79 years), while the ratio for falls from one's own height was 8.7:1 with an average age of 51.5 (\pm 17.5 years ranging from 15 to 85 years). Cases of blunt head trauma to the head showed a male:female ratio of 2.9:1 with an average age of 44 (\pm 19.8 years ranging from 9 to 81 years).

The goal of this study was to improve the discrimination between falls and homicidal blows by a blunt weapon in a forensic pathology setting. The request to give an expert opinion on this distinction is a common and crucial one given the legal consequences. Overall, based on the present study as well as previous ones, the criteria pointing towards blows are:

1. More than three lacerations
2. Laceration length of seven cm or more
3. Comminuted or depressed calvarial fractures
4. Lacerations or fractures located above the HBL
5. A left side lateralization of lacerations or fractures
6. More than four facial contusions or lacerations
7. Presence of ear lacerations
8. Presence of facial fractures
9. Presence of post-crani

Blunt Head Trauma, Falls, Homicide

G43 Glioblastoma – Cause of Sudden Death on an Apparently Healthy Woman

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After attending this presentation, attendees will learn the importance of performing a complete autopsy in cases of sudden unexpected death, completed with a meticulous neuropathological examination, mainly in the cases where an extracranial cause of death was not found.

This presentation will impact the forensic science community by the report of a very rare case of sudden unexpected death by an undiagnosed glioblastoma.

Sudden unexpected deaths due to primary brain tumors are very rare in forensic pathology practice. Nowadays, most fatal brain tumors are diagnosed before a fatal outcome, based upon neurological manifestations and imaging techniques, such as computed tomography and magnetic resonance imaging. Glioblastomas are the most common primary brain neoplasms and account for more than fifty percent of the malignant gliomas. Usually they cause headaches, seizures and focal neurological deficits according to their anatomic location in the brain.

A case of a 44-year-old woman, who was found dead in her bed, resting naked with her body lying down ventrally. According to relative's statement she was apparently a healthy woman.

The autopsy revealed a vast "froth mushroom" covering her mouth and nostrils, as well as a marked cerebral edema with a cystic yellow lesion on the white matter of the right fronto-parietal lobe, surrounded by hemorrhagic foci. Neuropathological examination established the diagnosis of glioblastoma, grade IV according to WHO (World Health Organization).

The importance of performing a complete autopsy in cases of sudden unexpected death, complemented with a meticulous neuropathological examination, mainly in the cases where an extracranial cause of death wasn't found will be highlighted.

Glioblastoma, Brain Tumor, Sudden Death

G44 Stab Wounds, Incised Wounds, or Blunt Trauma With Single or Multiple Weapons – How to Read Soft Tissue and Bone Injuries

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The goal of this presentation is to remind attendees of the importance of careful observation in all autopsies performed (either on the skin or internally in soft tissues, organs and even bones), in order to know how to correctly classify injuries, as well as to establish a relationship between both the external and internal injuries and the weapon(s) involved. By combining the knowledge of all these elements, the pathologist will then be able to better read the wounds' language.

This presentation will impact the forensic science community by advocating a return to the basics in the analysis of wounds. Also defended is the need for pathologists to be highly trained in clearly distinguishing incised, blunt and ballistic trauma, and to be prepared to solve difficult cases with mixed and atypical injuries, such as the one presented here. It is argued that the best interpretation of autopsies will come from those who use all these capacities and experience in every case, providing good answers to the questions aroused from the criminal investigation.

A young woman that was found dead in her home, laying on the bed, dressed; the body, clothing, and sheets stained of blood. Profuse blood spatters were visible on the walls and floor. Fragments of cement were found aside of the left hip. The victim presented at autopsy with typical incised wounds in the arms, neck and in the scalp, some of them with a tail. The scalp wounds had an internal translation as bone cut marks. However, these marks had different shapes and particular patterns. Underneath one of the incised scalp wounds there was also a skull fracture of the right zygomatic and frontal bones and cerebral laceration.

The injuries of the head, neck, and arms, suggested at first a knife. However, after examination of the deeper head injuries, it was found that although they appeared incised, the margins were not so clean as usual, and some of the bone cut marks showed one clear cut margin and little splinters on the other margin. Consequently, the knife assumption was discarded and instead, an axe or a similar tool was considered as a hypothesis, reinforced by the blunt trauma seen on the right side of the skull. Nevertheless, one abraded tangential lesion of the skull and the undulated shape of one of the cut marks lead us to look for another weapon that could produce blunt trauma and incised-blunt trauma at the same time – or to consider two different weapons.

This presentation will discuss the possible weapon(s) used to produce the different and complex injuries described, matched to the skin, subcutaneous tissues, organs and bones patterns of wound. The lethal wounds will be identified and possible defense lesions among the multiple injuries observed. Hypothesizing the existence of one or more aggressors and estimating the position versus the victim is also debated.

The solution of this case was found by the police in the main suspect's van (the victim's husband) near other material that as a builder, worked with: a bloody shovel – that fit with all the injuries found.

It was concluded that, facing complex and contradictory lesions such as the ones presented in our case, the pathologist should interpret them all, provide information about the weapon or weapons probably involved, determine those that produced the death, and the position of the aggressor vs. the victim, among other objectives that may appear during the investigation. He/she must be prepared, experienced, and able to read the wound language written in different morphological supports, including skin, soft tissues, and bone.

Cut Marks, Blunt, Shovel

G45 Sudden Infant Death Syndrome and Infant Mortality in Serbia

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After attending this presentation, attendees will understand possible pitfalls in infant death evaluation, in particular, related to sudden infant death syndrome (SIDS). The attendees should also become familiar with major gaps in data integration between forensic pathology institution and public health system.

This presentation will impact the forensic science community by providing figures on SIDS cases for a ten-year period (1998-2007). Data from two sources, autopsy records from the Institute of Forensic Medicine in Belgrade and the State Office of Statistics are provided, compared, and commented.

A review of 93 cases of SIDS will be presented within a ten years period where 6,980 deaths of children under the age of one year have been recorded. Issues of SIDS autopsy diagnostic and current legislation pertinent to postmortem examination is widely discussed.

Infant Death Evaluation, Sudden Infant Death Syndrome, Public Health

G46 Fatty Versus Fibrofatty Involvement of the Myocardium in Sudden Death and Heart Failure

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After attending this presentation, attendees will recognize the pattern of pathologic and histologic findings as correlated to clinical information from cases within the spectrum of fatty cardiomyopathy including arrhythmogenic right ventricular cardiomyopathy.

* Presenting Author

This presentation will impact the forensic science community by reviewing clinical and pathological data as well as associated histology for sudden cardiac death cases from the spectrum of fatty cardiomyopathy and arrhythmogenic right ventricular cardiomyopathy. Forensic and cardiovascular pathologists, as well as other forensic scientists, may find this information useful for comparison with observations from their home institutions and practices.

Arrhythmogenic right ventricular cardiomyopathy (ARVC) is a genetically determined heart muscle disease characterized by fibrofatty replacement of myocardium in the right ventricle (RV) and to lesser degree in the left ventricle. ARVC is commonly associated with sudden death and heart failure. Isolated infiltration of the RV by fat alone is also believed to be associated with sudden death. However, the ARVC phenotype versus that characterized by isolated fatty infiltration alone have an unclear separation. Such lack of clarity makes pathological evaluation of sudden death in these circumstances very challenging. While genetic testing for mutations in genes known to be associated with ARVC would aid in rendering a diagnosis, that approach is not practical in everyday pathology practice. One other possible strategy in better delineating phenotypic variation might be immunohistochemical staining and quantitative evaluation of proteins related to genetic mutations underlying some ARVC phenotypes.

Purpose and Approach: In this study, heart case materials from autopsy (8) and cardiac transplantation (2) from patients with ARVC and fatty infiltration of the RV are characterized. Each case was accessioned in the iCAPTURE Cardiovascular (CV) Biobank at St. Paul's Hospital/University of British Columbia and each case was referred to a cardiovascular pathologist at the CV Biobank for assessment. Under approved ethics protocols, patient data were obtained from medical records or referring pathologists. The CV Biobank, a research and educational tool, was established in 1982 and includes cardiovascular tissue specimens from surgery and autopsy, along with their accompanying annotations and data held in a secure database.

Methods & Results: The Ten sets of case materials were archived between 1993 and 2008. All hearts were assessed for their macroscopic and microscopic features with confirmation by at least two observers. The specimens were found to fit into one of two patterns. Nearly two-thirds demonstrated **fibrofatty** (6 male, age = 17-36 years) replacement of the RV myocardium, while about a 1/3 showed a pattern of predominantly **fatty** replacement (2 male, 2 female; age = 15-64 years). Within the fatty replacement group, individuals died during non-strenuous activity and at rest. In this group, one individual had a history of fainting and clinical intervention for arrhythmia and one patient had a history of anorexia and bulimia. In the fibrofatty replacement, group patients died following non-strenuous activity, during strenuous activity and at rest. This group of patients included one individual with documented familial ventricular tachycardia for which he received treatment, one patient with dilated cardiomyopathy and mitral valve regurgitation, and one individual with sudden death of a brother due to an unspecified "aneurysm". Quantitative computer-assisted morphometric analysis confirmed two pathological phenotypes, fibrofatty and fatty. Of interest, the distribution and extent of involvement differed substantially between fibrofatty and fatty patterns, with changes being more extreme and widely distributed in the fibrofatty group, while localized to the anterolateral apex and lateral base in the fatty category. None of the hearts studied had a notable cellular inflammatory element. Further, immunohistochemical staining was performed on all heart cases for desmosomal protein plakoglobin, a protein that links adhesion molecules at the intercalated disk to the cytoskeleton and is thought to aid in the evaluation of ARVC.

Summary and Conclusion: Fibrofatty replacement of the RV, characteristic of ARVC, and fatty infiltration of the RV alone are distinctive phenotypes in the setting of sudden cardiac death and heart failure. The distinctly different extent and distribution of involvement between the two morphological patterns supports the concept that they represent different disease processes. Further, preliminary quantitative

analysis of immunohistochemical staining for plakoglobin suggests that such staining may aid in the assessment and distinction of these two conditions.

ARVC/ Fatty Cardiomyopathy, Cardiovascular Pathology, Sudden Cardiac Death

G47 A Homicide Due to an Atypical Asphyxiation Tool: A Rolling Pin

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The goal of this presentation is to present an unusual case of homicide asphyxia due to an atypical compression of the neck by a rolling pin.

This presentation will impact the forensic community by discussing the rarity of the deaths due to rolling pins utilized as an asphyxiation tool, the particular features of macroscopic lesions caused by the tool, and for the importance of a careful autopsy examination with an immunohistochemical study in order to clarify the exact mechanism of the death.

Death by asphyxia can present in various different ways. It is usually determined by typical actions imputable to an asphyxial agent of compression on the neck, usually classified as throttling, strangulation, hanging, and mugging. All these tools can cause an external compression of the neck. Various atypical forms have been described, caused by rods or sticks used to compress the neck anteroposteriorly, by wooden rods with cords or screws attached to their extremities used in garroting, by violent pulling of the neck backwards in a pincer movement between the forearm and arm in mugging, or by compression of the victim's neck by the aggressor's knee or foot. In this case, the tool used to kill was a rolling pin.

On December 1, 2008, at 3:00 p.m., a man called the police and said that he found his wife dead. The police and the forensic pathologist went to the crime scene and found the body of a 74-year-old Caucasian woman inside of the kitchen of her own house. The woman lived in the house with her husband and her only son. The corpse was lying supine on the floor. She was fully and tidily dressed, the head rested on a pillow, the arms were adducted to the trunk, the forearms were on the abdomen, and the legs were extended and slightly spread.

Close to the shoulder of the woman, on the floor, under a metallic feet-stool, was a brown wood rolling pin with a length of 79.5 cm, maximum circumference of 11 cm, diameter of 3.5 cm, and weight of 530 g. The thanatological data recorded by the forensic pathologist called to the scene stated that, at the time of discovery (4:00 p.m.), the corpse did not show rigor mortis, and the hypostasis blanched with finger pressure but was congruous with body position. The rectal temperature was 35 °C and ambient temperature was 24 °C. The prosecutor arranged for an autopsy because the circumstances of the death suggested that it was an homicide, and made inquiries about the son and the husband.

A complete autopsy was performed twenty-four hours after death. The external examination showed a remarkable cyanosis of the face, lips and nails; skin petechial hemorrhages in frontal and periorbital region, and mucosal petechiae on the oral vestibule and conjunctivae. On the neck were two parallel, horizontal, oval shape, mild blue bruise areas, the first on the anterior face of the neck (measuring 2.3 cm x 1.8 cm) and the second on the left mandibular region (measuring 2.8 cm x 2.4 cm). Dissection of the neck revealed thin hemorrhages in the subcutaneous tissues and in both sternohyoid and sternothyroid muscles and right thyrohyoid muscle. The esophagus, larynx, and trachea were unremarkable. Subpericardial and subpleural petechiae were observed. The other organs did not show specific alterations except for an intense vascular congestion. Skin sections for histological examination were removed at the neck in long strips perpendicular to bruises. Sample of

muscle tissue were also taken at the neck (sternohyoid, sternothyroid and thyrohyoid muscle). The histological examination showed mild hemorrhages in the cutaneous and subcutaneous tissues, and in the muscles. The stratum corneum of the epidermidis was detached and the dermis was split from the epidermis. An immunohistochemical study was performed to assess the vitality of the skin injury with antibodies to CD 15, IL15, and tryptase and the microscopical observations showed a strong positivity of tryptase, IL15 and weaker reaction to CD 15. Moreover, histological investigation of other organs showed mild cerebral and pulmonary edema, focal emphysema, and perivascular and intra-alveolar hemorrhages. The toxicological analysis was negative. According to the examination of neck bruises, autopsy findings and histological data, the mechanisms of death was consistent with asphyxia. Death was attributed to an external neck compression, and the tool that caused the death was perfectly compatible with the rolling pin found on the floor near the body. Fingerprints belonging to the son were identified on the rolling pin. Detailed examination of the crime scene and autopsy, along with the investigation of the psychological background of the son produced clear evidence that killer was the son and few days he confessed to the murder.

Rolling Pin, Atypical Asphyxia, Vitality Lesions

G48 Use of Volatile Organic Compounds and Chemometric Procedures to Determine Postmortem Interval

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After attending this presentation, attendees will be familiar with the use of volatile organic compounds and chemometric procedures for the estimation of postmortem interval (PMI).

This presentation will impact the forensic science community by further developing a chemical method to estimate the postmortem interval, which can be applied to death investigations, when traditional PMI estimations may fail.

An important aspect of any death investigation is to determine time since death, or postmortem interval (PMI). Establishing the PMI is important for identifying and eliminating suspects as well as helping to reconstruct the crime. However, unless eye-witnesses are known, it is difficult to establish when the death occurred. Many of the current methods that are used for PMI estimation involve gross changes to the body and are only useful for the first few days after death. However, after death, chemical changes also occur within a body. This research has focused on the chemical changes that occur in individual viscera to estimate the PMI. The purpose of this initial work was to identify biomarkers that can be useful for the estimation of the PMI.

An initial *in vitro* study was conducted on four viscera (heart, lung, liver, and kidney) harvested from two different pigs. Samples were collected from all viscera and from different areas within each viscus throughout the decomposition process. All samples were homogenized in a tissue grinder, extracted, and derivatized prior to analysis by gas chromatography-mass spectrometry (GC-MS). Total ion chromatograms (TICs) were assessed initially and, through mass spectral interpretation, major volatile organic compounds (VOCs) that are potentially important biomarkers, were identified. Principal components analysis (PCA) was then applied to identify differences in VOCs for samples collected from different areas of the same viscera, as well as differences in VOCs in different viscera. Compounds that showed minimal variation within a viscera and between viscera were selected as biomarkers for PMI estimation. It is important to identify biomarkers that do not have wide variability, in order to allow for accurate PMI estimation. The changes

in abundance of these biomarkers in each viscera, over time, were observed and used to create a model that could be used to estimate the PMI. Samples from each viscera were collected from both pigs over time and analyzed by GC-MS. The abundances of the VOC biomarkers were normalized to an internal standard and plotted as a function of accumulative degree days (ADDs) in order to estimate the PMI. The results of these studies will be presented and discussed along with the implications for PMI determinations using the developed model.

Postmortem Interval, Chemometrics, Volatile Organic Compounds

G49 A Comparison of Drug-Related Deaths in Tarrant County, Texas, With Law Enforcement Seizures of Illicit Substances Over a Similar Time Frame

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After attending this presentation, attendees will have an awareness of the most recent pattern of abuse of illicit substance use in Tarrant County and understand which substances are responsible for the most lethal intoxications in this Texas county.

This presentation will impact the forensic science community by sharing recent information on substance abuse and lethal intoxication in one community. It should also encourage similar studies and the sharing of this information between law enforcement and forensic laboratory personnel.

Hypothesis: There is a change in the pattern of drug-related deaths and substance abuse in Tarrant County.

Methods: Information covering the last twelve months, from three laboratories which do testing for law enforcement agencies in Tarrant County, Texas have been gathered and synthesized. These laboratories perform toxicological analysis on autopsy fluid and tissue, and on evidence seized by law enforcement officers. The results and pattern of substances in fatal intoxications and in drug seizures over a related period of time have been compared.

Results: Tarrant County is a Texas county with a population of approximately 1.7 million which includes its largest two cities, Fort Worth and Arlington which have populations of approximately 650,000 and 650, 000 respectively. The county covers an area of 897 square miles, over thirty incorporated cities and towns and covers urban and rural territory. The demographics of the population include a diverse racial and age makeup and includes more than fifteen different school districts. The Tarrant County Medical Examiner's Office, along with two regional labs serves over 100 county law enforcement agencies. All three labs have cooperated to produce this data.

Although there are differences in the statistics gathered by each laboratory, all have seen a distinct change in the pattern of drug abuse over the last few years. These changes include the emerging popularity of certain prescription drugs as well as illicit drugs, and the appearance of new designer drugs such as "cheese", benzylpiperazine (BZP), 3-trifluoromethylphenylpiperazine (TFMPP) and others. The three laboratories serve different size towns and cities and the drugs seized from these communities follow certain trends, so the laboratories see a different spread of cases in seizures from the small towns than in seizures from the larger communities. In the small towns, law enforcement seizures tend to yield the highest incidence of methamphetamine, ecstasy and pharmaceuticals. The larger towns and cities' cases more frequently involve cocaine and heroin. These findings are consistent with national reports.

Conclusion: The pattern of drug-related deaths and abuse of illicit substances has changed through the years. This study reports some of the changes seen recently. These include the increase in popularity of

certain prescription drugs and the appearance of “new” drugs of abuse and a change in the drugs responsible for acute intoxication and fatal overdose.

Substance Abuse, Lethal Intoxication, Illegal Substances

G50 Nocturnal Oviposition of Blow Flies (Diptera: Calliphoridae) in the Lower Mainland of British Columbia, Canada

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After attending this presentation, attendees will better understand the nocturnal egg-laying behavior of several of the blow fly (Diptera: Calliphoridae) species that commonly inhabit suburban regions of the Lower Mainland of British Columbia, Canada.

This presentation will impact the forensic science community as it will discuss the potential implications of nocturnal oviposition of blow flies (Diptera: Calliphoridae) on postmortem interval (PMI) estimations in human homicide investigations.

The most important and common use of forensic entomology is to estimate the elapsed time since death. Specifically, the postmortem interval (PMI), defined as the minimum time that has elapsed since death, is determined through the analysis and identification of the forensically important insect species present at the crime scene. An accurate PMI estimation has been proven very valuable in homicide investigations as it points the investigators toward the correct time frame.

Nocturnal oviposition of blow flies has not been investigated in Canada; therefore, the potential effect of its presence on the PMI was unknown. If some or all of the blow fly species in British Columbia were found to lay eggs at night, this could have major implications in the Canadian Criminal Justice System, as the presence of nocturnal oviposition could alter the PMI by up to eight to twelve hours. Such an error rate could lead to the appeal of previous cases in which conviction was based on the assumption that nocturnal oviposition does not occur. This may also play a role in unsolved homicides, as suspects would have originally been interrogated based on a time of death that was incorrect.

In this study, six beef liver baited inverted cone traps were put outside in a suburban garden on individual days in July and August in order to monitor the egg-laying behavior of local blow fly species. Individual experimental days were chosen based on an expected nocturnal minimum temperature of greater than 12°C. Oviposition was monitored over twenty-four hour periods in two locations, one with complete darkness nocturnally and one in the presence of artificial light produced from a high pressure sodium street light. The bait was replaced with fresh bait every four hours and the number of eggs was visually estimated. The eggs were then reared to adulthood at the Centre for Forensic Research at Simon Fraser University, for species identification. The use of these traps also allowed for the nocturnal activity levels of blow flies to be assessed as active adults were caught in the plastic bag attached to the top of the trap.

In this experiment, no eggs were ever found after sunset or prior to sunrise on any of the experimental days. The artificial street light was not sufficient to stimulate egg laying at night. The three species that were primarily caught were *Calliphora vicina* (Robineau-Desvoidy), *Lucilia sericata* (Meigen), and *Lucilia illustris* (Meigen). No calliphorid adults were caught after sunset or before sunrise, except on one night, in which three *L. sericata* adults were caught post sunset in two different traps. Based on these results, forensically-important blow fly species in this region do not nocturnally oviposit or remain active at night.

This experiment is the first of its kind to be done in Canada and therefore, these results suggest that the assumption of no nocturnal oviposition that has been used for many years by the Canadian Criminal

Justice System and local forensic entomologists is likely to be accurate. As a result, this research will allow forensic entomologists to estimate time of death in future B.C. homicide investigations with greater accuracy and confidence.

Forensic Entomology, Nocturnal Oviposition, Blow Flies

G51 Blood Aspiration as a Vital Sign Detected by CT Imaging and Postmortem CT Guided Biopsy

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After attending this presentation, attendees will have learned about the possible contribution of multi-detector computed tomography in forensic investigations on blood aspiration.

This presentation will impact the forensic science community by suggesting that the execution of a CT scanning prior to autopsy in cases suspected for occurrence of blood aspiration may avoid misdiagnoses and provide an easier and immediate visualization of distribution and severity of aspiration.

Based on the proved efficient role of the modern cross-sectional techniques as complementary/additional tool to traditional forensic methods, the aim of this study was to examine the value of postmortem CT imaging in evaluating pulmonary findings related to blood aspiration, compared to traditional forensic pathology techniques.

Identification and correct interpretation of blood aspiration is of substantial importance in forensic cases, as this finding can provide the forensic pathologist with information on whether an injury occurred intravital or postmortem, and give suggestions on the cause of death.

Between January 2005 and December 2008, at the Institute of Forensic Medicine in Bern a total of 359 human corpses underwent MSCT scanning prior to autopsy, within the project. Thirty-seven non-decomposed bodies where blood aspiration was documented with the traditional examinations, or where blood or bloody fluids were found in the airways from larynx to small bronchi were selected. A total of thirty-one cases had demonstration of aspiration in lung parenchyma on autopsy inspection or on histological analysis. The remaining six cases all showed blood or bloody fluids in the airways. Blood aspiration was reported in final autopsy reports as being the primary, assisting or competing cause of death in seven cases. All cases underwent body CT scanning on a six slice scanner. Two- and three-dimensional reconstructions were obtained at a workstation. The images were assessed for presence, entity, density and composition of material in the airways, and for presence, entity and distribution of lung density alterations. The possibility to consider blood aspiration as cause or assisting cause of death was also assessed.

In one exemplary case, biopsy-specimens from abnormal regions of the lungs have been obtained under CT fluoroscopy guidance for histological examination.

The thirty-one cases with traditional demonstration of aspiration in lung parenchyma had ground glass opacities suggestive for blood aspiration on pulmonary CT imaging. In the six remaining cases CT imaging detected pulmonary abnormalities suspected for blood aspiration that was not mentioned in the final autopsy reports. In two cases among these, the route of aspiration was evaluated on the basis of injuries detected by whole body CT images as being anterograde and of

scarce severity, in one case retrograde, and in three combined. The biopsy specimens obtained in the one case confirmed the occurrence of blood aspiration. The concordance between post-mortem CT imaging and traditional techniques in attributing primary, assisting or competing cause of death to blood aspiration was of 71%.

Our results show the superior sensitivity of post-mortem CT imaging in detecting areas suspected for blood aspiration in some particular cases of blood aspiration of scarce severity, or when pulmonary injuries are associated. In these circumstances, the typical macroscopical findings on the lung inspection may be absent or be largely concealed by other alterations. Thus, postmortem CT can be excellently used in these cases to guide the forensic pathologist during lung tissue investigation, and to provide focused specimens for the histological examination.

Moreover, postmortem two and three dimensional CT techniques have been proven by this study to be a great device to better analyze distribution and amount of aspirated blood and to document and conduct hypotheses on the cause of death. With the traditional diagnosis of a fatal blood aspiration (made through the analysis of just few slices of the lung tissues considered representative for the whole pulmonary volume) information about the real extent and distribution of this phenomenon is lost. On the contrary, CT imaging techniques can provide a complete collection and documentation.

The analysis of post-mortem CT images of lungs and airways alone doesn't offer in many cases enough data to distinguish with certainty pulmonary findings due to blood aspiration and lung alterations due to other causes. Nevertheless, it should be considered a fundamental, highly suggested complementary tool to traditional autopsy techniques in cases of blood aspiration to avoid misdiagnoses and to provide complete and exhaustive description of the severity of the phenomenon.

Blood Aspiration, Postmortem CT, Postmortem Needle Biopsy

G52 Brain Tissue Responses After Traumatic Brain Injury in Animal Models

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After attending this presentation, attendees will more clearly understand the types of animal models of traumatic brain injury (TBI), the significance of experimental studies of TBI and the mechanisms of brain damage after TBI.

This presentation will impact the forensic science community in aiding the understanding of the mechanisms of brain damage after closed and open head injuries. These studies also show the sequential changes occurring in the brain after TBI: changes that should be useful for estimating the time after trauma in cases of head injury.

TBI can be caused both directly, by immediate mechanical disruption of brain tissue, and indirectly, by delayed injury mechanisms that include intracranial hemorrhage, brain edema, and hypoxic/ischemic damage. Whereas human TBI is a highly complex multifactorial disorder, animal models of TBI are able to focus on various specific factors involved in TBI and so have helped develop a better understanding of pathophysiology after brain injury, including changes in cellular and molecular pathways. The commonly used models that replicate human closed head injuries are fluid percussion, controlled cortical impact, weight drop and freeze injury models. Utilizing these models allows us to produce a controlled range of severity of brain injury.

The magnitude- and time-dependent changes after TBI in a rat fluid percussion model was studied. The focus was on synaptophysin (SYP), a molecular marker of synapse. SYP immunoreactivity increased in both the cortex and subcortical white matter with increasing magnitude of injury and time after trauma. Increased SYP immunoreactivity was

accompanied with neuronal degeneration and glial cell proliferation. The amount of SYP remained unchanged in brains after trauma. These findings indicated that after trauma, SYP accumulates at injured sites of neurons without any change in SYP content. The increased SYP immunoreactivity in the cerebral cortex following traumatic injury reflects an inhibition of synaptic vesicle transportation and synaptic dysfunction, thus providing a histological substrate for brain dysfunction.

In cases of open head injuries, a foreign body may remain in the brain for a period of time after the trauma. A animal model incorporating a foreign body in the brain was developed. The time-dependent brain changes caused by a foreign body was studied. A lead or a glass ball was used as the foreign body and was implanted in the cerebral cortex of rats. Brains were analyzed at various times between twelve hours and four weeks after implantation. Results from brains with a lead ball were compared with those with a glass one. The number of macrophages increased significantly with increasing time after implantation of a lead ball. Multinucleated giant cells appeared at three weeks in brains with a lead ball. The immunoreactivity of metallothionein, a metal binding protein, increased significantly in astrocytes and endothelial cells with increasing time after implantation of a lead ball. Moreover, apoptotic cells were identified at two weeks, but had mostly disappeared at four weeks after implantation of a lead ball. Apoptotic cells were not observed in brains with a glass ball. This study showed that lead leached from a lead ball induces macrophage infiltration, metallothionein expression and apoptosis in the brain.

Forensic Neuropathology, Head Injury, Experimental Model

G53 Determination of Procalcitonin, C-Reactive Protein, Tumor Necrosis Factor-Alpha, Interleukin-6, and Interleukin-8 Levels in Serum, Vitreous Humor, and Cerebrospinal Fluid as Markers of Sepsis

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The goal of this presentation is to evaluate the potential role of procalcitonin, C-reactive protein, tumor necrosis factor alpha, interleukin-6 and interleukin-8 levels in different biological fluids (serum, vitreous humor and cerebrospinal fluid) as markers of sepsis, to evaluate the stability of these markers at different measurement times after collection, and to evaluate additional benefits of combined analysis of the mentioned markers compared to procalcitonin and C-reactive protein alone.

This presentation will impact the forensic science community by evaluating different markers that can be useful in postmortem diagnosis of sepsis.

In forensic pathology routine, a well-documented medical history is often not available for a deceased person and sepsis as the cause of death remain difficult to diagnose. In fact, postmortem blood cultures are often contaminated by putrefaction processes and macroscopic postmortem findings (such as myocardial ischemia, pulmonary edema and hemorrhages, hypoxic liver damage, mesenteric and gastrointestinal hemorrhages, spleen infarctions and septic spleen alterations, kidney ischemia, and brain edema), as well as routine histological findings, may have an infectious or non-infectious origin and are neither specific nor sensitive for recognizing sepsis-associated fatalities.

The observation by Assicot and coworkers that serum procalcitonin levels increase above normal values in patients with bacterial sepsis, but not in patients with viral infection or without infection, has generated considerable interest in this marker.

A large number of clinical studies have investigated procalcitonin levels and courses of procalcitonin levels under various clinical conditions and they concluded that procalcitonin is valuable as a marker of serious bacterial sepsis and show a good correlation with the severity of the disease. In different groups of patients with sepsis, procalcitonin was compared to C-reactive protein (CRP), tumor necrosis factor alpha (TNF- α), interleukin-6 (IL-6), interleukin-2 (IL-2), interleukin-10 (IL-10) and interleukin-8 (IL-8) as a diagnostic and prognostic parameter. The results commonly showed that procalcitonin exhibits a greater sensitivity and specificity in differentiating patients with systemic inflammatory response syndrome (SIRS) from those with sepsis.

Tsokos and co-workers have investigated procalcitonin, C-reactive protein and interleukin-6 in postmortem serum as a marker of sepsis. Their results show that serum procalcitonin levels can be considered as a valuable postmortem marker to distinguish sepsis-associated fatalities from other non-septic causes of death. Compared to other potential biochemical postmortem markers of sepsis, procalcitonin has several advantages: in contrast to tumor necrosis factor alpha and interleukin-6, procalcitonin has a long half-life (25 to 30 hours); in comparison to cytokines, procalcitonin is a very stable protein, even at room temperature; procalcitonin concentrations do not differ in arterial and venous blood samples from living persons; repeated freezing and unfreezing of the blood samples does not significantly influence procalcitonin concentration.

Levels of C-reactive protein and interleukin-6 may increase very rapidly in response to inflammation of infectious origin; however, significantly elevated C-reactive protein and interleukin-6 levels can also be demonstrated in a large number of life-threatening clinical conditions, such as major trauma, extensive surgical procedures or burn injury, as a result of the systemic inflammatory response syndrome, irrespective whether the patient develops a sepsis or not.

Statement of the Method: Postmortem blood, vitreous humour and cerebrospinal fluid samples were collected at autopsy. Two study groups were formed according to whether there was an underlying septic condition as the cause of death based on the subject medical records as well as autopsy findings. Marker levels were measured at different times after collection. In the sepsis group, cause of death was multiple organ failure. In the non-sepsis group, cardiopulmonary resuscitation was not attempted in any case. Autopsy findings did not give any cause to suspect an underlying infectious disease.

Results will be presented and compared with published results in the literature.

Postmortem Chemistry, Sepsis, Diagnostics

G54 Sudden Death Due to Mesothelioma of the Atrio-Ventricular Node

Géraldine Maulean, MD, Alain Tabib, PhD, Daniel Malicier, and Laurent Fanton, PhD, Institut of Legal Medicine, 12 Avenue Rockefeller, Lyon, 69008, FRANCE*

After attending this presentation, attendees will gain much knowledge on sudden cardiac deaths, and understand that sudden cardiac deaths constitute a major health problem as one of the central topics in forensic literature. Although most cases are still attributed to complications of cardiomyopathies or coronary artery diseases, functional dysregulations are nowadays reported with an increasing frequency, due to the development of molecular autopsy. The role played by primitive cardiac tumors in sudden deaths is smaller as their prevalence is estimated to 0.05% of autopsies. Despite its rareness, mesothelioma of the atrioventricular node should be considered in the differential diagnosis of heart block in children or young adults.

This presentation will impact the forensic science community by informing attendees that the clinical presentation of a mesothelioma of the atrio-ventricular node is non-specific and may considerably vary

from sudden death to an asymptomatic patient. This presentation is the third case of sudden death in patients with pace makers. The role played by primitive cardiac tumors in sudden deaths is small as their prevalence is estimated to 0.05% of autopsies. Among such lesions, mesothelioma of the atrio-ventricular node is rare and has only been reported about seventy-five times since its first description in 1911.

Case: A 35-year-old man was found dead in the early morning by one of his friends, while he was lying on his sofa, after having lived it up with some friends. The emergency physician could only certify death. Six years previously, the man had a syncopal episode while coming out from his truck. Electrocardiography showed a type I second degree atrioventricular block. Echocardiography was normal and no curable etiology could be found. He finally had a dual-chamber pacemaker fitted a few weeks later, which had been reliably effective and well tolerated up to his sudden death. Considering the young age of the man and the sudden character of his death, a medicolegal autopsy was ordered to determine the cause of death.

On external examination, the body was that of a young Caucasian man, 164 cm in height and 80 kg in weight. Nonspecific abrasions were detected on both the right and left frontal scalp. Toxicological investigations, including alcohol, were negative. At autopsy, the only gross abnormality was a left atrophic kidney, which was 24 g in weight. The heart weighted 420 g; there was no abnormality in the epicardium or in the valves. The coronary arteries only showed a few lipidic striae. One endocavitory pacemaker lead was found located in the atrial cavity, and was involved by noninfectious vegetations. The other pacemaker lead, which was observed in the right ventricular cavity, was also affected by some fibrosis. The myocardium showed fibrosis blocks and recent left subendocardic ischemia. Left and right ventricular walls were respectively 18 and 8 mm thick. Histopathological examination revealed an extensive infiltration of the atrioventricular node and of the his bundle trunk, corresponding to a benign tumor called a mesothelioma. This tumor consisted in tubular adenoid micronodules of various sizes, lined by mesothelial cells. In the lumens, pseudo colloid eosinophilic material was found. Some areas of the tumor also showed a moderate degree of fibrosis.

On the basis of these findings, arrhythmia-related death was diagnosed, directly caused by a mesothelioma of the atrioventricular node, despite the presence of a pace maker.

Discussion: The clinical presentation of a mesothelioma of the atrioventricular node is nonspecific and may considerably vary from sudden death to asymptomatic patient, including syncopal episodes related to severe atrioventricular block, with a possible familial occurrence discussed by Travers. No correlation was found in the literature between the size of the tumor and the symptomatology observed.

This explains that the precise incidence of such a disease is quite difficult to estimate, as much as diagnosis is most often done after death when an autopsy is ordered, only nine cases having been successfully treated antemortem.

Conclusion: This report is the third case of sudden death in patients with pace maker. Despite its rareness, mesothelioma of the atrioventricular node should be considered in the differential diagnosis of heart block in children or young adults.

Sudden Death, Mesothelioma, Atrio-Ventricular Node

G55 Accidental Drowning Deaths in a Coastal Region of South India – A Ten Year Study

Tanuj Kanchan, MD*, Kasturba Medical College, Department of Forensic Medicine, Light House Hill Road, Mangalore, 575 001, INDIA

After attending this presentation, attendees will identify with the pattern and trend of drowning deaths in a coastal region of South India. This presentation will impact the forensic science community by developing an understanding of the burden of accidental drowning in the coastal region and to develop preventive strategies so that precious human lives are saved.

Accidental drowning constitutes a significant public health problem that is often neglected in our country. This study will describe the epidemiology and pattern of accidental drowning deaths in Manipal, a coastal region in South India. This study is a registry based descriptive research spanning over a period of ten years from January 1998 to December 2007. All medicolegal autopsy case records were retrospectively reviewed and the cases of death due to drowning were studied. The information obtained from autopsy reports, police investigations and toxicological analysis was registered in a database and analyzed. All deaths where the manner was recorded as suicidal or homicidal were excluded from the study.

During the study period forty cases of drowning deaths were reported. Males accounted for 82.5% of cases, male-female ratio being 4.7:1. Majority of the victims were in 2nd and 3rd decades, together accounting for 55% of drowning deaths followed by children in the first decade (15%). Fresh water drowning was reported in 70% cases. Rivers constituted the most common sites of drowning (35%) followed by sea (27.5%). Wells, canals, lakes, ponds, and water tanks were the other sites of drowning. Most (87.5%) victims of drowning were found dead. The remaining five cases died in hospitals later on. The maximum period of stay in hospital before a fatal outcome was three and a half days. Most of the accidental drownings (45%) were reported in the post monsoon period. Nearly one-third (30%) of the total drowning deaths were reported in the years 2006 and 2007.

Drowning is a major global public health problem which is amenable to prevention. The study highlights the pattern of accidental drowning deaths in Manipal, a coastal region of South India. Morbidity and mortality due to drowning can be prevented by understanding its epidemiology, common patterns and educating people about prevention. This is especially when hindsight often shows that many deaths from drowning are preventable.

Drowning, Accidents, South India

G56 Sudden Death From Atypical Pneumonia in a Healthy Adolescent

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After attending this presentation, attendees will become familiar with the possibility that a completely asymptomatic atypical pneumonia may induce sudden death, even in a previously healthy adolescent, with absence of histological signs of diffuse alveolar damage.

This presentation will impact the forensic science community by making attendees aware of the insidious development of atypical pneumonia in immunocompetent subjects, focusing the possible responsible mechanisms of sudden death in such cases, in the absence of ARDS and histological signs of diffuse alveolar damage.

The most common causes of atypical pneumonia are *Mycoplasma pneumoniae*, *Chlamydophila pneumoniae* and *Legionella pneumophila* which cause fifteen percent to as much as fifty percent of cases of community-acquired pneumonia. Other organisms include viruses; few cases are due to zoonotic agents like *Chlamydophila psittaci*, *Coxiella burnetii* and *Francisella tularensis*. Clinical and pathological patterns range from mild upper respiratory infection to severe lower respiratory tract disease. Atypical pneumonia generally is benign, with systemic complaints often more prominent than respiratory ones; fever, headache and myalgia are common. Although the clinical course is often self-limited, these pathogens can cause severe community-acquired pneumonia. The inflammatory reaction is localized in the alveolar septa that appear thickened, edematous, with infiltrates of leukocytes. In severe cases, fibrinous thrombi inside alveolar capillaries and haemorrhagic necrosis of alveolar walls are visible. Alveoli may contain scant exudate. Fibrin and hyaline membranes line the denuded alveolar walls, due to diffuse alveolar damage. Superimposed bacterial infection is common.

Case Report: A 16-year-old boy who spent all the day with his family, went to sleep after dinner. His brother checked on him after one hour and found him agonizing in an anomalous prone position, with the legs out of bed. Immediately he turned the body supine, called the ambulance, and tried to resuscitate him. When the doctor arrived, after the attempting with reanimation maneuvers, pronounced the adolescent dead. The boy had a negative history (except for a mild headache) and a negative family history for sudden death. He was a basketball player on the school team and was not known as a drug abuser. Death scene investigation was unremarkable. External examination was insignificant except for the presence of a little superficial wound on the right frontal scalp. The internal examination revealed polyvisceral congestion, cerebral and pulmonary edema, free fluid in the pleural cavities, and release of foamy material on sectioning of both lungs. The left ventricle showed a concentric hypertrophy (anterior wall 2 cm, lateral 2.4 cm, posterior 2 cm, septal 2.2 cm). The histological examination showed a pattern of massive diffuse interstitial pneumonia with markedly thickened alveolar septa with extreme congestion of capillaries, the presence of abundant eosinophilic material, and infiltrates of leukocytes. In the adjacent fields there were some amorphous eosinophilic material and erythrocytes inside the alveoli. The immunohistochemical stains revealed that the pulmonary infiltrates consisted of lymphocytes, histiocytes and plasma cells. There were some foci of leukocytes within the epicardium, and focal areas of patchy myocardial fibrosis and perivasculär fibrosis were visible, with a mild degree of myocardial hypertrophy. The encephalon showed leukocytic meningitis with subarachnoid infiltrates of lymphocytes and mild perivascular edema. The immunohistochemical analysis (RSV, HSV1, HSV2, VZV, CMV, HHV A and B, Parainfluenza Virus 1, 2 and 3, Adenovirus, Aspergillus spp., P. carinii, T. gondii) gave negative results. Additional tests were carried out to identify possible pathogenic agents through microbiological studies. Toxicological screening was negative. Molecular genetic analysis was conducted and excluded underlying heritable diseases. The decedent's parents indicated that the boy did not have the scalp injury before going to sleep, so it's possible that the boy suddenly fell to the bed, striking the bedside table and arresting in the anomalous position described by his brother. To explain the occurrence of sudden death in this case, two possible mechanisms of acute respiratory failure are hypothesized: (1) the underlying respiratory acidosis (well tolerated by a young active boy, by means of an induced tachypnoea) and hypoxemia may have conducted to tachycardia and deteriorating hemodynamics. This instability may have elicited a lethal ventricular arrhythmia supported by a mechanism of re-entry, considering that the boy's heart showed diffuse areas of patchy fibrosis; and (2) the irritation of the adjacent cerebral cortex by inflamed meninges may have caused epileptic seizures. Seizure activity can disrupt normal physiological regulation and control of respiratory and cardiac activity (similar to mechanisms operating in cases of sudden

death in epilepsy), precipitating the unstable equilibrium present at lung level (reduction in gas exchange due to massive interstitial pneumonia), causing an acute respiratory insufficiency.

Sudden Death, Atypical Pneumonia, Meningitis

G57 Virtopsy Project - Postmortem Needle Biopsy of the Lungs: A Feasible Tool for the Study of Fat Embolism as Vital Reaction

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After attending this presentation, attendees will learn how to overcome the diagnostic gap of postmortem cross-sectional imaging in detecting the occurrence of fat embolism as vital reaction, by using percutaneous needle biopsy techniques.

This presentation will impact the forensic science community by demonstrating how percutaneous needle biopsy technique can improve the diagnostic accuracy of postmortem imaging investigations on pulmonary fat embolism as vital reaction within the concept of a minimally invasive virtual autopsy.

Pulmonary fat embolism, usually, and pulmonary embolism of bone marrow, always, can be considered indicative for antemortem violence. In fact, it is a vital phenomenon after trauma, depending on the pumping action of the heart and an intact circulation. The postmortem diagnosis of pulmonary fat embolism is traditionally based on the histological demonstration and analysis of fat droplets within the lung microcirculation.

The study population consisted of twenty-six randomly selected autopsy cases examined from September 2008 to November 2008, delivered to the Institute of Forensic Medicine of the University of Berne.

In each case, probes from both lungs were obtained using two different sampling methods. Prior to the autopsy, multiple postmortem biopsies from both lungs were executed using clinically approved and postmortem tested ACN-III biopsy core needles (14 gauge -160 mm) with an automatic pistol device. Then, during the traditional autopsy of the same cases, other thin slices of lung tissue from both lungs were taken, using a double-edge knife technique. The double-edge knife consists of a blade sharpened on one or both slides to which a second blade, similar in size and shape, is added on the side, folded out by means of a joint. A knurled nut regulates the distance between the blades, and thus the slice thickness.

All the samples were subjected to water storage and Sudan III staining. The microscopical examination was then performed by six board certified forensic pathologists, and scores were assigned according to the grading scale by Falzi et al. A comparison was made between the results of the histological examinations on both lung specimens from the twenty-six death cases, obtained with postmortem needle biopsy and double edge knife techniques respectively. A statistical analysis of the results was performed.

The statistical analysis conducted separately for each sampling technique showed no significant differences in the grading score for the samples from both lungs obtained with the two techniques. Moreover, it was demonstrated that the six forensic pathologists evaluated homogeneously the slides obtained by both lungs. Absence of pulmonary fat embolism was detected in the same cases investigated by

both techniques. With respect to the assigned grading score, a statistically relevant discrepancy between the results of the histological examination conducted on samples by the needle biopsy and double edge knife techniques was found in six cases. Nevertheless, the discrepancy was not systematic, because in three cases the analysis conducted with needle biopsy gave results bigger than that with double edge knife, and in the other three smaller.

In conclusion, this study demonstrates that postmortem pulmonary biopsy, if compared with double edge knife technique, can represent a feasible method of specimen collection for detecting and analyzing pulmonary fat embolism as vital reaction.

Although further studies are needed, the application of post-mortem percutaneous needle biopsy methods to forensic investigations on fat embolism as vital reaction could be able to improve the diagnostic accuracy of postmortem imaging examinations, and even more, the possibility of a minimally invasive virtual autopsy can be envisaged for select cases.

Pulmonary Fat Embolism, Percutaneous Needle Biopsy, Postmortem Imaging

G58 Cerebral Artery Thrombosis After Penetrating Oral Trauma: An Exceptional Autopsy Case

Renaud Clement, MD, 1 Rue Gaston Veil, Nantes, 44093, FRANCE*

After attending this presentation, attendees will understand the mechanisms of interruption of intracranial cerebral circulation by thrombosis arising in the anterior cerebral artery as a result of penetrating oral trauma.

This presentation will impact the forensic science community by presenting the forensic examination supported by the histological findings. Microscopic examination made it possible to establish the exact causes and vascular consequences of the impalement; they explain perfectly the clinical symptomatology, as well as its neurologic evolution.

A young man fell onto a metal rod at a construction site. The accident resulted in perforation of the oropharynx. After several hours, right hemiplegia developed.

Complementary examinations revealed left middle cerebral artery thrombosis. Forensic autopsy performed after the death of the patient revealed left sylvian artery thrombosis extending into the left intracranial carotid sulcus, into the left internal carotid artery and into the left anterior cerebral artery. Skull base exploration demonstrated a fracture of the left internal tip of the petrous bone. There was a breach of the intima in the anterior communicating artery and extensive thrombosis extending to the anterior, middle and internal cerebral arteries, and to the internal carotid arteries. As the adventitia was spared, this indicated indirect injury to the anterior communicating cerebral artery. This is the first description of cerebral artery thrombosis caused by indirect traumatic injury to this artery. Although the case is clinically similar to internal carotid arterial thrombosis by perforating trauma of the palate in young children, the initial clinical symptoms and signs were different, with hypoesthesia in the territories of the V2 and V3 branches of the fifth cranial nerve. These clinical findings indicated traumatic injury to the base of the skull.

Anterior Communicating Cerebral Artery, Thrombotic Process, Penetrating Trauma

G59 Does Embalming Impact Vitreous Glucose Levels?

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After attending this presentation, attendees will understand how embalming may impact the level of glucose found in vitreous fluid obtained during autopsy.

This presentation will impact the forensic science community by educating the viewer on the utility of analyzing vitreous glucose in embalmed decedents and by informing people of the valuable resource of human body donors and how they can be used to further forensic science.

This case involves an 80-year-old female who was known to be a brittle diabetic. Because of a presumed natural cause of death, the body was originally released to the funeral home. Adult Protective Services requested the coroner perform an investigation into the death due to allegations of elder abuse/neglect by a home care provider. The decedent was embalmed six days prior to autopsy using Ultra 27 (Pierce Chemicals/Royal Bond, Inc) as the arterial preservative and Restorative (The Dodge Company); both fluids are rich tissue hydrators. Most mortuary chemicals use glycerol as the main humectant. The vitreous glucose was analyzed at University of California Davis Medical Center using a GLUCm reagent on a Beckman Coulter Synchron System. The concentration of glucose is determined by measuring the rate of oxygen consumption based on the following chemical reaction:

Vitreous fluid collected at autopsy had an elevated level of glucose (544 mg/dL). The cause of death was determined to be from hyperglycemia due to diabetes mellitus with hypertensive cardiovascular disease listed as a contributing condition. The caregiver, a registered nurse, is facing criminal charges of elder abuse/neglect for failing to provide medical care.

It is not uncommon for the forensic pathologist to perform an autopsy on an individual who has already been embalmed. The interpretation of tests performed on the blood is clearly limited due to the dilution effects of the embalming process, but what about the vitreous fluid within the eyes? Is this fluid protected from the embalming process and can it be used to aid in postmortem examination? Can the value of an elevated glucose level in a post-embalmed individual be trusted or is the result falsely elevated due to contamination by an embalming fluid with high glycerol content? Was the analytical method used to measure the glucose specific for this analyte or was it unable to distinguish glycerol from glucose?

An experiment was designed to test the vitreous glucose levels on a body donor before and after embalming. The body donor was a 78-year-old female, average height and weight that died from respiratory failure and interstitial lung disease. Standard anatomical embalming was performed. The donor remains were arterially injected, and the preservation was supplemented by hypodermic injection to poorly preserved areas. The total amount of fluid injected was 951oz., much more than the funeral home had injected. The embalming solution used consists of various preservatives, disinfectants, water correctives, and humectants. A total of three samples of vitreous were obtained; the first an unadulterated sample from the un-embalmed donor, the second, also from the un-embalmed donor, was "spiked" with embalming solution by adding a drop to the test tube, and the final sample was obtained post-embalming. All samples were sent for glucose testing by the same service that tested the autopsy sample.

Results: There was a very slight increase in the post-embalming glucose level compared to the pre-embalming samples (15 mg/dL vs. 7 mg/dL), but not enough to be clinically significant. Both pre-embalming samples (neat and spiked) had the exact same result (7 mg/dL).

Conclusion: Embalming does not interfere with the analysis of glucose in the vitreous fluid when using the Beckman Coulter Synchron System with the GLUCm reagent. This study supports what has been previously published in the literature.

Autopsy, Embalm, Glucose

G60 Analysis of an Unusual Misfire of a Common Handgun

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After attending this presentation, attendees will be informed of an unusual mechanism accounting for the misfire of a common handgun.

This presentation will impact the forensic science community by illustrating the utility of cooperation between experts from different disciplines in reconstructing incidents.

There are many circumstances in which an apparent live cartridge may misfire even though the firing pin has struck the primer. Factors that contribute to those circumstances include design, manufacture, and condition of the ammunition and firearm as well as the actions of the individuals involved in the case.

In this report, a case will be illustrated in which two unusual misfired cartridges were found at the scene of the suicide of a 53-year-old woman by means of gunshot using a Glock 9 millimeter handgun.

Expert examination of the firearm and ammunition involved determined that the main factors contributing to the misfiring of the cartridges were likely the design of the firearm in conjunction with the actions of the decedent. The examination supported the conclusion that the misfires were caused by the decedent pressing the firearm slightly against her head in such a way that a safety mechanism was activated.

Questions outside of particular investigators' areas of expertise can arise during any investigation. In such cases, cooperation between experts from different disciplines is essential to understand the complexities of reconstructing incidents.

Misfire, Handgun, Glock

G61 Fatal Cardiac Perforation During Percutaneous Treatment in Iliac Artery Occlusion

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After attending this presentation, attendees will have learned of an extremely rare complication of percutaneous transluminal angioplasty (PTA) and stenting for iliac artery occlusive disease; attendees will also understand the cause of the error and verify the professional liability profiles derived from this case.

This presentation will impact the forensic science community by reminding researchers of this rare complication and the opportunity to avoid this event.

Only a complete forensic approach by means of autopsy and microscopy examination led to the conclusion for cardiac tamponade due to left ventricular wall rupture.

Aortoiliac occlusive disease (AIOD) is a common manifestation of atherosclerosis that may lead to lower limb ischemia. In this case the Trans Atlantic Inter-Society Consensus (TASC) offers guidelines for the treatment of such disease. In particular total unilateral iliac occlusions should be treated by primary stenting, reducing the risk of embolisation in iliac stenoses, and moreover the periprocedural morbidity and mortality rates. In addition, primary stenting is indicated in the presence of specific risk factors as ulcer/gangrene, smoking history, and chronic renal failure with hemodialysis. Following these directives the use of endovascular interventions for arterial occlusive lesions continues to increase consequently causing the detriment of open surgical revascularization. A careful evaluation of the various restraining parameters should precede the choice of surgical approach, to ensure the selection of the most suitable technique in each individual patient on the grounds of clinical presentation of the disease. For example, TASC lesions type A or B are best treated with angioplasty and stenting, while TASC lesions type C and D show better results with surgical treatment.

Technically PTA provides for an ipsilateral, or less frequently contralateral, common femoral artery access, crossing the lesion with a guide wire, dilating the vessel with an angioplasty balloon catheter and placing a self-expandable stent. Sometimes a brachial approach is preferred, especially when many lower limb vessels are impaired. In this kind of approach it is important to pay attention at some neurological complications (i.e., hematoma that compresses the brachial plexus leading to a sensory-motor deficit) and vascular ones (i.e., pseudoaneurysm, local thrombosis or distal embolism) which have a low incidence, estimated between 2 and 13,4% (Tsetis et al, 2008).

A 68-year-old male smoker presented to the hospital with a history of bilateral and severe lower limb arterial disease. He was suffering a left common iliac arterial occlusive lesion as showed by the arteriographic examination. The patient was treated with PTA and stenting through the left brachial artery, instead of contralateral femoral approach, due to the presence of small lesions in the right leg vessels. During the procedure, the radiologist used videoscopic to help to see the part of the iliac artery concerned the occlusion without following the entire route taken by the guide wire. By doing this he did not notice that he had taken a wrong direction, passing through the ascending aorta and then going into the cardiac chambers; in a second attempt he finally was able to enter the descending aorta and reach the left common iliac artery where the stent was successfully located.

Two hours after PTA the patient suddenly died. An autopsy was arranged for investigating any professional liability profiles. A complete postmortem examination was performed three days after death.

External examination was insignificant. The internal examination revealed a cardiac tamponade without identifying the breaking point, but with evidence of hemorrhagic infiltration area in the epicardium and throughout the thickness of the myocardium at the distal part of the left ventricle. At the aortic cone level a small area of hemorrhagic infiltration, in contact with the fibrous pericardium, was found. The presence of a correctly positioned stent in the left common iliac artery was observed. Other findings concerned polyvisceral congestion, cerebral, and pulmonary edema.

The histological heart examination, performed with routine hematoxylin-eosin, revealed hemorrhagic dissection of myocardial tissue at left ventricle level consistent with a rupture of the heart, excluding natural causes of death as myocardial infarction.

In conclusion, the cause of death was attributed to a cardiac tamponade due to traumatic left ventricular rupture during PTA procedure.

This case, which has attracted medicolegal interest because of medical liability profiles that were assumed as the doctors' fault, shows a fatal PTA complication particularly uncommon, as reported by

literature. The complications rate for angioplasty selective stenting, indeed, is generally very low both for perioperative deaths (0,03-0,06% - Aburahma et al, 2007) and immediate total complications (0,7% - Kudo et al, 2005).

Iliac Artery Occlusion, Percutaneous Transluminal Angioplasty, Fatal Left Ventricular Rupture

G62 Swiss Virtobot (Virtual Autopsy) Documentation and Analysis: Work Flow and Procedure

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The goal of this presentation is to discuss the 2009 report concerning "Medical Examiners and Coroners Systems: Current and Future Needs" of the "National Academy of Sciences", it is written, that modern imaging technologies (Virtual autopsy, Virtopsy, www.virtopsy.com) has a great potential to detect forensic relevant findings. In the lecture, based on the experiences obtained up until now, the possibilities and realization of a process-optimized forensic examination procedure, including the subsequent analysis process, are illustrated.

This presentation will impact the forensic science community by presenting an overview of the techniques of forensic imaging and virtual autopsy and the effect to forensics in future and in correlation with the 2009 National Academy of Sciences report concerning, "Medical Examiners and Coroners Systems: Current and Future Needs".

Over ten years ago, the Virtopsy Project with its systematic integration of various technologies and modalities, such as photogrammetric 3D surface scanning, computer tomography and magnetic resonance scanning as well as in the area of clinical and postmortem forensic medicine as well as postmortem biopsy and angiography and synthetic somatic modeling development, was perceived by professional circles as being revolutionary.

After a decade, these technologies at the University Forensic Institute Bern have been integrated as an evolutionary process development in daily forensic practice.

The almost completed documentation procedure in the postmortem area has also influenced future image-based documentation and analysis processes in clinical forensic medicine.

Forensic Imaging, Virtual Autopsy, Virtopsy

G63 Mortuary Management in the Aftermath of the 2009 Australian Bush Fires

Jodie J. Leditzschke, PhD, Victorian Institute of Forensic Medicine, 57-83 Kavanagh Street, Southbank, Melbourne, 3006, AUSTRALIA*

After attending this presentation, attendees will have a greater understanding of the principles and logistics behind mortuary management following a mass fatality incident.

This presentation will impact the forensic science community by serving as a reference for improving the management of the dead and encouraging greater emergency preparedness within communities.

The Victorian Institute of Forensic Medicine (VIFM) is a statutory body with the responsibility to provide forensic pathological, clinical forensic medical, and related services to the State of Victoria, Australia. This includes the conduct of postmortem examinations and the provision of a range of forensic scientific investigations in cases referred by the coroner.

One of the roles of the VIFM is to provide scientific services in the event of multiple fatalities within the State of Victoria and extending to around Australia where necessary. Some of these past incidents include the 1996 Port Arthur Massacre, 2003 Bali Bombing, 2004 Tsunami and the Australian Embassy bombing in Jakarta.

On February 8, 2009 now known as Black Saturday, the State of Victoria, Australia suffered the deadliest bushfires recorded in its history. There were 173 fatalities and over 2,200 homes were destroyed. Over the following days 298 suspected human remains were admitted to VIFM.

On the day of the fires VIFM activated its emergency plan. Within 48-hours, a temporary mortuary was constructed adjacent to the existing mortuary facility. This temporary mortuary had the capacity to store up to 300 deceased persons. It was linked to the main building by a series of marquee walkways, was completely undercover and surrounded by security fencing. Additional catering and office spaces were also constructed.

Pathologists, anthropologists, odontologists, police, and mortuary assistants responded from all around Australia, New Zealand and Indonesia. The mortuary facility and staff were divided into two areas: DVI (Disaster Victim Identification) and “normal operations.”

A high priority for the mortuary was to ensure all “normal” admissions of deceased persons (those cases which were not related to the bushfires) were handled concurrently and in a timely manner. The VIFM examines approximately 3,000 deceased persons per year and in 2005 a multi-slice CT scanner was installed. This scanner has become integral to the day to day operations of the VIFM and played a major role in the identification of the victims.

On admission, each bush fire victim was given both a unique DVI and a coroner’s case number. The case was CT scanned, examined by a pathology team, an anthropologist, an odontologist, and in some instances a fingerprint expert. Where possible a DNA sample was taken. All processes, samples, labels, and paperwork underwent a quality assurance check prior to the case completion. Regular audits were conducted. The majority of postmortem examinations were completed within twenty days of admission.

Occupational health and safety issues of the staff were paramount; this included correct manual handling, infection control, and psychological debriefings. During the operation it was found that some remains were contaminated with asbestos. Procedures were set in place to manage these cases individually and each was isolated to reduce the exposure to staff.

On May 1, 2009 the identifications of all missing persons was complete. Of the 164 missing persons, 163 were found, identified, and the remains returned to the families. Nine deceased persons died in hospital or related circumstances and did not undergo the formal DVI process.

This operation identified a number of significant challenges, in particular the management of multiple parts of human remains for one individual. A new procedure was developed to ensure all human remains, where possible, were reconciled with deceased persons prior to the release to the funeral director.

Finally, no mass disaster operation can function successfully without a close working relationship between police, mortuary, medical examiners, and coronial staff. This operation highlighted the value of cultivating this relationship during the “quiet” times to ensure efficient

activation of an emergency response, timely identifications, and ultimately some degree of closure for the victim’s families.

Mortuary, Disaster, Bush Fires

G64 A Uniform Protocol to Address the Rapidly Accumulating Unidentified Human Remains and Missing Persons in the United States — A Nation’s Silent Mass Disaster

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After attending this presentation, attendees will understand the problems involved with the investigation of unidentified human remains (UHR). The strengths and limitations of current technologies and resources available for investigating UHR cases will be discussed as well as presenting for the first time, a uniform protocol and procedures for the identification of UHR.

The presentation of this protocol will impact the forensic science community by serving as a guideline as it can expedite and augment UHR identification efforts by presenting the resources available in an organized and consistent format. As a direct result, utilization of this protocol may help identify the tens of thousands of UHR that are currently being held within medical examiner/coroner’s (ME/C) offices throughout the United States. More importantly, families of these deceased individuals will no longer wonder what happened to their loved ones and struggle with the agony of possibly never having the ability of laying their loved ones to rest.

Statistical data from UHR cases at the San Diego County Medical Examiner’s Office (SDMEO) from 1997-2007 will impact the forensic science community by demonstrating the effectiveness of this new protocol.

No uniform protocol or procedure exists describing every avenue currently available to facilitate the identification of UHR. Therefore, many jurisdictions lack consistent guidelines for pursuing the identification of UHR and continue to be unaware of the most current resources available to aid in their investigations. This study was conducted to determine whether a uniform protocol could be developed to aid in streamlining the process of identification. Many avenues currently available to aid in the identification of UHR were examined and combined to create a comprehensive and universal procedure that can be followed by any agency or organization in the forensic science community tasked with the identification of unidentified persons.

During a brief time period from January 2007 to January 2008, when components of the uniform protocol were used for the investigation of specific UHR cases at the San Diego County Medical Examiner’s Office (SDMEO), there were seventeen “cold” UHR cases from the 1997-2007 time period that were identified. Furthermore, there were only four UHR cases recorded in 2007, a significant decrease from the average number of fourteen UHR cases per year. An obvious decline in the number of unidentified persons was yielded, which correlated to the utilization of components of the uniform protocol.

A uniform protocol as will be presented can be created to assist in the identification of current and “cold case” UHR and linking them to missing person cases, which can further assist law enforcement in any related criminal investigations.

Collaboration and organized, consistent protocols among local, state, and federal agencies tasked with the identification of missing and unidentified persons will expedite the collection and distribution of information crucial to these investigations. Thus, a consistency of

incoming information will be established, allowing the searching and correlating of case information and as a result, increasing the probability of UHR cases being linked to missing person cases. This will likely result saving millions of dollars and countless hours of time that could be used more efficiently by the agencies involved with the identification of UHR.

Specific resources and supporting data for the application of the uniform protocol in ME/C offices in the United States will be presented. It is recommended that ME/C offices and agencies tasked with the identification of UHR become familiar with the various UHR identification avenues available that the protocol will exhibit.

Unidentified Human Remains, Missing Persons, Investigation

G65 Request for Uniform Autopsy Protocols on Certain Drowning Victims

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The attendees will learn indicators that may determine whether drowning victims may require additional forensic examination to assess whether the drowning is in fact a homicide staged to look like an accident. Attendees can anticipate implementing autopsy protocols that help identify the need to conduct examinations that assist law enforcement in investigating suspicious or inadequately corroborated deaths while proactively addressing potential threats to vulnerable populations of abuse/neglect.

This presentation will impact the forensic science community by providing key indicators to identify drowning cases of interest, improving their understanding of a certain class of victim (victims of unobserved and inadequately corroborated drowning) resulting in improved forensic evidence collection, enhancing the accuracy and utility of the autopsy on these victims, and increasing the ability for law enforcement to respond and investigate viable/scientifically-driven time sensitive leads.

Use of Indicators for Positive Impact: A plan of action to improve forensic evidence collection related to victims of unobserved or inadequately corroborated drowning will enhance the utility of the autopsy, and positively impact the medical examiner (M.E.)/forensic scientist community, law enforcement (L.E.) partners, victims' families and the safety of both children and adults. Oftentimes, the M.E./forensic scientist community is best situated to provide investigators tools to recognize a homicide staged to look like an accident; excluding natural, traumatic, and toxicological factors in the medical cause of death (COD) are critically important.

Preservation of Forensic Evidence: Frequently, forensic evidence indicating criminal conduct is destroyed or washed away in victims of unobserved or suspicious drowning. While the accurate assessment of autopsy findings requires thorough examination of circumstances preceding death and circumstances of recovery – without advance evidence of foul play, when victims are recovered from the water, the circumstances, manner of death (MOD), and water entry point often lack thorough examination. NCMEC request consistent initial drowning examinations to complement L.E. efforts nationwide – as timely information on MOD can lead L.E. to water entry point analysis and other investigative leads prior to the disappearance of critical evidence.

Methodology Changes: NCMEC request the AAFS support the establishment of uniform nationwide protocols for the examination of unobserved drowning victims and for victims recovered in the water under suspicious or inadequately corroborated circumstances. Treating these investigations as homicides from initiation is vital to judicious evidence recovery and adoption of certain examinations (including testing for sexual assault, subcutaneous bruising, predatory drugs, etc.)

under a defined set of circumstances can provide vital forensic clues regarding the MOD, and potential prevent serial or repeat murders.

Drowning, Protocols, Homicide

G66 MAPS: How a Statewide Pharmaceutical Database Improves Death Investigation

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After attending this presentation, the attendee will have a better understanding of the benefits of using a controlled substance pharmaceutical database such as the Michigan Automated Prescription System (MAPS) when obtaining a decedent's medical history. Attendees will be presented with several case studies illustrating how the MAPS system can provide missing information and potentially change the cause and/or manner of death.

This presentation will impact the forensic science community by raising awareness among all parties involved in death investigation, specifically medical examiners, by describing the Michigan Automated Prescription System (MAPS) and its use in aiding in the investigation of deaths reported to medical examiners.

Accurate patient medical history is essential to the success of every death investigation. However, gaps in patient histories and medical records can sometimes lead to incorrect interpretation of data and may compromise the opinion rendered by the medical examiner. Obtaining accurate information regarding a decedent is critical to a high quality investigation and the interpretation of postmortem toxicology. The Michigan Automated Prescription System allows the medical examiner to gather information regarding controlled substances prescribed to the decedent for months before the death.

MAPS grants physicians with a DEA number the ability to access pharmaceutical dispensing data statewide to determine all controlled substances dispensed to a particular patient. The MAPS requires pharmacists, veterinarians, and dispensing physicians to report electronically (or by mail) all controlled substances dispensed in Schedules 2-5. Michigan launched the service in its current form in January 2003, and any previously existing prescription, patient, and healthcare provider data were entered into the new system. With over 1.2 million prescriptions reported each month, the MAPS system was built for ease of use, fast report generation (average turnaround time for individual reports is less than ten minutes), and prescription trend watching.

In cases of suspected drug overdose due to a controlled substance with "positive" toxicology, the medical examiner makes an inquiry into the database using the name and date-of-birth of the decedent. The report generated may indicate no information is available for an individual with the particular information. More commonly, the report generates a list of the controlled substance(s) prescribed, the quantity dispensed, the date dispensed, the prescribing physician(s), and the dispensing pharmacy(s).

The use of information provided by MAPS led to the prospective review of seventeen deaths since February 2009. Of the seventeen deaths, the MAPS report in three deaths did not change the opinion or assist the medical examiner in the investigation, the report in ten confirmed or supported the medical examiner's opinion, and in four cases, a change of the cause and/or manner of death occurred based on information contained in the MAPS report.

Example cases will be presented in detail to demonstrate how the information available in a database of controlled substances dispensed to

patients contributes to the investigation of deaths of individuals with postmortem drug screens “positive” for prescription medications in which drug intoxication may have caused or contributed to the death.

Death investigators should be aware of this advantageous tool. With a better understanding of the patient’s history, investigators can paint a more accurate picture of the life of the decedent, which, in turn, gives the medical examiner better tools to properly evaluate the situation and return a more confident ruling regarding cause and manner of death.

Toxicology, Death Investigation, Drug Related Fatalities

G67 Death Investigation and Organ and Tissue Donation in Clark County, Nevada

Alane Olson, MD, Clark County Coroner’s Office, 1704 Pinto Lane, Las Vegas, NV 89106*

After attending this presentation, attendees will be acquainted with alternatives and compromises which have been adopted between a medicolegal death investigation agency and the local organ procurement organization in an effort to optimize medicolegal death investigations and organ and tissue procurement.

The presentation will impact the forensic science community by providing knowledge of some successful alternatives in meeting the needs of coroner/medical examiner offices and organ procurement organizations.

During its 2007 session, the Nevada Legislature considered model legislation to modify the Uniform Anatomical Gift Act. At the same time, the Clark County Office of the Coroner/Medical Examiner and the Nevada Donor Network initiated discussions aimed at tailoring the model legislation to better accommodate specific needs and existing relationships. As a result of these activities, the legislation finally enacted contains provisions which, among other things, allow the coroner’s office to refuse organ and tissue donation if it will interfere with the death investigation, attend the procurement if necessary, be reimbursed for attending the procurement, and obtain video and photographic documentation before, during, and after the procurement. In order to accommodate the anticipated need for photo documentation, the coroner’s office formed the Forensic Investigative Rapid Support Team (FIRST), which is composed of experienced autopsy technicians who are on-call and available to respond to hospitals in conjunction with the coroner investigator for the purpose of photographing prospective donors. When the coroner’s office is notified of a request for donation, on-call medical examiner is responsible for deciding if the procurement can take place, and the FIRST team is activated at his/her discretion. The coroner’s office and organ procurement organization consider this a reasonable compromise between optimizing recovery of organs and tissues, and the requirements for conducting thorough medicolegal death investigations.

Death Investigation, Organ Procurement, Legislation

G68 Fatal Sexual Violence Database for Postmortem Genital Examinations With Colposcopy

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The goals of this presentation are to provide a systematic method of data collection and storage that will enable us to better understand the nature and appearance of the anogenital tissues at various postmortem intervals; to integrate a taxonomy that is consistent with conventional

terminology, e.g., terms used in forensic pathology and forensic odontology; and to study the reliability of previously-presented methodology for postmortem genital examinations, with colposcopy.

This presentation will impact the forensic science community by improving the diagnostic acumen of the forensic examiner and serve as a format for quality improvement; providing a framework for the evaluation of fatal sexual violence against women; and increasing the reliability and validity of both taxonomy and techniques (methodology) used to examine victims of fatal sexual violence.

This paper describes ongoing clinical research of postmortem genital anatomy and a methodology to capture data gleaned both from baseline studies and presenting cases of fatal sexual violence.

The nature of these crimes, coupled with a lack of a detailed history from the victim, predicates adoption of the most accurate methodology and technology available; these victims are not available for follow-up examinations.

A fatal sexual violence database provides a relational system in which to record, analyze, and compare data from both baseline studies of normal anogenital anatomy and cases of sexual homicide. While it is helpful for the forensic examiner to be cognizant of previous classification systems used to describe findings in living subjects (Fraser: WHO, 1999), a taxonomy germane to the postmortem arena should incorporate salient terms that will be consistent and universally applicable and acceptable within the forensic community (Crowley & Peterson: AAFS, 2004). Inclusion of these findings into a relational database will permit aggregate summaries of individual and population-based summaries.

Materials and Methods: Initial case documentation for the baseline clinical study conducted at the Donated Body Program of University of California Davis, Sacramento, is via the *Postmortem Genital Examination Case Worksheet*. A hardcopy of this form is completed in the morgue. It contains all data fields, with essential elements of the case, methods of examination, and summary of findings.

For these cases of normative controls, some fields in the database will not be populated; other variables are common to both sexual homicide and control groups. Because the strictest efforts are enacted by the Donated Body Program to protect identifying data and personal information of the donors, some information is simply not available, e.g., date of birth (only age is used), address, disposition of the body, time body found, position of the body, social history and lifestyle, gynecological history, clothing, and other personal items on the body at the time of death. Conversely, for cases of sexual violence, the aforementioned variables, plus date of birth, elements of the crime scene, restraints and bindings, body positioning, nongenital trauma, including bitemarks and other patterned injuries, genital trauma, and all biological and forensic specimens for the Sexual Assault Evidence Kit are germane to the case composite. Some techniques for examination would be relevant to medical-legal cases, but might not routinely be available for normative studies, e.g., Wood’s Lamp, alternate light source, or reflective light imaging.

Some variables common to both normative and sexual homicide cases include age and reproductive status, (pre-pubertal, reproductive age, peri-menopausal, and post-menopausal) and genital examination techniques (gross visualization, colposcopy, single lens reflex (SLR) camera photography, speculum and anoscopic examination, and the use of balloon-tipped swabs). Also, the same twelve anatomic sites are visualized, inspected, and photographed: *labia majora, peri-clitoral area, peri-urethral area, labia minora, hymen, vagina, cervix, perineum, fossa navicularis, posterior fourchette, anus, and rectum*.

Other common variables include the unique case identifier, date and time of the examination, interval from death to arrival in forensic science morgue (< 24 hrs., 24-48 hrs., 48-72 hrs., 72-96 hrs., ³ 5 days); general condition of body; race and ethnicity (per CDC definitions); cause of death, and contributory and/or concomitant medical and gynecological conditions, especially those presenting lesions.

Postmortem artifact, such as mucosal autolysis and skin slip that is visualized in the anogenital tissues is documented for each anatomic site where it is noted.

Initially, a spreadsheet was utilized for its capability to easily record, sort, and organize the various data elements. A relational database, e.g., ACCESS®, permits data to be divided into many subject fields and represented only once. Divided information can be resynthesized via common, related subject-based tables. This will remove data redundancy and help ensure accurate information. The rows and columns in the tables are expanded data collections of the postmortem examination worksheets for documentation of data during the course of the clinical examination. Data can eventually be exported into other data systems, e.g., SPSS®, for more advanced statistical analysis.

Discussion: In addition to the multiple variables present during any female genital examination, the postmortem arena superimposes a unique set of factors onto the scene. Many of these were not previously been studied or sufficiently documented in the literature. A fatal sexual violence database serves as an efficient repository of data accumulated during the Donated Body Program baseline study, in addition to any concomitant, presenting sexual homicide cases.

Missing data may also be significant e.g., the fact that a body of a Jane Doe found without any identifying information, e.g., driver's license, passport, could be a potential link to human trafficking (Crowley: AAFS, 2009). Records of actual fatal sexual violence cases will have many variables that are not germane to the baseline controls. Thus, a relational database is an ideal method to simplify and quantify data for interpretation, analysis, and linkage to other cases.

Storage and evaluation of data will help avoid ambiguity in the interpretation of findings for this target population. Analysis and interpretation of data will increase the diagnostic acumen of the forensic examiner. It will also facilitate effective and reliable communication within the forensic and legal community, via a more descriptive taxonomy. An effective database will allow eventual comparison of the genital findings in fatal sexual homicide victims to a control group of individuals who died of other causes, i.e., natural, accidental, suicide, and non-sexual homicide.

Finally, the ultimate goal of this research is to improve our understanding of what is normal, and what is not, for the anogenital anatomy during the postmortem interval. To this end, data gleaned from a fatal sexual violence database can be used to expand and enhance our knowledge. The forensic examiner is presented with the challenge to "capture" in hardcopy and electronic systems, a myriad of variables and conditions presented by each body in the morgue. Until recent years, a paucity of information existed on the appearance of the anogenital tissues during the postmortem interval. Comparisons to either living sexual assault victims or postmortem cases of non-sexual etiology were extremely difficult. Thus, it is paramount that the examiner always be cognizant of the need to perform these examinations with optimal levels of expertise and to permanently chronicle vital information. In this manner, our capacity and understanding of fatal sexual violence against women will continue to grow.

Fatal Sexual Violence, Colposcopy, Forensic Clinical Nurse Specialist

G69 Grant Solicitations: New Opportunities for Medical Examiners and Coroners – Tips on the Process

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After attending this presentation, attendees will be able to avoid pitfalls in the process of preparing grant solicitations.

The availability of Federal grants for medical examiners and coroners has been limited. In contrast to academics, medical examiners

and coroners do not have much experience in preparing grant solicitations. With new funding available, this presentation will impact the forensic science community by demonstrating how medical examiners could benefit from some tips on pitfalls in the process.

Grant funding for medical examiners and coroners has previously been limited. New federal funding sources are now available with more expected in the future. Preparing a grant solicitation may appear to be a daunting task. This presentation will offer some simple tips to make a grant solicitation more appealing to reviewers and some pitfalls to avoid.

Grant Solicitations, Grant Pitfalls, Grant Tips

G70 Development of Standard Operating Procedures for Conducting Arthropod Succession Studies: Improving Postmortem Estimates Through Ecology

Jeffery K. Tomberlin, PhD*, Department of Entomology, TAMU 2475, College Station, TX 77843-2475; and Jason H. Byrd, PhD*, Maples Center for Forensic Medicine, University of Florida, 4800 Southwest 35th Drive, Gainesville, FL 32608

The goal of this presentation is to provide attendees with a better understanding of experimental design as it relates to arthropod-based decomposition studies.

This presentation will impact the forensic science community by demonstrating the development of standard operating procedures for conducting arthropod succession studies in the field.

The period of insect activity (PIA) encompasses the time from discovery of human remains to when the remains were actually colonized. Therefore, the PIA in most cases represents the minimum postmortem interval (minimum-PMI). The amount of the PMI encompassed by the PIA can vary depending on a number of variables such as wind, rain, temperature, or if arthropods are excluded from the remains due to a physical barrier (i.e. wrapping, enclosed in a car or home). Consequently, understanding the variability the actual time of colonization as it relates to the actual time of death is of great importance.

Arthropod succession studies are conducted for a number of reasons. The majority of these studies are done to determine the species composition for a given location during a particular time of year to provide data that can be used to determine the "postmortem interval" of a decedent discovered in the same vicinity of the study site, and to determine the variation in time of initial colonization of remains.

A review of the forensic entomology literature indicates that a standard operating procedure is needed to in order to glean as much information from these decomposition studies as possible. Such information could lead to a better understanding of the succession and decomposition variability in different geographic regions and greater explanation of variables delaying arthropod colonization patterns on human remains. Furthermore, developing consistent practices could lead to data sets that can be combined in meta-analyses.

The following variables are suggested for inclusion in a SOP for arthropod succession studies:

1. Actual time of death of the remains used in the study
2. Storage of remains prior to use (i.e., frozen)
3. Method used for euthanasia
4. Actual time of initial colonization
5. Identification of species initiating colonization
6. Environmental conditions at the time of colonization (temperature, rain, shade, etc)
7. GPS coordinates of study site

Forensic Entomology, Ecology, Period of Insect Activity

G71 Using Biolog EcoPlates™ as an Economical Approach to Determining Postmortem Body Dump Sites Through Microbial Community Level Physiological Profiling

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After attending this presentation attendees will have a better understanding of the role microbial communities play in the rate and ecological dynamics of decomposing remains, and how this information can be used to better understand the timing and postmortem placement of human remains in the environment. Attendees will learn how changes in microbial community level physiological profiles (MCLPPs), during community succession on a body and in the soil beneath, can be utilized to predict the location and duration of decomposing remains.

This novel approach will impact the forensic sciences community by providing a more in-depth understanding of the ecological principles governing microbial community succession. Its cost-effective framework makes it ideal for use in crime scene investigations. On a broader scope this technique will provide insight into the influence of the microbial composition and metabolic products on insect colonization of decomposing remains (i.e., forensic entomology), thus improving the science behind estimates of the period of insect activity (PIA), and hence, that of the postmortem interval (PMI).

Microbial communities are a substantial component of the decomposition ecology and processing of organic material, such as carrion and human remains. Studies in both aquatic and terrestrial systems have shown that microbial communities follow a pattern of succession by metabolizing and modifying resources in a way that makes them usable or undesirable to other organisms, such as insects. While there have been studies describing the succession and diversity of microbial communities involved in carrion decomposition, none have evaluated their potential use for determining the postmortem spatial and temporal placement of decomposing remains in the natural environment. Further, most forensic entomology studies of insect succession suggest that volatile metabolic by-products of this community cue initial blow fly attraction and colonization. Postmortem structural and functional changes in these microbial communities may thus affect the PIA on decomposing remains, having applied importance to estimates of the PMI.

One established and economical method for understanding changes in environmental microbial communities is the use of Biolog EcoPlates™. EcoPlates™ have 31 different carbon sources represented in triplicate on each plate, and were designed for describing entire microbial communities from environmental samples such as soil. The pattern, or signature, of carbon resource utilization by the microbial communities provides MCLPPs. The MCLPPs, calibrated with temperature and genomic sequencing, has the potential to provide ecological data that can predict how long a body has been decomposing, and for how long at a particular location (e.g., on soil).

The objectives of this study were to describe microbial community changes over time (i.e., succession), in a variety of environmental settings and throughout multiple seasons, using Biolog EcoPlates™ in conjunction with pyrosequencing of the microbial genome. MCLPPs from communities on decomposing remains and the soil beneath were

hypothesized to change as a function of succession, and identified stages of succession could be used to determine the stage of decomposition and the spatial and temporal positioning of remains on a rural forest floor. Further, we hypothesized that microbial successional dynamics (community structure rate and sequence of change) would impact initial species-specific blow fly oviposition and colonization. We predicted that MCLPPs could be matched and calibrated with genomic-based methods of describing microbial communities, providing a more economical approach for use in crime scene investigations.

For this study, microbial samples were taken from carrion (swine) ($N = 3-9$) and the soil underneath (treatment soil) and at two distances lateral (0.25 and 1.0 m) of each carcass (control soil). To understand microbial community structure differences on the carcass, swabs of the buccal, urogenital and shoulder skin were evaluated, and all samples were described using Biolog EcoPlates™. This study was done in two seasons and two geographic locations to understand variability and generality of these techniques. In one location, matched samples of each individual sample, or composite sample, were taken and evaluated using the Roche 454 FLX pyrosequencing platform. Each of the samples were analyzed using the bacterial tagged encoded FLX amplicon pyrosequencing (bTEFAP) method to identify patterns of organisms occurring on the decomposing tissue during the longitudinal study and calibrated to MCLPPs from the EcoPlates™.

Preliminary results found substantial change in microbial communities both on the carcass and in the soil beneath the carcass, with little change in the control soil communities over time. Variation of MCLPPs among body regions was minimal and could be combined to provide an average body MCLPP signature. During the decay stage of decomposition, MCLPPs were significantly different in soil beneath compared to soil lateral of the body; this supported the hypothesis that MCLPP have the potential to differentiate soil communities where decomposition has been occurring, and possibly predict the time since placement. Further, there was substantial MCLPP variation among interreplicate body communities, indicating different volatile signatures which could be important to initial blow fly attraction and oviposition location; creating “founder” conditions that could influence subsequent intra- and inter-specific competition, the duration of PIA and, thus, estimates of PMI. Calibration of MCLPPs with metagenomic sequencing is on-going. We will continue to evaluate these communities during multiple seasons and habitats, providing new data important for a better understanding of the ecology of decomposition, and its relevant application to forensic science.

Biolog EcoPlates™, Forensic Entomology, Microbial Communities

G72 Microbes Associated With Decomposing Remains Regulate Insect Colonization

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The goal of this presentation is to give attendees a better understanding of the role microbes play in regulating colonization of decomposing remains by blow flies (Diptera: Calliphoridae).

This presentation will impact the forensic sciences community by providing a more in depth understanding of the ecological principles governing insect succession of human remains.

Explaining why insects delay their colonization of human remains in some instances while colonizing immediately in others is a fundamental question in forensic entomology. Two of the authors of this

presentation, Tomberlin and Benbow, along with others have developed and proposed a new framework for studying human decomposition. They point out that a majority of past research focuses on the post-colonization interval (post-CI) which extends backwards in time from the discovery of the insect infested remains to the point that the insects initially colonized the remains. The time of colonization estimation is viewed as the period of insect activity (PIA) and is often considered the minimum postmortem interval (minimum PMI). The time frame prior to colonization has been termed the pre-colonization interval (pre-CI). Speculations as to why insects delay colonization have been suggested and small advancements explaining this ecological unknown have been made. Known abiotic factors, such as temperature, wind, and rain play a role in regulating colonization of human remains. It is hypothesized that microbial populations associated with human remains represent a major biotic factor regulating insect colonization.

Human remains represent nutrient rich resources for many organisms ranging from microbes to vertebrate scavengers. Microbes were initially thought of only as nutrient recyclers. However, recently other hypotheses have been suggested. Some researchers speculated that microbes were resource competitors with other consumers, including insects. Microbes may alter food resources and produce toxins that affect the “appeal” of the resources, and themselves, to other consumers. It is hypothesized that volatiles emitted by microbes associated with carrion, regulate the attraction to and diversity of colonization of the remains by insects. It is further hypothesized that volatiles emitted by microbes associated with and physiological by-products produced by blow fly larvae feeding on the remains influence the attraction and colonization of the resource by future blow fly species. It has been demonstrated that many saprophagous insects feed directly on microbes associated with decomposing material as part of their diet. In addition, microbes can have a mutualistic relationship with these arthropods. It is hypothesized that specific bacterial species which survive digestion and pupation with one fly species, may not with another fly species. Therefore, bacterial proliferation and dispersal is mitigated by colonization patterns of fly species. Such an association could, however, prove detrimental to both microbe and associated fly if the volatiles emitted also attract predators. Basically, it would be a two-way ecological chess match where the pawns are the insects and the players are the associated microbes. But, these roles can be reversed depending on those involved. This model examines if the volatiles emitted by the native species, *Cochliomyia macellaria*, larvae (the prey) and associated bacteria attract the introduced predatory blow fly, *Chrysomya rufifacies*.

A series of laboratory experiments were conducted examining the interactions between microbes associated with carrion (beef liver) and the attraction of *C. rufifacies* and *C. macellaria* adults. Furthermore, two field experiments were conducted examining the interaction of microbes on carrion with the attraction of blow flies as well as the role of excretions/secretions of blow flies on the attraction of Diptera. These results will be provided in this presentation and will hopefully shed light on biotic factors governing the time span of the pre-CI.

Forensic Entomology, Microbes, Trophic Interactions

G73 Lower Temperature Threshold for Black Soldier Fly (Diptera: Stratiomyidae) Egg and Adult Eclosion

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After attending this presentation, attendees will learn the lower developmental threshold dynamics of temperature that either facilitate or impede black soldier fly egg and adult eclosion.

* Presenting Author

This presentation will impact the forensic science community by providing valuable insight into variation in developmental thresholds with respect to insect development and its application in calculating the minimum time to colonization.

Black soldier flies, *Hermetia illucens* (L.) (Diptera: Stratiomyidae) are of particular interest for their applications in forensic entomology. Initially thought to be a late colonizer (20-30 d postmortem) of carrion, recent evidence indicates they will colonize a corpse within the first week after death. Black soldier flies are native to warmer environments, including North and South America, and therefore studies on black soldier fly development have primarily focused on determining the higher temperature thresholds and optimal temperatures for development. This study determined the lower temperature thresholds for egg and adult eclosion. Preliminary studies indicate temperatures facilitating successful egg eclosion do not necessarily result in larval development and adult eclosion. For that reason, the black soldier fly has two different lower developmental thresholds; one supporting egg hatch, and one supporting egg hatch and larval development to the adult stage. In relation to the postmortem interval, not differentiating these two temperature thresholds could result in errors in calculating larval age and retrospectively, time of colonization. Black soldier fly eggs were collected in corrugated cardboard clutches from an established colony outdoors, at the Texas A&M University's F.L.I.E.S. facility in College Station, Texas and placed in three growth chambers, each maintaining a 70% RH, 14:10 [L:D] photoperiod respectively. Each growth chamber was set at 12°C, 15°C or 18°C. Egg clutches were randomly assigned to each treatment. Percent hatch and survivorship to the adult stage were recorded. Larvae were provided bovine liver *ad libitum* and allowed to develop without disturbance. Egg eclosion, length of development, and adult eclosion was recorded daily.

Black Soldier Fly, Lower Developmental Threshold, Forensic Entomology

G74 Colonization Behavior of Forensically Important Blow Fly Species: Implications for Postmortem Interval Estimations

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After attending this presentation, attendees will have a better understanding of ecological interactions between various forensically important blow fly species and how this relates to PMI estimation.

This presentation will impact the forensic community by providing insight into the importance of understanding species interactions and individual colonization events and how these behaviors can impact one's estimation of the MTC. This presentation will highlight the importance of rigorous scientific testing in order to validate current assumptions in the field with respect to delays in colonization prior to their incorporation into estimations of colonization events and, ultimately, PMI estimations.

Blow fly species are known to be among the primary colonizers of remains and as a result, blow fly species composition, colonization events and successional patterns are important aspects to consider in the determination of the postmortem interval (PMI) and minimum time of colonization (MTC). Previous research and case studies have indicated that certain blow fly species may experience a delay in colonization (i.e., *Phormia regina* (Meigen) and *Chrysomya rufifacies* (Macquart)). These findings have led to a debate within the field of forensic entomology as to whether or not these delays should or should not be incorporated into MTC and PMI estimations.

It was hypothesized that the colonization behaviour of blow flies (i.e., *P. regina* and *C. rufifacies*) would be altered based upon the presence or absence of an additional blow fly species (i.e. *Lucilia sericata* (Meigen)). The colonization behaviour of three forensically

important blow fly species were examined: *L. sericata*, *P. regina* and *C. rufifacies*. Specifically, gravid adult females of *L. sericata* and *P. regina* and *L. sericata* and *C. rufifacies* were allowed to colonize fetal pig carcasses, *Sus scrofa* (Linnaeus), however, their arrival order varied according to one of five different treatment conditions. Species were allowed to colonize either on their own, in the presence of an additional species, and prior to and subsequent to an additional species. colonization events and behaviour were recorded from the time of arrival to forty hours postmortem. Upon removal of the carcasses, egg masses were examined and depth measurements were recorded. The eggs masses were then photographed and volumetric measurements were obtained using the Image J software program. A linear regression was carried out (using SPSS) with volume (mm³) versus total number of eggs in known egg masses in order to predict the number of eggs based upon the volumetric measurements recorded.

It was determined that the colonization behaviour varied with respect to time of first colonization, location of colonization, and total number of eggs laid on an individual species basis. In particular, *P. regina* experienced a significant decrease in time to first colonization and laid more eggs in the presence of *L. sericata*, which indicates that the presence of an additional blow fly species could act to facilitate the colonization of *P. regina*. Thus, the colonization behavior of blow flies should be examined on an individual basis. Furthermore, ecological interactions between other blow fly species could play an important role in altering a species colonization behavior, specifically with respect to the time and location of colonization, as well as the amount of eggs laid.

Blow Fly, Postmortem Interval, Minimum Time of Colonization

G75 Petechiae in Hanging: A Retrospective Study of Contributing Variables

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After attending this presentation, attendees will better understand the variables contributing to the development of petechiae in hanging.

This presentation will impact the forensic science community by providing evidence-based data on the contributing variables to the development of petechiae in hanging.

Introduction: It is often stated in the literature that petechiae are more frequently observed in cases of hanging where part of the body is supporting the victim's weight, i.e., cases of incomplete hanging, because it is believed that the jugular veins become occluded while the deeper and less compressible carotid and vertebral arteries remain patent. The present study is intended to evaluate the relationship between petechiae and the type of hanging (complete vs. incomplete) as well as several other variables: victim's age, height, weight, the body mass index (BMI), type of ligature and cardiopulmonary resuscitation.

Material and Methods: A total of 309 suicidal hanging deaths were autopsied in the province of Quebec (Canada) over an 8.5-year period. Of these, one case was excluded since it was not a typical hanging but a hanging from height, with dislocation of neck vertebrae (hanging after jumping from a bridge). Additionally, fifty cases were excluded from the analysis because postmortem changes interfered with the evaluation of petechiae (significant decomposition, skeletal and charred bodies). Finally, fifty two cases were also excluded because the type of hanging was not specified in the autopsy files, thus making their analysis not applicable to the present study. Overall, a total of 206 cases were analyzed for the presence of conjunctival, palpebral, gingival and facial petechiae. For each case, the following information was also compiled: gender and age, height and weight, the type of hanging (complete or incomplete), the type of ligature used (rope, wire, clothes, sheet or lace) and the presence of alcohol or drugs. A note was also

added about whether or not the victim had received cardiopulmonary resuscitative maneuvers.

Results: *Incidence of petechiae in relation to cardiopulmonary resuscitation maneuvers:* Of the 206 hanging victims, thirty-six underwent attempts at cardiopulmonary resuscitation (CPR). No significant difference existed between the two groups ($\chi^2 = .34$, df = 1, N=206, p=.56).

Incidence of petechiae in relation to the type of hanging: Of the 170 victims without reanimation manoeuvres, 128 died of an incomplete hanging and 42 of complete suspension. The incidence of petechiae in incomplete hanging (50%) was significantly higher than in complete hanging (29%) ($\chi^2 = 5.87$, df = 1, N=170, p=.02). The age and sex distribution was similar between both groups.

Incidence of petechiae in relation to the type of ligature: The type of ligature was known in all 170 cases of hanging victims without reanimation manoeuvres: 72 ropes, 28 electrical cords, 27 pieces of clothing, 30 bed sheets, and 13 shoe strings. These types of ligatures were regrouped into two broad categories: narrow and wide. The incidence of petechiae was similar ($\chi^2 = .66$, df = 1, N=170, p=.42) for wide and narrow ligatures (47% and 40% respectively).

Incidence of petechiae in relation to age: The incidence of petechiae decreased slightly with age, from 61% in teens to 40% in adults over forty years of age. However, the differences between the three age groups was not statistically significant ($\chi^2 = 2.41$, df = 2, N=170, p=.30), and neither was the statistical comparison of victims older to younger than 40-years-old ($\chi^2 = .66$, df = 1, N=170, p=.42).

Incidence of petechiae in relation to the BMI: In the studied population, only two hangings occurred in underweight individuals. For the remaining 204 there was no statistically significant difference between the incidence of petechiae in normal weight individuals and overweight individuals ($\chi^2 = .13$, df = 1, N=204, p=.71). The comparison between the three groups (normal weight, overweight and obese) was not statistically significant either ($\chi^2 = .82$, df = 2, N=204, p=.67).

Incidence of petechiae in relation to height: The incidence of petechiae varied inversely with the height of the victims: 77% in victims of less than 1.60 m, 44% in victims between 1.60 and 1.79 m and 35% in victims of 1.80 m or more ($\chi^2 = 5.36$, df = 2, N=204, p=.07). This is not merely attributable to a difference in the proportion of complete vs. incomplete hangings in the different height groups. Among incomplete hanging victims, a similar inverse relationship with height was noted ($\chi^2 = 4.64$, df = 2, N=155, p=.10).

Asphyxia, Hanging, Petechiae

G76 Fractures of the Neck Structures in Suicidal Hangings: A Retrospective Study on Contributing Variables

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After attending this presentation, attendees will better understand the variables contributing to the development of neck structures fractures in hanging.

This presentation will impact the forensic science community by contributing to a better understanding of important factors to the development of fractures of the thyroid cartilage and hyoid bone in hangings.

Introduction: Fractures of the neck structures figure among the classic autopsy findings in suicidal hangings. Several factors may play a role in the development of fractures of the neck structures in hanging. It has been repetitively demonstrated that the incidence of fractures increases with age. The role of gender is less clear: some authors found

G77 Precision of Autopsy Body Length Measurements

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After attending this session, attendees will learn the precision of body length measurements at autopsy and its importance in medicolegal death investigation. In addition they will learn how this compares to height determination precision in antemortem clinical practice.

This presentation will impact the forensic science community by introducing quantitative measures of error in an important determination made at autopsy.

In many cases, the height of a decedent is important in the investigation of his or her death. For instance, prosecutors may wish to posit hypotheticals and ask if it is physically possible for a person of a given height to commit suicide with a particular weapon, such as a long gun. In these cases, autopsy body length measurements are sometimes used as ground truth for antemortem height. This study attempts to provide a bounds on the precision of autopsy body length measurements in one facility.

Methods/Data collection: For a period of approximately two and one-half months (83 days) as cases were sequentially brought into the morgue facility, all staff members on duty and available in the autopsy area were asked to independently measure the length of each body. Measurement was done with a standard metal tape measure (Metric/English, 8m/26'). This particular facility is an academic facility with permanent staff members, student workers, resident physicians in training, and attending physicians. In most cases, only one or two staff members were available, but for those cases in which three or more were available, the body length measures were recorded. Each observer was blinded to the measurement results of other observers. The measurement by the assistant assigned to the case was recorded as the nominal "correct" body length measurement for the autopsy report. The bodies were weighed on a calibrated scale, and body mass index (BMI) was calculated using the official length recorded in the autopsy report. Visual evaluation was done to estimate the degree of body deformation due to rigor or pugilistic pose in charred remains, and recorded on a subjective scale of one (straight) to five (full fetal or pugilistic pose) by the second author, blinded to the measurements.

Study Population: A total of 74 cases had three or more measurements. Of these, 73 were adult cases. A total of eight observers were involved, including two certified Pathology Assistants, two full-time staff members, two student workers and two resident physicians. Twenty-six cases had three measurements, 33 cases had four measurements, 12 cases had five measurements, two cases had six measurements, and one case had seven measurements.

Results: The average range of measurements was 1.86 inches (4.72 cm) with a standard deviation of 1.2 inches (2.99 cm). The range varied from 0 to 5.5 inches (0-13.97 cm, Figure 1). No individual observer displayed significant systematic error (Table 1). The average range did not vary significantly with the number of measurements(Chi-square p=0.54), body length (Pearson's r = 0.08), or body deformation (Spearman's r= 0.15, two-tailed p= 0.2). There was a moderate correlation with BMI (Pearson's r = 0.27, two-tailed p=0.019).

Discussion: Autopsy body length measurements are prone to numerous errors. There are issues of posture, with some bodies being straight and other being held in flexion by rigor, heat effect, or other constraints. Obese bodies may have an artificially increased body length if the tape is laid over the panniculus. Charred and fragmented bodies may not have all body parts. The position of the feet may cause the heel to rise or fall. Hair may cause observers to incorrectly estimate the exact

a male predominance of fractures, whereas other observed a female predominance or no significant difference between genders. Similarly, studies on the role of several other factors have shown opposite results for the type of hanging (incomplete or complete suspension), the type of ligature, the location of the knot, the highest suspension point and the suspension time. However, most of these studies evaluated these factors independently of the age of the victims. Considering that age is probably the most important factor in the development of neck structures fractures, all other contributing factors should be studied in relation to age. The goal of the study is to evaluate the role of contributing factors to the development of neck structures fractures, taking age categories into account.

Material and Methods: Overall, a total of 206 suicidal hangings were analyzed for the presence and localization of fracture of the neck structures. For each case, the following information was also compiled: gender and age, height and weight, type of hanging (complete or incomplete), type of ligature used (rope, wire, clothes, sheet or lace) and localization of the knot (anterior, right, left or posterior).

Results: *Incidence of fracture in relation to age and gender:* The incidence of neck structures fractures increased with age ($\chi^2=21.851$; p=.000). Victims of less than forty years of age presented an incidence of fracture of 18% whereas this incidence increased significantly to 49% in victims of forty years or more. The average age of victims without fractures of the neck structures was 31.7 compared to 42.6 for victims presenting fractures (t=5.66; p<.001; D=.88). As for gender, the incidence rate of fracture is significantly higher in male victims (31.4%) compared to female ones (11.8%) ($\chi^2=5.408$; p=.020).

Incidence of fracture in relation to the height, weight and BMI: The incidence of fractures varied significantly with the height (t=2.19; p=.031; D=.33), weight (t=4.38; p<.001; D=.89) and BMI (t=3.84; p<.001; D=.60) (Table 3). The average height of hanging victims with fractures of the neck structures was of 1.74 m compared to 1.71 m for victims without fractures. As for the average weight and BMI of victims with fractures, it was of 78.2 kg and 25.6 respectively, compared to 68.6 kg and 23.2 in victims without fractures.

Incidence of fracture in relation to the type of hanging and the type of ligature: The incidence of fractures did not vary significantly with the type of hanging ($\chi^2=.05$; p=.828; Phi=.015) and the type of ligature ($\chi^2=3.12$; p=.077; Phi=.077). However, when taking the age of the victims into account, a different picture was revealed: in individuals aged forty years or more, victims with complete suspension of the body presented with a significantly higher incidence of petechiae (63.2%) compared to victims with incomplete suspension (31.0%) ($\chi^2=6.79$; p=.009; Phi=.318). This difference was not present in individuals of less than forty years of age ($\chi^2=.52$; p=.471; Phi=.061). As for the type of ligature, no significant difference was found in individuals of less than forty years of age ($\chi^2=.11$; p=.737; Phi=.028) as well as in older victims ($\chi^2=.01$; p=.936; Phi=.010)

Incidence of fracture in relation to the localisation of the knot: The incidence of fractures did not vary significantly with the localisation of the knot ($\chi^2=4.11$; p=.250; Phi=.141). The side lateralization of fracture in relation to the position of the knot will also be presented.

Conclusion: Apart from age, several other factors seem to play an important role in the development of fractures of the neck structures: height, weight and BMI. The type of hanging is also an important factor in victims of more than forty years of age.

Hanging, Thyroid Cartilage, Fracture

position of the top of the head. Different observers may measure with different care.

This study attempted to evaluate the precision of body length measurement within one facility. This was specifically not an attempt to estimate accuracy, not merely because the nominal antemortem height was generally not known, but also because antemortem height measurements are themselves variable. The concept of "ground truth" in body length measurements may be inappropriate.

Studies on antemortem height measurement show significant variation for measurements of a single individual. Antemortem height can vary over time. It can vary significantly with posture. Further, antemortem height measurements are themselves fraught with error. Studies of the measurement of height routinely show that observer variation provides enough error to make them uninterpretable for some purposes.

Precision, Error, Autopsy

G78 "Goodness Gracious Great Balls of Fire": Genital Thermal Injuries From Airbag Exhaust

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After attending this presentation, attendees will understand the potential for thermal injuries from airbag exhaust.

This presentation will impact the forensic community by expanding the investigators knowledge of airbag induced injuries, in particular second and third degree burns.

Burns, thermal and chemical, from the hot gases and chemical by-products of deploying airbags account for approximately 7-8% of all airbag-induced injuries. Three mechanisms for thermal injuries have been described: (1) the direct skin exposure to hot gases expelled from the airbag vents; (2) the melting of fibers or burning of clothing from exposure to the hot gases; and, (3) direct contact with a hot airbag.

A 25-year-old restrained driver was transferred to an urban trauma center from a suburban emergency department for evaluation of thermal injuries to his penis, scrotum, thighs and arm. The patient reported that he was involved in a single-vehicle collision on his way work after a deer ran into his path. He stated he turned his steering wheel 180-degrees to the right when the front of his vehicle impacted the rear of a parked vehicle at approximately 20 mph. Moments later he noticed two areas of flames coming from his pants, one in the area of his upper left thigh and the other over his groin. The driver quickly removed his seat belt and attempted to smother the flames with his hands and arms. He exited the driver's door, dropped to the ground and rolled to smother the remaining flames. He stated he was not wearing any underwear.

Examination of the patient's skin revealed first and second degree thermal injuries to the following areas: left forearm, left thigh, left inguinal area, scrotum and penis. Blisters were noted on the glans, scrotum and medial aspect of the left thigh. Arm and pubic hair were also burned to the skin level in some areas. The patient's pants demonstrated two areas with melted and charred fibers over the groin and left anterior thigh.

The vehicle, a 2009 Dodge Charger was examined within hours of the event. The airbag vents are located at the 1 and 11 o'clock position when the steering wheel is in a straight ahead position and in the 5 and 7 o'clock position when the wheel is turned 180-degrees. Examination of the airbag vents revealed melted nylon airbag fibers around both vent openings and charred material, presumed to be fibers from the pants, around one vent.

Hot gas is generated within an airbag from an exothermic reaction that occurs when sensors within the vehicle are activated during a sudden deceleration. The gas, principally nitrogen that is a byproduct from the

rapid burning of sodium azide, is exhausted from inside the airbag through vent holes in the airbag. The temperature of the exhaust gases has been measured to be between 200 and 500 °C.

The 180-degree rotation of the steering wheel at the time of impact resulted in the vents and the associated hot exhaust gases being discharged directly toward the driver's pants in the area of his groin and left thigh. The synthetic composition of the pants, 75% polyester and 25% rayon, melted and produced a flame based upon the patient's history and confirmed from inspection of the clothing. The melting point of Rayon is 120 to 170 °C and 225 °C for polyester.

The extremely hot gases associated with airbag deployment pose a risk of burns to vehicle occupants. Thermal injuries to the male genitals and inguinal area from the exhaust gases have not been reported in the medical literature. Consideration of modifying the direction of hot vented gases from the airbag by the automotive industry and airbag manufacturers maybe warranted in light of the severity of injuries sustained in this patient.

Airbag, Thermal Injury, Airbag Exhaust

G79 Histologic Diagnosis of Amniotic Fluid Embolism: Providing Context Through Immunohistochemistry

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After attending this presentation, attendees will understand that a substantial amount of cytokeratin-positive cellular material is consistently present in the vasculature of lung sections obtained at autopsy from non-gravid women, complicating the utility of keratin immunohistochemistry in the evaluation of cases of suspected amniotic fluid embolism. This cytokeratin-positive material is likely an autopsy artifact, as corroborated by the presence of TTF-1-positive cells within vascular spaces in the same lung sections. The caliber of vessel in which cytokeratin-positive material is found may help to identify true circulating keratin.

This presentation will impact the forensic science community by using immunohistochemistry to characterize the intravascular cellular material in postmortem lung specimens from non-gravid women in order to provide the appropriate context in which to assess the same immunohistochemical stains when they are employed in the evaluation of suspected cases of amniotic fluid embolism.

Amniotic fluid embolism (AFE) is among the most common natural causes of maternal death in the United States, yet AFE remains an enigmatic condition that is difficult to diagnose, the identification or confirmation of which often rests on the autopsy pathologist. The microscopic examination of multiple lung sections is essential when evaluating for AFE, with the identification of squamous cells, keratin debris, mucus, and other presumably fetal cellular debris, usually in the lungs, widely considered diagnostic in the appropriate clinical setting. Identifying these cellular elements, in particular circulating squamous cells or keratin, can be challenging despite extensive tissue sampling and thorough microscopic examination.

The difficulty in finding circulating keratinocytes is compounded by other cellular debris that may mimic their appearance, such as sloughed endothelial cells and pneumocytes. Immunohistochemistry, in particular cytokeratin AE1/AE3, has been advocated as a means to identify circulating keratinocytes. However, cytokeratin immunostains are not specific for fetal keratinocytes, and the immunohistochemical

profile of intra-vascular cellular material in autopsy lung specimens from women who are not pregnant has not been formally described. To this end, three immunohistochemical stains—cytokeratin AE1/AE3, Thyroid Transcription Factor-1 (TTF-1) and CD34—were used to characterize the intravascular cellular debris in postmortem lung sections from non-gravid women in order to provide the appropriate context in which to interpret such stains in the evaluation of suspected cases of AFE.

Fourteen cases of women who died without penetrating injuries or identifiable peri-mortem needle punctures, who were not pregnant, and who were not decomposed at the time of autopsy were selected. Lung tissue was fixed in formalin and embedded in paraffin as part of the routine histologic sampling of each autopsy. Hematoxylin and eosin (H&E), TTF-1, cytokeratin AE1/AE3 and CD34 stains were performed on sections of each block of lung tissue. For purpose of comparison, H&E stains and the same three immunohistochemical stains were also performed on blocks of lung tissue from a known case of unequivocal amniotic fluid embolism and a case of a deceased neonate with abundant intra-alveolar amniotic fluid. The H&E sections were evaluated for the presence of intra-vascular material consistent with or resembling squamous cells or keratin debris. The immunostains were evaluated for the presence or absence of positive-staining intra-vascular cellular material.

All fourteen lung sections from non-gravid women contained elongate cellular material and debris by H&E staining, most of which appeared to be sloughed endothelial cells and only superficially resembled epidermal squamous cells and keratin when compared to the known AFE case and the neonatal lung. Rarely, fragments of bronchial epithelium were located in intra-vascular spaces. In both the known AFE and the neonatal lung sections, keratin characterized by distinct basophilic, “glassy” flakes of material, often in aggregates, was easily identifiable by H&E staining. No such material was identified in the lungs of the non-gravid women. All fourteen lung sections also contained intra-vascular keratin-positive cellular material, usually in great abundance. This material consisted of round cells and debris, some of which was reminiscent of keratin. However, the keratin-positive material in these lung sections was present only in larger caliber vascular spaces and not in capillaries and arterioles. By contrast, the keratin-positive material in the known AFE case was present in both large and small caliber vessels, including capillaries and arterioles. Eleven of fourteen cases had TTF-1 positive cellular material in intra-vascular spaces, although always a small amount and consisting only of round cells. All fourteen cases had abundant intra-vascular CD-34 positive material, consisting of elongate cells and debris.

Most intra-vascular cellular material that even superficially resembled circulating squamous cells and keratin in the lung sections from fourteen non-gravid women was sloughed endothelium as confirmed by CD34 immunostaining. The cytokeratin-positive intra-vascular cellular material in the lungs of the non-gravid women most likely represented respiratory elements trans-located into the vascular spaces as an autopsy artifact, an etiology corroborated by the presence of TTF-1-positive cells within vascular spaces. The consistent abundance of intra-vascular cytokeratin-positive cellular material emphasizes the need for caution interpreting cytokeratin stains when evaluating autopsy lung sections for amniotic fluid emboli. The caliber of vessel which contains cytokeratin-positive material may help to differentiate true circulating keratin from an autopsy artifact, as only the known AFE case had keratin in capillaries and arterioles.

Amniotic Fluid, Immunohistochemistry, Maternal Mortality

G80 Utility of Large Bowel Examination in Medicolegal Death Investigation

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After attending this presentation, attendees will understand the contribution to medicolegal death investigation of examination of the lumen and mucosal surface of large bowels.

This presentation will impact the forensic science community by showing what additional information can be contributed to medicolegal autopsies by examination of the large bowel.

The mucosal surface of the large intestine is not always directly examined in cases where findings in the bowels are not suspected to be a cause or contributing cause of death. Some pathologists opt to examine the serosal surfaces and palpate the colon while others routinely open all colons during the course of the autopsy. Numerous disease processes such as ischemia, ulceration, colitis or diverticulitis, which may have contributed to death, may be overlooked if the colon is not thoroughly examined. Additionally, the autopsy provides an opportunity for surveillance for colon carcinoma or precancerous lesions. Routine thorough examination of the colon can potentially provide valuable information to the family members of the decedent if a hereditary natural disease is found, and can also provide general epidemiological data on the prevalence of early precancerous lesions in the population younger than the age currently recommended for screening by colonoscopy. To study the utility of opening colons in medicolegal autopsies, we present a series of over 200 colons examined from sets of sequential autopsies performed at our institution. Colons were opened, rinsed of their contents, and examined along their entire length internally and externally. Correlation of findings with decedent's age, sex, and cause and manner of death are presented. The most common pathological finding is diverticulosis, and after examination of over 100 colons in this ongoing study, no carcinomas have been identified.

Colon, Examination, Large Bowel

G81 Detection of KCNQ1 Genetic Variations by High Resolution Melting Analysis for the Diagnosis of Channelopathies in Postmortem Investigations

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After attending this presentation, attendees will be informed of the great interest of the high resolution melting method used for genetic variations screening in cardiac ion channel genes in postmortem investigations.

This presentation will impact the forensic science community by demonstrating the application of a recently developed molecular technique, high resolution melting (HRM), for the detection of genetic variant on genes implicated in channelopathies in postmortem investigations.

In developed countries, sudden cardiac death (SCD) is one of the most common causes of death. One of the largest epidemiological studies of unexpected deaths in young people showed that more than half of the deaths were of cardiac origin and in 29% no recognizable cause was identified at postmortem (Tester et al., 2007).¹

Potentially lethal ion channel disorders (channelopathies) such as long QT syndromes, catecholaminergic polymorphic ventricular

tachycardia (CPTV) and the Brugada Syndrome may be responsible for a portion of such cases of sudden death in young persons.

Postmortem genetic testing for sequence variations in cardiac ion channel genes has become an important tool for elucidating the cause of sudden cardiac death (Ackerman et al, 2001; Kauferstein et al., 2009).² Formalin-fixed and paraffin-embedded tissue (FF-PET) as well as frozen tissue could be used as source of DNA in postmortem investigations. If frozen tissue is undoubtedly the greatest source of intact DNA, in some cases FF-PET is the unique source of genetic material.

In this context, the purpose of our study was first to validate a successful DNA extraction and purification method corresponding to the association of phenol-chloroform extraction and silica-based purification protocols. This protocol was previously reported in ancient DNA studies on archaeological bones but had not been used for DNA extraction from FF-PET. The second step consisted of genetic investigations on frozen and FF-PE tissues in each case of sudden death involving adult younger than thirty-five years with no significant morphological anomalies particularly with no cardiac structural disease and with negatives toxicological investigations. The samples studied were collected from autopsy cases performed at the Institute of legal Medicine from Strasbourg (France). The autopsy practice and modalities of sampling were realized according to the recommendations of the "European Cardiovascular pathology Association" (Basso et al. 2008).³ The KCNQ1 gene was chosen in a first approach.

Since, according to the literature, mutations on this gene are randomly distributed, genetic screening was performed for each studied case, with the HRM method on the LightCycler 480 (Roche). The HRM is a technique that can detect sequence changes in amplicon through monitoring of the fluorescence of a double DNA binding dye which dissociates from DNA as it denatures with increasing temperature. If sequence changes are present within the amplicon, they cause a difference in the melting profile compared with wild-type. The principle of this methodology will be more developed in the presentation.

The comparison of results obtained with frozen and FF-PE samples showed that the two types of samples have a great interest in the genetic investigations. The advantages and limits of each type of samples will be discussed in details. From this study, it appeared that the HRM is a rapid, cost-effective and specific method allowing identification of KCNQ1 genetic variations and avoids systematic sequencing of the entire coding region of gene of interest in postmortem investigation of sudden cardiac death.

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High Resolution Melting, KCNQ1, Formalin-Fixed and Paraffin-Embedded Tissue

G82 Cardioinhibitory Reflex Cardiac Arrest – Myth or Reality?: A Systematic Review From Cases

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After attending this presentation, attendees will be presented a systematic review of literature concerning reported cases of death by

cardioinhibitory reflex cardiac arrest due to short neck trauma and a proposal on how to diagnose it.

This presentation will impact the forensic science community by presenting constructive evidence based guidelines to diagnose death caused by death from a cardioinhibitory reflex due to short neck trauma will be proposed.

Background: Forensic physicians often evoke baroreflex cardiac arrest following short neck trauma as a cause of death. No clear evidence is available to support this hypothesis.

Objective: Construct evidence based guidelines to diagnose death caused by death from a cardioinhibitory reflex due to a short neck trauma.

Methods: A systematic review of the literature extracting case studies or reports from cases using [Medline, ISI Web of Knowledge, and Embase.] Two independent reviewers selected and extracted data. From the available data, the four authors then discussed the most probable cause of death for each case. A narrative approach was finally used to define conditions and procedures to be followed to evoke cardioinhibitory death.

Results: From the forty two cases (thirteen are anecdotes) which mention cardioinhibitory reflex as a possible cause of death, twenty two are most likely due to other causes (mechanical asphyxia, excited delirium and drug abuse). The twenty remaining cases were mainly men (15/20) and were from all ages (5 yrs to 74 yrs). From the fifteen who were autopsied, ten had local lesions at carotid bifurcation, seven had reported heart disease, and six were under the influence of alcohol.

Conclusion: Death should only be attributed to cardioinhibitory reflex when sequence of events are known, duration of trauma is certain, macroscopic and microscopic findings reveals important subsequent trauma lesions of the carotid bifurcation, and all other possible causes of death are excluded, including excited delirium, and cerebral hypoxia due to substance abuse. Such cases are apparently extremely rare.

Neck Trauma, Baroreflex, Death

G83 Differentiation of Bullet Type Based on Analysis of Gunshot Residue Using Inductively Coupled Plasma Mass Spectrometry

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The goal of this presentation is to demonstrate a chemical means to differentiate gunshot residue (GSR) deposited by two different bullet types throughout decomposition. Porcine tissue samples shot with full-jacketed and non-jacketed bullets and analyzed using inductively coupled plasma mass spectrometry (ICP-MS) displayed differences in chemical composition of the resulting GSR, allowing differentiation between the two bullet types. Decomposing porcine tissue samples were also analyzed to identify the most persistent elements to be used for differentiation between the two bullet types at all stages of decomposition.

These research findings will impact the forensic science community by increasing the confidence of gunshot wound identification, aiding pathologists and medical examiners in cause of death determination even in corpses presented in an advanced state of decomposition. Identifying wounds as gunshot wounds also aids law enforcement agencies in their search for the perpetrator, and knowing the bullet type may provide a link between a suspect and a crime.

In decomposing corpses, the presence of GSR can be difficult to visualize due to the decomposition process and larval activity, making

chemical means of GSR identification necessary. Solution ICP-MS has been used for the determination of antimony (Sb), barium (Ba), and lead (Pb), elements characteristic of GSR, from cotton swabs spiked with these elements, from shooters' hands, and from shot cotton tissue. Preliminary studies conducted in our laboratory have demonstrated the utility of ICP-MS for the determination of Sb, Ba, and Pb in decomposing GSR-containing porcine tissue samples through all stages of decomposition. However, in order to increase confidence in GSR determination in advanced stages of decomposition, the identification of additional elements, characteristic of the bullet or the interior of the barrel, is necessary. The goals of this research were to differentiate two different bullet types based on element profiles and to investigate the persistence of GSR in decomposing tissue as a function of bullet type.

In order to study the elemental composition of GSR deposited by different bullet types, three pigs were euthanized and control (unshot) samples of skin removed from one. The other two pigs were then shot using a .357 Smith & Wesson Magnum revolver. One pig was shot with ammunition cartridges containing full-jacketed bullets, and the other with non-jacketed bullets. The fresh wounds were excised, and sections of each wound were microwave digested for ICP-MS analysis. Sections of each wound type were also removed for histology analysis, and results confirmed the presence of GSR in both wound types. The digests were initially analyzed in full mass scan mode to identify all elements present at significant levels in the GSR-containing tissue but not present in the control tissue. A selected ion monitoring (SIM) method was then developed to detect only the suite of characteristic elements from both bullet types with greater sensitivity. The significance of variation in element concentrations among full-jacketed bullet wounds, among non-jacketed bullet wounds, and between full-jacketed and non-jacketed bullet wounds were assessed statistically. Differences in element concentrations between the wound tissue (both full-jacketed and non-jacketed) and the control tissue were then assessed statistically. In this way, the two bullet types were differentiated based on differences not only terms of elements present but also based on differences in concentration of common elements.

For this research to have any impact on the forensic science community, the effect of decomposition on GSR persistence was investigated. Three euthanized pigs were obtained and wounded. One was shot with full-jacketed bullets, one was shot with non-jacketed bullets, and one was stabbed to generate open wounds to serve as control (unshot) tissue. Wounds and control tissue samples were collected throughout the decomposition process, and then digested for ICP-MS analysis. Histology was also used to detect GSR throughout decomposition, and results were compared with those from ICP-MS analysis. The tissue digests were analyzed using the SIM method developed previously for ICP-MS analysis of the characteristic suite of elements that differentiate the two bullet types. The most persistent elements throughout decomposition were identified, as they are the most useful for discrimination of bullet type.

Gunshot Residue, ICP-MS, Firearms

G84 Vehicular Emissions Systems and Their Effects on Suicides and Attempted Suicides by Carbon Monoxide

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After attending this presentation, attendees will understand the workings of vehicular emissions systems and their ability (and inability) to generate CO (Carbon Monoxide). As cars run cleaner, CO suicides in a closed space (garage) are more difficult to accomplish. The cleaner car allows for more time for a "victim" to alter his intentions. The attendee will understand these timing issues, as well as the possibility that death is brought on not by CO intoxication, but by hyperthermia.

This presentation will impact the forensic science community by showing how to properly investigate deaths associated with vehicles left running in confined spaces.

Concerns about automotive emissions, greenhouse gasses, and fuel economy have led car manufacturers to decrease CO emissions from vehicles. Over the last thirty years, CO emissions levels from tailpipes have dropped substantially. Corresponding with this drop in CO, the presenter has seen a substantial drop in his caseload of deaths brought about by acute CO intoxication (usually suicide) brought about by running cars in enclosed garages.

The modern automotive engine (gasoline) makes use of an oxygen sensor to determine how close the engine is running at ideal stoichiometry: - 14.75 parts air to one part fuel. The engine has one (or several) O₂ sensors placed in the exhaust stream to measure free oxygen. In an open air atmosphere, the oxygen sensor and ECU (Engine Control Unit) work together to insure that CO emissions are kept low.

For a person attempting suicide, the effects of the emissions system can have three outcomes:

1. Non event – no fatal levels reached
2. Suicide – fatal COHb levels reached
3. Suicide – minor to moderate COHb levels reached, but death caused by hyperthermia

The non-event is perhaps the hardest for a medical examiner system to analyze, as there is neither a death or case report.

Empirically, testing of vehicles has shown that in some instances, a garage has enough "leakage" and infiltration (air changes per hour) that there is sufficient oxygen to keep the engine running clean and for CO levels to stay at a minimum. This "non-event" can manifest itself in one of three ways:

1. The emissions system 'slowed' down CO production so much that the would-be suicide candidate changed his/her mind.
2. A fatal COHb level was never achieved because the vehicle ran out of fuel, thwarting the suicide.
3. The vehicle had enough free O₂ (leaky building) that under no circumstances would a fatal COHb level ever be achieved.

The fatal CO event is the easiest case to analyze. Grossly, the cherry red lividity is the telltale sign, along with supporting COHb levels at autopsy. But the fatal level raises the question: with modern cars running so clean, how does one ever achieve fatal results. Testing carried out shows the function of the O₂ sensor in the exhaust stream. This sensor is a ratiometric device, comparing free O₂ in the exhaust stream to free O₂ in the atmosphere. The vehicle's ECU will keep CO production to remarkably low levels for some time, but there reaches a point (in a well sealed garage) that the design assumptions (IE, 20% free O₂ in the atmosphere) are invalid and the vehicle become very dirty. Note that this fatal outcome is just an extension of one, above – CO production was slowed down, but the candidate's ardor was not inhibited; the death just took longer to achieve. Using empirical data, the presenter has been able to model the CO production/accumulation as a first order differential equation.

The fatal outcome with low CO is at first the most complex to analyze. The body presents with CO levels more associated with high levels of cigarette smoke: 5 to 10%, possibly higher, but never at levels associated with death. Testing done at our lab shows that temperatures can be reached in garages (closed spaces) that are untenable. The indicator that first led us to this area of inquiry was the existence of spray cans (paint, insecticides) that had bulged at their seams. It was known at what internal pressures the cans would expand, as well as the nature of the propellant gas inside. This data shows the increase in temperature over time within various garages, and the factors that work for and against this type of hyperthermic event are presented. In these cases the manner of death is still suicide, but causation has changed from acute CO intoxication to hyperthermia.

Suicide, Carbon Monoxide, Hyperthermia

G85 Pseudostrangulation

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After attending this presentation, attendees will recognize autopsy findings that can be misinterpreted as due to homicidal strangulation. Attendees will also learn how to avoid making false positive determinations of strangulation in cases where the body is found dead at the scene.

This presentation will impact the forensic science community by instructing forensic pathologists how to avoid concluding falsely in any case that strangulation is the cause of death. Successful application of these concepts by forensic pathologists will prevent injustices that come from false accusations made by police officers and prosecutors – accusations that may lead to false convictions and imprisonments.

The investigation of the death of a person found unexpectedly dead is critically important. Prosecuting attorneys and police officers rely on the knowledge and expertise of the forensic pathologist to determine the cause and manner of such deaths. Unfortunately, the unwary forensic pathologist may misinterpret findings in the head and neck areas of the dead person at autopsy and falsely conclude that strangulation is the cause of death and that the manner of death is homicide. Incorrect determinations such as these all too often lead to the arrests of innocent people on false charges, to confusion in the courtroom with the presentation of misinterpreted evidence, and to false imprisonments. Even in cases truly involving foul play, a falsely positive determination of strangulation may lead to a misunderstanding of the chain of events that led to the violent death.

The classic and typical autopsy findings for manual or ligature strangulation are well documented in the literature and in forensic pathology textbooks, but simply relying on autopsy findings alone to reach a proper conclusion will lead to mistakes. Without knowledge of the witness evidence and other physical evidence in a case, a pathologist at the autopsy table may misinterpret certain head and neck findings, falsely concluding that they indicate homicidal strangulation. On the other hand, knowledge of the witness evidence and other physical evidence and the proper interpretation of this evidence will prevent the pathologist from being misled at the autopsy table.

Five general sources of confusion at autopsy will be presented. These include: (1) confusion of ligature marks with band-like discolorations from decomposition; (2) confusion of asphyxial findings with artifacts from postmortem hypostasis; (3) confusion of strap muscle hemorrhages caused by blunt or sharp force with strangulation; (4) misinterpretation of blood extravasations posteriorly placed within the neck; and, (5) misinterpretation of laryngeal petechiae.

The forensic pathologist may make an erroneous determination of strangulation when he or she attempts to surmise the past events that led to the physical findings disclosed by autopsy without regard to the statements of the witness or witnesses, particularly if the witness is the defendant. In this presentation, why that approach leads to mistakes will be demonstrated. The Also demonstrated is how to correctly test witness accounts with the physical evidence in order to determine if the witness accounts are truthful.

The cases and illustrations used in this presentation come from the author's forensic pathology consultation practice. The forensic pathologists who originally performed the autopsies concluded in each case that strangulation caused each of the findings.

Strangulation, Homicide, False Positive

G86 Investigation and Autopsy Procedures in Cases Involving Conducted Energy Devices (CEDs) in the State of Maryland

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After attending this presentation, attendees will understand the investigation and autopsy procedures necessary in cases involving the use of CED's and the demographics of their use.

This presentation will impact the forensic community by reporting investigative and autopsy findings in a group of conducted energy device cases.

Controversy exists over the possible contribution of CED use to sudden death. CEDs are primarily used as a restraint method by law enforcement personnel on aggressive individuals. The typical scene involves an acute onset of agitated and delusional behavior in a person with mental health issues and/or who is on drugs. An attempt is made to control the uncooperative individual leading to a struggle at which some point the person becomes unresponsive. Experience at the OCME has emphasized the necessity of complete investigation and autopsy in these complex cases.

From 2004 until January 2009, the OCME autopsied 12 cases involving CEDs. The most commonly used CED in Maryland is the X26 TASER®. The TASER® was used in drive stun mode only in 2/12 (16%) cases, probe deployment only in 6/12 (50%) cases, and combination of both in 4/12 (33%) cases. In 75% of the cases, the TASER® was used more than once. The average age of the individuals was 35 years old, 92% were male, 67% were black, and 33% were white. Manner of death was ruled undetermined in 58% of the cases, homicide in 25% of the cases, and accident and suicide in 8% each of the cases. In two of the homicides, gunshot wounds were the cause of death when the X26 TASER® was ineffective. Excluding these two homicides, the accident and the suicide, the TASER® probes were deployed in seven of the eight remaining cases. The time elapsed between deployment of the TASER® and the time the individual went unresponsive was several minutes in four cases and in three cases it could not be determined with certainty. In the eight remaining cases, the cause of death was generally considered to be a combination of police restraint methods, the agitated/excited delirium state of the individual, the presence of drugs or alcohol, and heart disease when these were identified. In no case was the TASER® considered the sole cause of death. Of these cases, 75% were considered to be in an agitated/excited delirium (ED) state and 87.5% had ethanol or illicit drugs including cocaine, heroin, or phencyclidine in their systems. Of the ED cases, all were obese and most had heart disease. The non-ED cases included two thin individuals who struggled with police and both cases had either ethanol or illicit drugs in their system. The temperature was not recorded in the majority of cases. The initial cardiac rhythms recorded were also evaluated.

In June of 2008, in their interim report studying deaths following electromuscular disruption, the National Institute of Justice (NIJ) published considerations in the performance of investigation and autopsy in CED cases. The OCME has adopted these considerations and added to them. Investigation should develop a timeline of events with emphasis on when the subject went unresponsive. A complete review of past medical records and incident EMS, hospital, and police records, TASER® dataport download, types of restraint used, witness reports, and any videos or photos must be performed. Autopsy procedures should include: documentation of all injuries with both black and white and color photographs, measurement of the distance between the injuries and soft tissue injury, separate anterior and posterior neck dissections, cut downs of the body, microscopic sections of organs and injury, cardiovascular and neuropathology consultations, and a full toxicology screen.

Recommendations in this report are based on the experience at the OCME and follow those put forth by the NIJ in their interim report. These complex cases should each be evaluated on an individual basis, as the correlation of the investigation and autopsy findings is critical in order for the medical examiner to come to a determination of the cause and manner of death.

Conducted Energy Device, Investigation, Autopsy

G87 Postmortem CT-Angiography Using Angiofil®

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After attending this presentation, attendees will know how to perform a postmortem CT-Angiography using Angiofil®, will understand the differences between this technique and other techniques of postmortem angiography, and will understand the advantages and limitations of postmortem angiography.

This presentation will impact the forensic science community by presenting a new technique of postmortem angiography which has the potential to be largely used for postmortem radiological examinations. The perfusion machine and other technical materials developed for the method as well as a standardized protocol makes it easy applicable and therefore interesting for postmortem examiners.

Postmortem CT-angiography using Angiofil® is a minimally-invasive technique that allows to map the vascular system of a decedent in detail and therefore to perform vascular diagnosis similar to clinical CT-angiography.

Synopsis of Contents: *Preparation of the corpse:* To perform the postmortem CT-angiography, the body is placed on the CT-table. There, a small incision is made in the inguinal region to prepare the femoral vessels. Cannulas are inserted into the vascular lumina, and connected with the tubes of a special perfusion machine.

Perfusion Machine: In the University Center of Legal Medicine Lausanne and Geneva, a special perfusion machine has been developed that is easy to handle. Its special software gives further information about the pressure measured in different regions of the vascular system and these parameters provide some information about the conditions of the investigated vessels.

Contrast Agent: Angiofil® is a mixture of paraffin oil and iodized linseed oil. Thanks to the hydrophobic abilities of this oily contrast agent, no extravasation through the intact vascular wall is observed. Therefore, infiltration of the surrounding tissue is avoided. This is important to increase the quality of the procedure and to avoid deformation of the investigated body as it happens when using aqueous contrast agents, especially when important quantities of aqueous contrast agent are injected.

Technique of the Angiography: To start the angiographic examination, the cannulas are inserted into the femoral vessels and connected with the tubes of the perfusion machine. The examination consists of different phases. As a first step, the arterial phase of

angiography is performed. The perfusion machine is started and Angiofil® is introduced into the vascular system, entering by the femoral artery. To demonstrate the venous part, the contrast agent is injected by the femoral cannula and a further CT-acquisition is started.

As a third step, one or more further CT-acquisitions can be performed after establishing a “postmortem circulation”. Hereby the contrast agent is flowing from the arterial into the venous system and quits the vascular system by the femoral vein.

Conventional autopsy: In the University Center of Legal Medicine Lausanne and Geneva the radiological findings are compared with those obtained by conventional autopsy. This procedure is important to verify the angiographic diagnoses and to define advantages and limitations of the angiographic examination.

Results: By performing a dynamic postmortem CT-angiography, the vascular system can be visualized in detail. Vascular pathologies such as ruptures of vessels, aortic dissection and cardiac tamponade can be diagnosed. By comparing the different phases of angiography, information about the rapidity of extravasation and therefore about the quantity of blood loss can be gained.

However, problems persist in the diagnosis of thrombosis and embolism, since postmortem clots have the same appearance on CT-images.

Conclusion: Postmortem dynamic CT-angiography is of great interest in forensic pathology, because the detailed mapping of the entire vascular system is almost impossible with conventional autopsy tools. The presented method and the use of the recently developed perfusion machine allow postmortem angiography in an easy and standardized way. The new method using Angiofil® as a contrast agent allows to investigate blood vessels under pressure similar to real life conditions without creating artifacts due to extravasations and therefore without deforming the corpse. By performing different phases of angiography, information about the relation between the quantity of blood loss and time can be gained.

Postmortem Angiography, Forensic Radiology, Postmortem CT

G88 Radiological Interpretation of Postmortem CT-Angiography

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After attending this presentation, attendees will have the knowledge to distinguish normal from abnormal findings on postmortem CT-angiography, to recognize the traumatic and non-traumatic pathologies, to understand the differences between clinical and postmortem CT-angiography, and to know the limitation of diagnosis in postmortem CT-angiography.

This presentation will impact the forensic science community by demonstrating the key findings of traumatic and non-traumatic vascular lesions allowing for an accurate diagnosis of the cause of death.

Postmortem CT-angiography is a minimally invasive technique which enables the diagnosis of traumatic and non-traumatic vascular lesions with confidence. However, interpretation of postmortem CT-

angiography varies from clinical CT-angiography and demands special knowledge from the interpreting radiologist.

This presentation will introduce the attendees to the general principles of postmortem CT-angiographic interpretation describing the normal and pathological presentation of the venous and arterial vascular circulation. After a short introduction on the technique of opacification we will first present the normal appearance of the organs during arterial opacification, followed by the normal appearance during the venous opacification and in the end during systemic continuous circulation with the help of a perfusion pump. The description of the pathologic findings will distinguish the traumatic and non-traumatic pathologies with special care, describing the false positive findings and how to distinguish them. The most common pathologies responsible for death and visible in CT-angiography are traumatic rupture of vessels, mostly aortic ruptures followed by aortic dissection and aneurismal ruptures. Traumatic organ lacerations are also a common finding, splenic lacerations being the most frequent, followed by renal and hepatic lacerations. These organic lacerations are by themselves most of the time not the cause of death, but accompany more vital lesions, such as aortic, cerebral and cardiopulmonary ones. On the venous side the most common pathology responsible for death are also ruptures due to trauma, followed by massive pulmonary embolism. This pathology is picturing the limitation of postmortem angiography because it is the origin of most of the diagnostic errors. The reason therefore is the presence of postmortem blood clots which are often situated in the pulmonary vessels and the heart chambers. While small exemplars of these clots can be rinsed out by an ongoing perfusion, large ones can not be removed and imitates the radiological image of thrombosis or embolism. The importance of imaging during active circulation will be discussed to distinguish embolism from postmortem thrombi, in the arterial as well venous circulation.

Conclusion: The advent of postmortem CT-angiography allows visualization of traumatic and non traumatic lesions of the arteries and veins. Clear advantages of postmortem angiography over conventional autopsy are observed in detecting sources of bleeding. By the use of our method, which includes acquisition of data during a dynamic circulation, it is even possible to quantify blood loss. This is important to confirm if a lesion may have been the cause of death and if the injury may have led to an immediate or a delayed death. The main limitation of the technique is the inherent difficulty in differentiating pre and postmortem thrombi and emboli. Another difficulty, due to the same mechanism, is to distinguish aortic dissection from sedimented postmortem blood clots, mainly in the descending thoracic aorta. Because of all these challenges in vascular diagnosis, the help of an experienced angiographer has proven useful to us.

Postmortem Angiography, Postmortem CT, Forensic Radiology

G89 Perfusion Technique for Postmortem CT-Angiography

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After attending this presentation, attendees will understand the interpretation of different pressure variations and gradients, understand the concept of a specialized perfusion machine with integrated controller

and software for most-mortem CT-angiography, and know the concept of an ideal ante- or retrograde perfusion.

This presentation will impact the forensic science community by explaining the background and the development of a new technique and new equipment for postmortem CT-angiography, which is easily applicable and therefore interesting for everyone performing postmortem analysis.

By the use of special perfusion techniques and equipment, important information about the status of the vascular system can be gained, even without performing radiological imaging. The combination of such adequate perfusion and imaging by CT-angiography provides images and physical data that allow diagnoses of the vascular system.

In the University Center of Legal Medicine, Geneva – Lausanne, a research group has been created with the goal to develop a standardized protocol and special equipment for postmortem CT-angiography. Therefore, a specialized perfusion machine that should ease the use of the technique and that includes software giving information about the vascular status of the investigated body should be developed. With the knowledge of two European-board certified perfusionists, pressure values obtained during the perfusion for postmortem angiography are used for this development.

In general, the postmortem perfusion can be obtained by a femoro-femoral access. Therefore, the femoral artery and vein of one side are cannulated. Once the cannulas are connected to the tubes of the perfusion machine, the perfusion is started using the oily contrast agent Angiofil®. The arterial and the venous tubes are connected to the pressure monitor to register the pressure variations and pressure gradients.

In the first phase of the perfusion, the arterial system is filled antegrade under pressure control. In general, 1200 ml of contrast agent are introduced during ninety seconds. Increasing pressure values measured in the venous tube are signaling the integrity of the arterial system. Once the defined quantity of contrast agent is injected, the arterial and venous tubes are clamped to keep the pressure inside of the vascular system steady and the perfusion machine is stopped. Under those “static conditions” (stopped perfusion), a first acquisition of CT-images can be performed to visualize the arterial phase of angiography.

The same technique is repeated with the venous system, with the only difference that the veins are perfused retrograde. This second phase of the perfusion is made to visualize the venous phase of angiography.

During the first to phases of postmortem angiography, the most important perfusion value is the “delta p” which is indicating the pressure gradient form the arterial to the venous system. A low delta p, during an arterial perfusion is a sign for an intact arterial system, during a venous perfusion it indicates the integrity of the venous system. If this value increases, a leak of the arterial (during the arterial perfusion) or the venous system (during the venous perfusion) has to be suspected.

As a third phase in postmortem angiography a dynamical perfusion can be performed, that means that further contrast agent is injected and CT-data are obtained during the ongoing perfusion. Depending on the case, one or more acquisitions of images can be made. During the perfusion, pressure gradients are measured under a volume-controlled pump speed. This dynamic phase is especially useful if leaks of the vascular system are identified. In those cases, it can allow to quantify blood loss in cases of hemorrhages.

Conclusion: By performing a standardized perfusion technique with adequate perfusion equipment, changes of perfusion values can indicate leaks and show whether they are situated in the arterial or in the venous part. By using a contrast agent as perfusate, the perfusion can be used to perform postmortem angiography. The developed perfusion technique and special perfusion pump with integrated controller and software allows the performance of postmortem CT-angiography and the interpretation of the perfusion values, so that the technique becomes applicable in the routine of postmortem investigation.

Postmortem Angiography, Forensic Radiology, Postmortem Perfusion

G90 The Role of Microscopic Postmortem Study in Explaining Traffic-Crash Related Neck Injury: A Case Review

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After attending this presentation, attendees can expect to understand the state of the literature regarding the microscopic investigation of histopathology of traffic crash-related neck injuries.

This presentation will impact the forensic science community by discussing how the histopathologic study of traffic crash related cervical spine injuries indicate that imaging occult injury must be considered as a possible source of symptoms in patients with apparently negative plain x-ray, CT or MRI studies. The relatively high false negative rate of conventional imaging for injury to the cervical spine following traffic crash must be taken into account when a forensic medical review of such injury is conducted.

Introduction: Approximately fifty percent of occupants involved in a road traffic crash sustain a painful neck injury, ranging in severity from short lived mild discomfort to long lasting pain syndromes. Approximately ten percent of all injured patients are impaired to the point that they are disabled from their work duties. In the majority of patients objectively identifiable injury using medical imaging modalities such as x-ray, CT, and MRI are the exception rather than the norm. Since the late 1980s it has been suggested by some authors that there are crash-related spine injuries that cannot be visualized with conventional medical imaging because they are too small. Subsequent postmortem studies describing microscopic investigations of cervical spine tissue in decedents with a history of neck injury have demonstrated that such imaging occult injuries do exist. The purpose of the current review is to present a review of the literature describing histopathologic studies of the post-traumatic cervical spine.

Methods: A MEDLINE search was conducted using the Mesh terms/keywords; "Accident, Traffic", "Spine", "Autopsy", "Whiplash Injuries", and keywords; forensic imaging, imaging occult lesions, postmortem, and cervical spine. Articles describing examination of the cervical spine after fatal road traffic trauma using microscopic procedures of stained histological sections were included and retrieved articles were further crosschecked for relevant references. The included references were reviewed with regard to microscopical procedures used, microscopical findings, and diagnostic imaging procedures, to be described in a table format.

Table 1

Reference	Number subjects (N) and type of trauma	Microscopical procedure	Microscopical findings	Diagnostic imaging procedures
Schonstrom et al. 1993 ¹	41 trauma cases (unknown number of motor vehicle trauma) and 10 controls	Evaluation of 2-mm thick slices using a dissecting microscope	Extra-capsular bruising, bruising of the synovial folds, tearing of joint capsules, haemarthrosis, facet fracture, haemarthrosis	None
Taylor et al. 1992 ²	16 cases (15 motor vehicle accident and 1 hanging) and 16 controls	Photographic evaluation of 2-mm thick slices and microscopy of 100-μm slices	Haemarthrosis, damage of the articular cartilage, IVD injury	All were negative on conventional radiology evaluation
Taylor et al. 1993 ³	109 trauma cases (72 motor vehicle trauma)	Evaluation of 2.5-mm thick slices using a dissecting microscope	Haemarthrosis, synovial fold injury, damage of the articular cartilage, intervertebral disc injury, ligamentous injury	Conventional radiology
Taylor et al. 1998 ⁴	108 trauma victims (unknown number of motor vehicle trauma)	Evaluation of 2.5-mm thick slices using a dissecting microscope, and histological examination in selected cases	Dorsal root ganglion injury, ventral root injury, and nerve root avulsion	None
Stäbler et al. 2001 ⁵	10 trauma victims (unknown number of motor vehicle trauma)	Microscopy of 3-μm thick stained histological section	Muscular bleeding, haemarthrosis, capsular injury, intervertebral disc injury, spinal cord injury, ligament injury, fracture of vertebral body and lamina	Conventional radiology, microfocus radiography, and magnetic resonance imaging

Yen et al. 2005 ⁶	5 trauma cases (4 motor vehicle trauma)	Histological examination not further defined	Medulla, spinal cord bleeding, upper cervical fracture	Computed tomography and magnetic resonance imaging
Uhrenholt et al. 2008 ⁷	19 traffic crash fatalities and 21 controls	Microscopy of 10-μm thick stained sections at 3-mm intervals	Injuries to the articular cartilage (horizontal splitting) and disruption of the synovial folds	None
Uhrenholt et al. 2009 ⁸	19 traffic crash fatalities and 21 controls	Microscopy of 10-μm thick stained sections at 3-mm intervals	Fractures of the facet joints, haemarthrosis, disruption of and bleeding in the synovial folds	Conventional radiology, computed tomography, and magnetic resonance imaging
Uhrenholt et al. 2009 ⁹	19 traffic crash fatalities and 21 controls	Stereomicroscopy of 3-mm thick slices and microscopy of 10-μm thick stained sections at 3-mm intervals	Fractures of the facet joints, haemarthrosis, disruption of and bleeding in the synovial folds	None

* References arise from one large-scaled study

Results: Nine references were retrieved for review (Table 1). The number of subjects suffering from road traffic crash related deaths was not defined clearly in all studies. The microscopic procedures included the evaluation of 2 to 2.5-mm thick slices using a dissecting microscope, and stereomicroscopy of 3-mm thick slices to microscopy of 3 to 100-μm thick stained sections. The microscopic findings were defined in all studies and included injuries to the osseous cervical spine (vertebral body, lamina and articular facets), surrounding soft tissues (muscles, ligaments, joint capsules, and synovial folds), articular cartilage, bleeding in the joints, dorsal root ganglion injury, ventral root injury, nerve root avulsion, and injury to the intervertebral disc. Diagnostic imaging procedures were performed in five studies, including one or more of the following procedures; conventional radiology, microfocus radiography, computed tomography (CT) and magnetic resonance imaging (MRI).

Discussion: The current review of publication describing an investigation of microscopic injuries to the cervical spine of occupants subjected road traffic crashes identified nine studies for review. Discrete non-fatal injuries to the cervical spine were described in all nine studies. Injuries to the facet joints (synovial folds, articular cartilage, joint capsule, and haemarthrosis) as well as the nerve roots were particularly common. The majority of injuries could not be identified using conventional plain x-rays nor could they be found using advanced diagnostic imaging procedures such as CT and MRI. Although the research described herein did not investigate whiplash injuries *per se*, the injuries identified in these postmortem studies were non-fatal in severity and potentially painful. The presence of similar injuries in survivors from road traffic crashes of different severities seems likely. Three studies were not included in the current review, as they did not utilize microscopical procedures but relied on macroscopic examination and evaluation of photographs.¹⁰⁻¹² Even though these studies were not included, they identified very similar findings of discrete injuries to cervical spine structures and supported the finding of these being imaging occult.

Conclusions: The present review demonstrates the important role that microscopic postmortem investigation can have in elucidating traumatic pathology that is not apparent with conventional medical imaging.

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Forensic Pathology, Microscopic Lesions, Imaging Occult

G91 Lethal Consequences Arising From the Rupture of an Undetected Large Ductus Arteriosus Aneurysm During a T-12 Kyphoplasty Procedure

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After attending this presentation, attendees will appreciate the complications encountered with a patent ductus arteriosus, the necessity for repair of the ductus, and a rare case of rupture of an undetected patent ductus arteriosus aneurysm.

This presentation will impact the forensic science community by addressing the importance of diligent diagnostic assessment of all patients. The decedent had undergone numerous prior imaging studies with failed recognition of a large ductus arteriosus aneurysm, and failure to detect such lesions can have disastrous consequences. Additionally, this case illustrates the importance of a thorough autopsy examination with toxicologic assessment to clarify the circumstances of in-hospital/intraoperative deaths, recognizing the potential civil litigative pitfalls should such an approach not be pursued.

The case of an 80-year-old white female who suffered hypertensive crisis and cardiovascular collapse during T-12 kyphoplasty is reported. The decedent had been admitted to the hospital for kyphoplasty to repair a T-12 compression fracture. She had a history of prior cerebrovascular accident, hypertension, hyperlipidemia, and osteoporosis. During the procedure, the decedent experienced a spike in blood pressure to approximately 200/100 mmHg, with sudden cardiovascular collapse. Resuscitative efforts were unsuccessful. Autopsy examination revealed rupture of a large ductus arteriosus aneurysm producing a large left hemothorax. The aorta and its main branches showed marked arteriosclerotic change with Monckeberg calcific sclerosis, and the heart was enlarged, with biventricular hypertrophy. Additionally, examination revealed arterionephrosclerosis and adrenal cortical hypertrophy. The cause of death was listed as massive left hemothorax due to rupture of a large ductus arteriosus aneurysm associated with marked aortic arteriosclerotic change, with calcific sclerosis during kyphoplasty of T-12, associated with intraoperative hypertensive crisis.

The ductus arteriosus connects the aorta to the pulmonary artery and functions in the fetus to bypass the unexpanded lungs. Ordinarily, this connection closes shortly after birth, but in some infants the ductus arteriosus remains patent. A patent ductus arteriosus creates a left-to-right shunt and can lead to complications like congestive heart failure, infective endocarditis, and aneurysm with subsequent rupture. However, not all individuals with a patent ductus arteriosus become symptomatically evident, and some people can live normal lives never knowing they have this congenital abnormality. In the rare case of a patent ductus arteriosus aneurysm, the ductus must be repaired to prevent rupture of the aneurysm. Rupture of a ductus arteriosus aneurysm is a devastating event and often leads to a swift death.

Detection of a large ductus arteriosus aneurysm can often be accomplished through the acquisition of a chest x-ray, though arteriography is the definitive technique if such an anomaly is suspected. While multiple imaging studies of her chest had been conducted in the past, the decedent's large ductus arteriosus aneurysm was nonetheless not identified. It is unclear what event prompted the sudden, lethal hypertensive event which led to aneurysm rupture, though an adverse event arising from administered anaesthetic agents must be considered as a potential etiology. The tragic consequences arising from this sad sequence of events is a sobering lesson that uncommon and unsuspected diagnoses are far too commonly lethal.

Ductus Arteriosus, Aneurysm, Rupture

G92 Exploring the Potential for Nocturnal Colonization of Fresh Cadavers by Carrion Flies in the Central United States

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After attending this presentation, attendees will understand the unlikelihood of nocturnal colonization of bodies by blow flies and how this affects estimates of the postmortem interval.

This presentation will impact the forensic science community by demonstrating that while nocturnal colonization of human bodies by carrion flies is conceivable, it remains highly improbable and nocturnal colonization of carrion by flies appears to be the exception rather than the rule.

Forensic (or medicocriminal) entomology, the use of arthropods in legal investigations, is most frequently employed to estimate the postmortem interval (PMI) of victims of violent crimes or suspicious deaths. The most commonly used method of PMI estimation employs temperature-dependent developmental rates of blow fly larvae (Diptera: Calliphoridae). Retrospective scene temperatures, those temperatures which the insects experienced during development, are used in combination with known developmental rates of the species involved to estimate the age of the insects.

Because forensically important flies are known to colonize cadavers very shortly after death (often within minutes), the age of their developing offspring found on a body often corresponds closely with the time of death. One exception to this standard has traditionally been death occurring at night, when flies are not presumed to be actively searching for host carrion, and colonization is often assumed to be delayed. Recent studies both confirm and refute this assumption. However, none of the previous studies have actually examined whole carrion that has been freshly killed after dark. Previous work has been limited to butchered meats, thawed carcasses, or aged meats, all of which do not adequately replicate the conditions often encountered during medicocriminal investigations of human death; death occurring during the hours of darkness.

Live pigs (*Sus scrofa*), ranging from 23-32 kg each, were euthanized at the study site via captive-penetrating bolt device to the brain. Euthanization took place after astronomical twilight had passed, ensuring that conditions were as dark as possible. Each night of the study, three pigs were placed at a site illuminated by a mercury vapor lamp and three pigs were placed at a separate site that was kept dark. Periodic observations of the dark site were made using 3rd generation night vision equipment to observe any insect activity. Exposure of the cadavers continued until either astronomical twilight began or ambient air temperatures went below 5°C, whichever came first, with a minimum period of exposure of four hours. Following exposure of the cadavers, the body surface and orifices of each pig were closely examined under a bright light for the presence of fly eggs, maggots, or fly artifacts (spots caused by regurgitation or defecation).

After eighteen studies in both brightly lit and completely dark field settings with dense populations of necrophilous insects, no colonization of the cadavers was observed at night. It is our opinion that estimates of PMI based on insect development should continue to exclude nighttime as potential times for colonization. The data at hand from multiple studies indicates nocturnal colonization of human bodies by carrion flies is highly improbable and appears to be the exception rather than the rule. When applied to medicocriminal investigations, the data do not support nocturnal colonization as a plausible scenario.

Forensic Entomology, Postmortem Interval, Nocturnal Colonization

G93 Suicide by Extraordinarily Numerous Blade Wounds

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After attending this presentation, attendees will understand the importance of correlating terminal events, scene investigations, and autopsy findings in determining the manner of death in a multiple stab wound suicide.

This presentation will impact the forensic science community by outlining the findings of a case of uncommon method of suicide by multiple stab wounds.

In the absence of any circumstantial information, the autopsy finding of multiple stab wounds ordinarily creates the rebuttable presumption of homicide. Classification of the manner of death always requires integration of the terminal circumstances, scene investigation and autopsy findings. This case illustrates the importance of all three in assigning manner of death.

The decedent was a 42-year-old man with a history of depression, suicidal ideations and an involuntary admission to a behavioral health institution. On the day of his death, neighbors did not see or hear any suspicious activity. He was found dead by his girlfriend on the garage floor of his undisturbed single family home, when she returned from work. The body was lying at the edge of a very large stain of smeared blood on the floor. A large, blood-stained, non-serrated, kitchen knife was on the floor. The wall opposite the bay door had smeared hand marks. The floor below had drops of blood with a pattern of vertical impact. Several bloody footprints were on the floor, and matched the decedent's shoes. The body was in a flexed position, face down on the floor, leaning to the right; numerous stab wounds to the neck, chest and forearms were visible at the scene. The death was deemed of suspicious circumstances by the police.

The autopsy revealed more than fifty four incised and stab wounds. These included Twenty three stab wounds to the right side of the neck, three stab wounds on the anterior aspect of the neck, eight stab wounds on the left side of the neck, nineteen stab wounds on the anterior aspect of the thorax, and one stab wound to the abdomen. The wounds

penetrated the pharynx, pericardium, heart, left lung, and the blood vessels of the neck. The left wrist had multiple horizontally oriented superficial cuts. The configuration of wounds, i.e., shape, depth, location, etc., in correlation with the scene findings and circumstances of death indicated that the manner of death was suicide, despite the unusually high number of the injuries, and impressively complex blood stain pattern at the scene.

Multiple stab wounds are possible but not common with suicides. This case demonstrates the importance of correlating terminal events, scene investigations and autopsy findings in determining the manner of death in a multiple stab wound case.

Multiple, Stab Wound, Suicide

G94 A DNA Database for Species Identification of Forensically Important Flesh Flies (Diptera: Sarcophagidae) in the Continental United States

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The goal of this presentation is to inform attendees of the basic content for a newly developed DNA database for the identification of carrion flies in the continental United States. In particular, emphasis is placed upon the flesh flies (Diptera: Sarcophagidae), a hitherto largely unusable resource due to the lack of expertise in species identification for either adults or immature (larval or pupal) stages.

This presentation will impact the forensic science community because with this tool, species identification of sarcophagid flies is possible in a fast, precise method. This will then allow flesh flies, species commonly encountered at carrion, to be used by forensic entomologists in postmortem interval (PMI) estimation.

Species were collected from as far across their United States geographic range as possible. Geographic patterns of the mtDNA locus as well as the utility of subdivisions of the locus for species identification will be discussed.

Additionally, data is also provided for other sarcophagid species that are believed to be closely related to forensically important species, or might be confused for forensically important species from morphological examination. In total, we report on twenty three individual species, for a total of over 200 specimens. All specimens are vouchered in a collection that will be publicly available, allowing for future comparison of the original specimens if necessary.

This sarcophagid data joins the 300 plus specimens already sequenced from the families Calliphoridae and Muscidae to provide the most comprehensive database to date for the sole purpose of species identification of these flies and allows for the first time a rapid, independent verification of almost every major species found actively involved in the decomposition process.

Forensic Entomology, PMI, Diptera

G95 NMR and Bioinformatic Studies on the Metabolic Effects of Acetaminophen in Rat's and Human's in Urine: A Metabonomic Approach

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After attending this presentation, attendees will have learned how acetaminophen affects the body differently, depending on the individual, and how to identify biomarkers that are unique to that individual's response to acetaminophen.

This presentation will impact the forensic science community by discussing how once unique biomarkers are identified and correlated, and how further study can be done to help determine which individual's will have adverse side effects to certain medications.

Acetaminophen is one of the most widely used analgesic drugs in the United States today due to its therapeutic effects and high toxicity threshold. This research aims to measure the effects of various acetaminophen doses on rats and humans using ¹H-NMR spectroscopy. Previous work has been done to establish the therapeutic and toxic levels of acetaminophen and found them to be 10-15mg/kg and 150mg/kg respectively. The purpose of this research is to study the effects of acetaminophen on rats to determine if metabolic biomarkers can be identified and then compare those biomarkers to those found in a human study. This research will show that the unique metabolic biomarkers found are due to the specific responses of exposure to the acetaminophen. This particular experiment will involve three groups of five rats (control, low, and high dose) and two groups of five humans (control and low dose). Urine will be collected over the course of seven days post-dose. A pre-dose urine sample will also be collected and this will act as another control. Once samples have been prepared and analyzed using a water suppression method, data analysis will begin. The spectra will be analyzed using various bioinformatics methods to see if changes occurred metabolically and what those changes were. These results will then be compared to those found in the human study to see if any correlations can be established. The biomarkers identified will determine whether or not the subject in question is genetically predisposed in their metabolism of acetaminophen. This can then be expanded to other medications, including those still undergoing clinical trials, to help establish what biomarkers are indicative of certain adverse side effects of a medication. This will assist in prescribing medications to individuals who will not exhibit the adverse side effects.

Metabonomics, Acetaminophen, Biomarkers

G96 A Cold Case: A Forensic Review Nine Years After the Crime

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The goal of this presentation is to provide information about potential capabilities and limits of forensic entomology analyses on an old case in order to determine time of death.

This presentation will impact the forensic science community by underlining how our current understanding of the forensic sciences can help solve old cases and how important it is to have a DNA database of forensically important insects.

Three days after the disappearance of a teenage girl from a small city in the South of Italy the corpse of a girl was found in a wood not far from that city.

Immediately it was clear that the girl was murdered and moreover the crime scene appeared to be an execution. She was still clothed, but her hands and feet were tied with wire, her head was covered with a supermarket plastic bag and her eyes were hidden by a plastic tape. The murdered girl was recognized as the girl who disappeared.

The autopsy noted that she was not sexually abused, but there were many contradictory observations about the cause of death. The head of the girl sustained a bloody wound and the plastic bag over her head was not sealed properly, so there was a large mass of fly larvae on the head wound and in the eyes. The entomological evidence was poorly sampled and not used at the time, instead the level of humidity of the girl's clothes was used to determine a contradictory time of death. Many medicolegal professionals were consulted and each one wrote a different conclusion.

Two years later, the investigation led to a male suspect who was found with a note written by the girl. However, after two years of imprisonment he was exonerated.

The case was reopened six years later and the prosecutors who were handling the case decided to use another team of investigators and they also decided that a forensic entomology analysis might be useful to determine the time of death.

All entomological samples collected during the autopsy were destroyed some years before, so the work was performed with the collaboration of old and new investigators and based only on reports, pictures, crime scene and autopsy video, the girl's clothes and meteorological data from the area nearest to the crime scene.

Desiccated insect material was collected after eight years from the girl's clothes and because of the state of this evidence a morphological examination was not possible. Instead using mtDNA analyzes (COI) the insect material was determined to be *Lucilia sericata* (determined by a taxonomist).

To identify the instar of the desiccated larvae a lab experiment was designed in order to identify the original length of maggots before the dehydration process. This experiment revealed that the larvae from the body of the girl were 2nd instars of *Lucilia sericata*.

This information together with the environmental parameters and the ecological data helped to determine when the eggs were deposited and therefore the most probable time of death. The investigation is still in progress.

Investigation, Entomology, mtDNA

G97 Dead Men in Wells: How Forensic Science Was Used to Solve a Crime in an Aquatic Environment

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The goal of this presentation is to provide information on how three allied sciences (pathology, anthropology, and entomology) working together can produce important information on a complex crime scene in an obscure location. Furthermore, some understanding of the technical difficulties of removing a corpse from an aquatic environment while still retaining corpse integrity.

This presentation will impact the forensic science community by underlining the importance of collaboration and dialogue between forensic specialists. Moreover, this case demonstrates how important protocols are in crime scene recovery so fundamental information is not lost.

A corpse in an advanced stage of decomposition was found in late February at the bottom of a well. The well was a small hole in the ground covered by a large and heavy stone and it was situated in an open roofed dwelling of an abandoned farmhouse not far from a lake in northern Piedmont (Turin, Italy).

The extraction of the corpse was very difficult because the very small opening of the well (about 50 cm of diameter). The size was just sufficient for the entry of one man with his equipment and the air tank. The well was deep, a little more than 6 m and the corpse was floating in about 3 m of water.

The corpse was clothed but no documents were found. Because of the high decay of both tissue and bone the identity of the corpse was performed by anthropological and anthropometrical examination. It was recorded that the man disappeared in May the year before.

Further pathological, histological, and SEM EDX examination of the bone marrow was performed to determine the presence of diatoms, causes of death were identified.

Forensic entomology was used in order to calculate time of death (colonization interval) and to investigate with a possible time frame in mind as to whether following his murder he was dumped in the lake. This led to the lake being scoured for months by many civil defense and firemen volunteers.

Entomological material was sampled both from the corpse and from the water in the well which was pumped into large plastic tanks. Numerous species of flies were identified including *Calliphora vicina*, *Fannia* sp., *Muscidae*, *Trichoceridae*, *Sphaeroceridae* and *Psychodidae*.

Data on seasonal presence of Calliphoridae in the Piedmont region of Italy and stage of corpse decomposition (saponification) helped to confirm that the time when the man first disappeared coincided with the beginning of insect colonization. Moreover, it was possible to demonstrate that the corpse was never in the lake environment, thanks to information gathered from the literature about the biology of the insects found on the corpse. This fact was supported by the absence of diatoms within the marrow of long bones, and by the presence in the internal organs of the same silicates found in the water.

This case underlines the importance of collaboration and communication at crime scenes. In particular, when there are several experts such as firemen, policemen, medical examiners and other different forensic scientists (entomologists, botanists, anthropologists) present team work is essential. When a crime scene is conducted properly, relevant evidence is conserved and subsequently a complete analysis of the association of the human remains and the place of recovery can be documented.

Moreover, this case highlighted the importance of evidence recovery from water bodies and the scant information available on this topic, in particular the lack of literature on protocols and equipment.

Aquatic Environment, Anthropology, Entomology

G98 Fatal Rescue Burns

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After attending this presentation, attendees will identify with the significance of identification of a rescuer in a case of burns to ascertain if burns are sustained in an effort to save the victim, or trying to commit the crime.

This presentation will impact the forensic science community by understanding the need to prevent rescuers from becoming a victim of burn injuries, and the need to identify rescuers for medicolegal implications.

Dowry deaths in India are an investigative challenge and identification of a rescuer can have serious medicolegal implications. A

case of fatal rescue burns where a six month pregnant female committed suicide by pouring kerosene and igniting herself will be reported. The father-in-law of the deceased, in trying to rescue her, got entrapped in fire and sustained fatal rescue burns. As per the preliminary investigations into the incident and eyewitnesses account, a young six month pregnant female poured kerosene and set herself ablaze following an argument with the mother-in-law. The father-in-law, in an attempt to rescue her, also sustained burn injuries. Subsequently both were rushed to the district hospital. The female aborted on the 4th day of the incident. The victim (female) and the rescuer (father-in-law) expired later. The pattern of burn injuries in the rescuer and the victim will be presented and the case details of the victims along with body involvement in burns will be discussed.

Self-immolation is a preferred method of suicide in Indian women. The death of married females due to thermal burns that is commonly reported in India is usually associated with the social evil of dowry. A fatal thermal injury in married women in India hence is a major concern for the investigating and law-enforcing authorities. It is a challenging task for the medicolegal experts to discriminate homicidal and suicidal burns in married women and comment on the manner of sustaining injuries in cases relating to dowry disputes. Pattern of distribution of burns in different circumstances have been studied and a difference has been noted in between assault and self-immolation groups as well as between males and females. The issue becomes critical in case of thermal injuries sustained to the relatives and associates of the victim (a young married woman) during such an incident. It is vital to ascertain if burns are sustained in an effort to save the victim or trying to commit the crime.

An unprofessional rescuer of a burn victim is one who tries to save the victim, in spite of the consequences of putting out the fire without any safety precautions. Menezes et al introduced the term "rescue burns" for such thermal injuries as an option to allow easy tracking and identification of such cases. They opined that difference between rescue burns, accidental burns, and suicidal burns can have profound ramifications to the family of the injured or deceased rescuer, or the insurance company concerned in the case, as well as the judiciary. In India, dowry is a tradition; bride burning a social problem, hence cases of thermal burns in newly married females is an investigative challenge and identification of a rescuer can have serious medicolegal implications.

Rescuers, under the influence of emotional distress and with great courage, try to save the victim. Efforts should be made so that a rescuer does not become the next victim. To prevent the rescue burns general public should be educated about precautions to be taken before trying to prevent a victim especially during their early years of life. Identification of the rescuer is vital since it has profound medicolegal implications.

Dowry Deaths, Rescuer, Rescue Burns

G99 Sports Tool as a Weapon of Assault: A Case Report

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After attending this presentation, attendees will understand the injuries produced by a rarely reported sports tool as a weapon of assault.

This presentation will impact the forensic science community by helping the officials responsible for the maintenance of law and order to administer the justice.

Trauma to different regions of the body using different types of weapons is commonly seen in literature, but there is a dearth of cases reported about sports equipment as a weapon of assault. Here a case of a moderately built male who had a homicidal attack with a hockey stick thus producing multiple injuries in head, abdomen, and genitals.

A case report will be presented of a sports tool as a weapon of assault, a rare event. It is recommended that medicolegal death investigators become familiar with such injuries in a detailed autopsy, which may ultimately prove or disprove the case, and may be of significant value to the investigating authority.

Sports Tool, Hockey Stick, Multiple Injuries

G100 Unusual Case of Blunt Chest Trauma Without Rib Fractures Leading to a Major Pulmonary Laceration

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The goal of this presentation is to describe and discuss a case of a major pulmonary laceration after a blunt chest trauma without rib fractures in an infant involved in a car accident as a passenger.

This presentation will impact the forensic science community by demonstrating an infrequently discussed mechanism of lung laceration due to a blunt chest trauma.

Pulmonary laceration is a common result of penetrating trauma but may also be caused by blunt trauma; broken ribs may perforate the lung, or the tissue may be torn due to shearing forces that result from different rates of acceleration or deceleration of different tissues of the lung.

This case involved a 6-year-old, Hispanic healthy female infant who was a partially restricted backseat passenger in a compact vehicle that was traveling along a local highway. She was lying across the back seat when the driver suddenly fell asleep and collided with the back of a large truck. As a result of the impact her body was thrown against the back of the passenger's front seat and died instantaneously.

At autopsy the body corresponded to a well-developed and well nourished female infant. She was forty inches tall and weighed thirty two pounds. External examination of the anterior torso disclosed the presence of a horizontal linear abrasion over the superior aspect of the left hemithorax. Also a small elliptical contusion was over the superomedial aspect of the right hemithorax. Other small abrasions were present in the lateral aspects of the right upper and lower quadrants of the abdomen and posterior aspect of the right arm. The body had no other external signs of trauma. Upon reflection of the skin of the anterior thorax, no hemorrhagic infiltrates were present. There were no rib fractures. The left pleural space had 420 mL of liquid blood. The right pleural space and pericardium had no hemorrhages. The left lung had an extensive oblique laceration that practically transected the upper lobe, from the apex to the inferior medial aspect of the base. In addition multiple contusions were present over the anterior and posterior aspects of both lungs. The rest of the thoracic and abdominal organs had no lesions. Toxicological evaluation was negative for alcohol, cocaine, opioids and cannabinoids.

Major laceration of the lung is a rare and not a well recognized complication of blunt chest trauma. Pulmonary laceration caused by blunt high-energy trauma results from a mechanical shear or puncture that disrupts the parenchyma, creating a cleavage plane within the lung. The mechanism of development of pulmonary laceration after blunt chest trauma is usually thought to be the result of direct impact leading to rib fractures and thereafter, the broken ends of the ribs directly tearing the lung. However, the absence of rib fractures in this infant makes this mechanism unlikely. In 1988 a group led by R.B. Wagner divided pulmonary lacerations into four types based on the manner in which the person was injured. In type 1 the laceration results from sudden compression of the thorax causing rupture of the lung. They usually

occur in a central location of the lung and tend to be large as in this case. Type 2 laceration results from severe compression of the pliable lower thorax of younger patients. Sudden herniation of the lower lobe in front of the vertebral bodies causes a paravertebral shear injury with laceration. Type 3 lacerations result from direct puncture of the lung by a displaced rib fracture. Type 4 results from lung shearing at sites of pleural adhesions.

This case represents a particular mechanism involved in a blunt chest trauma in which a high-energy non-penetrating injury was applied to one hemithorax leading to a major unilateral pulmonary laceration without other organ involvement

Pulmonary Laceration, Chest Trauma, Car Accident

G101 Postmortem Analysis of Vitamin D Using Liquid Chromatography Tandem Mass Spectroscopy

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The goal of this presentation is to review physiology of vitamin D, review current methodologies for measuring vitamin D, and understand the utility of measuring vitamin D in postmortem blood samples.

This presentation will impact the forensic science community by providing the framework to understand the utility of measuring vitamin D in postmortem blood samples. With the recent debate regarding vitamin D deficiency, bone fractures, and questions of child abuse it seems imperative to be able to address these issues as thoroughly as possible. Often is the case in forensic cases that antemortem blood samples are not available or specific questions have not been asked by a decedent's physician prior to death. Thus, there is no way to know if a vitamin D deficient state was present prior to death. The results study will allow the forensic community to know whether or not a postmortem blood sample can or cannot be analyzed appropriately for vitamin D nutritional status.

Objective: To measure vitamin D in postmortem blood samples using our recently developed liquid chromatography-tandem mass spectrometric (LCMSMS) method. Briefly, our current method provides for measurement of the 25-hydroxy derivatives of vitamin D, specifically 25(OH)-D₂/D₃, (OHD₂, OHD₃) in human serum. Increasingly, current clinical practice is to measure OHD₂ and OHD₃ to assess vitamin D nutritional status. To our knowledge, methods have not been evaluated for measuring these analytes in postmortem samples. The most common assay platform used today is an immunobased assay, which relies on antibodies which are known to cross-react with many vitamin D metabolites. Such immunobased assays are particularly sensitive to sample integrity and it is likely that a postmortem blood sample may not be appropriate due to hemolysis and other postmortem artifacts.

Hypothesis: Postmortem vitamin D concentration, measured with a sensitive and specific assay such as LC-MSMS, will correlate well with antemortem concentrations. Such analysis will be helpful in those cases where antemortem vitamin D levels have not been previously measured in the primary care setting. Furthermore, with the recent debate over vitamin D deficiency (Rickets) and suspicious non-accidental bone fractures, such an assay will, without doubt be of interest in cases questioning abuse.

Materials and Methods: In preliminary studies, three recent cases of natural disease were selected. In each case, peripheral blood (iliac vein) was sampled within 24 hours of the time of pronouncement. Approximately 8 ml of peripheral blood was drawn into a red-top tube

under gentle pressure to minimize hemolysis. Each sample was allowed to clot at room temperature for one hour and then centrifuged for twenty five minutes. The serum was then transferred to a clean red-top tube and frozen at -10 C until assayed. Hexa-deuterated OHD2 and OHD3 (OHD2d6 and OHD3d6, Medical Isotopes, Inc.) were used as internal standards (IS). Calibrators were prepared in acetonitrile (ACN) at 5, 10, 20, 50, 100 and 150 ng/ml for each analyte (OHD2 and OHD3). Samples and calibrators (500 ul) were spiked with 75 ng IS, extracted in 1 ml ACN and centrifuged. Thirty ul of supernatant was injected into a Shimadzu HPLC at 70% H₂O:30% ACN at 350 ul/min flow. Analytes were separated on a C18 column (100 mm x 2.1 mm x 3 um, RESTEK) and then introduced into a triple quadrupole mass spectrometer (ABI 3200 Q-trap) via an APCI source in the positive ion mode. The analytes were eluted at 100% ACN over a 13 minute run.

Results: Preliminary studies addressed whether or not vitamin D analytes are stable in postmortem blood and if so whether they can be measured with our LC-MSMS method. In each of the samples tested to date, successful and reproducible total vitamin D in levels ranging from 6.43 ng/ml to 95.3 ng/ml have been detected and quantitated. We are confident in these results because the level of quantitation (LOQ) has previously established of these assay at 5 ng/ml.

Summary: It can be shown that postmortem blood contains measurable vitamin D and can be accurately measured on our LC-MSMS platform. Immediate planned studies on adult and pediatric cases include: (1) a direct comparison of hospital admission antemortem blood with our 24 hr postmortem blood samples; (2) a direct comparison of plasma and serum samples; and, (3) a postmortem stability assay to characterize how the postmortem interval affects our ability to accurately measure vitamin D.

Vitamin D, Postmortem Analysis, LC-MSMS

G102 An Unusual Case of Homicide by Knife, Screwdriver, and a Kitchen Fork

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After attending this presentation, attendees will be familiar with wound patterns inflicted by multiple unusual means. Only a few cases of homicide by screwdriver, knife, and kitchen fork are reported in forensic literature. Sometimes it may be difficult for the forensic pathologist to identify the penetrating weapon missing from the crime scene. The importance of a thorough forensic investigation, including crime scene evaluation, analysis of circumstantial data, autopsy findings, toxicological analysis, histological, and immunohistochemical studies is emphasized.

This presentation will impact the forensic science community by presenting a homicide where the murderer assaulted the victim with a screwdriver, a knife, and a kitchen fork. The unusual injuring tools and the relevant injuries were studied and analyzed to approach the case. The confocal microscope was utilized to verify the three dimensional appearance of the cutaneous lesions.

Injuries caused by sharp or pointed objects are common. They rarely cause fatal injuries; however, and the fatality rate is estimated to be 3% at most. Most fatalities caused by sharp force are homicides. The ratio of homicide to suicide is estimated at 6:1 to 5:2. When investigating deaths owing to sharp force, the forensic pathologist is expected to give an opinion on the following points: the type of injuries; the number and anatomical distribution of injuries; the shape, size, length, and depth of injuries; the object (weapon) used; the amount of force needed to inflict the injuries; the extent of internal injuries; the cause of death; and the victim's capability to act. These points are of

decisive importance for the reconstruction of the sequence of events. Most homicides by sharp force are committed by males, often under the influence of alcohol. The most common tool used is a knife, but other pointed objects, such as scissors, ice picks, forks, or broken glass, may also be used. The victims are usually family members or acquaintances. The death scene is most frequently the victim's home. Fatal stabs are usually located in the precordial or cervical region. The number of stabs does not allow the drawing of conclusions as to the mode of death, the motive, or sex of the perpetrator. When the number of stabs is higher than necessary to kill the victim, this is referred to as "overkill," and may point to a strong emotional conflict between the perpetrator and the victim.

Case Report: The lifeless body of a 18-year-old girl was found in a mansard by the owner. He was giving hospitality to a friend since three months. The girl was the former girlfriend of his guest. The body laid face down in a large pool of blood. Immediately he tried to help her and called the ambulance, but she was pronounced dead. There was a great confusion in the room, on the floor beneath the body a large pool of blood was evident, with extensive blood spatter on the surface of the wall on the right, of the cupboard on the left and of the bed, in the center of the room. The head of the decedent lied near a chest of drawers which surface was full of stripes of blood made by the girl's fingers in an attempt to getting up from the floor. The postmortem examination showed the face devastated by very numerous cross lesion of the cutis, 0.4 cm in length, ending in deep incision on the bone surface underneath. The same wounds were also on the thorax and on the dorsal face of the hands. These wound appeared similar to the shape of a phillips screwdriver tip. On the left side of the face and neck there were many linear wound that appeared always paired and of the same length, suggesting the use of a sharp and pointed object like scissors, kitchen fork, etc. There were also numerous deep linear cutaneous wound on the anterior surface of the neck, slightly oblique, with clear-cut divergent margins, exposing the underlying structures, also sectioned, and ending in linear superficial incisions at different vertebral bodies of the cervical spine. Other deep linear cutaneous wounds were localized on the right emithorax; beneath these lesions the costal cartilage was sharply sectioned at many levels, with soft tissue bleeding underneath. No pulmonary lesions were found. On the hands and the forearm the girl showed many defense lesions made by the sharp and pointed object, and by a cross-tipped mean. Immunohistochemical studies were performed on the cutaneous specimens for the determination of the vitality. The evaluation of skin samples with confocal microscope allowed researchers to observe the three-dimensional model of the different wounds. Toxicological analyzes were negative. On the basis of the autopsy results, the pathologists gave indications to policemen about possible responsible weapons. A thorough investigation of the crime scene allowed the finding of a phillips screwdriver dried with blood and a kitchen fork in a drawer; no other weapons were found. The day after the body finding, the boyfriend, who was sought by police, crashed with his car while he was escaping along the highway. Inside his car police discovered a knife, stained with blood, and locks of hair.

Knife, Screwdriver, Fork

G103 Love and a Bullet: Autoerotic Accident or Intentional Suicide?

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The goal of this presentation is to highlight the potential for confusion regarding manner of death by using an interesting example.

This presentation will impact the forensic science community by highlighting the gray area of manner of death.

Autoerotic deaths have traditionally been caused by asphyxia due to hanging. To a lesser degree, trauma secondary to electrocution and

insertion of objects have resulted in death. Based on scene investigations and the autopsy findings in these more traditional autoerotic cases, manner of death is best classified as accident. However, there does arise within the forensic spectrum cases involving autoerotism where the manner of death is more equivocal. It is in these fringe cases where excellent investigation of the scene and the victim's past medical history, is paramount. We present here an unusual case of autoerotic death in which the autoerotism involved a gun.

The decedent, a 29-year-old man killed his father when he was thirteen-years-old. Using a handgun, he shot his father because he was repeatedly abused by him. His mother encouraged the murder. As a young man, the decedent found titillation from a toy handgun. As he grew older, he felt the need for a more powerful arsenal in order to achieve sexual arousal. During his last years, the decedent not only considered his silver .38 caliber Rossi handgun to be "sexy," but he smelled, fondled, and caressed it. The 38 Rossi was kept in a velvet bag in his bedroom, retrieved easily to be used as a sexual and masturbatory aid. His sexual routine with his beloved Rossi escalated from dry firing the empty gun, to leaving one bullet in the cylinder of the revolver while pulling the trigger. Eventually, this repeated practice resulted in his death due to a self-inflicted contact range gunshot wound to his head. A further complication in this case is the decedents past psychiatric history. He had mild depression and suffered from bouts of insomnia. So this case serves as a great illustration and topic for discussion regarding aspects of autoerotism, cause of death, manner of death, and the less clear distinction between suicide and accident.

Gunshot Wounds, Autoerotic, Manner of Death

G104 Laryngeal and Hyoid Bone Trauma Resulting From Forces Other Than Compression of the Neck

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The goal of this presentation is to describe and discuss ten cases associated with laryngeal and hyoid bone blunt trauma.

This presentation will impact the forensic science community by demonstrating the pathological features of this infrequently discussed entity in the non-homicidal setting.

Hyoid bone fractures are usually the result of direct trauma to the neck through manual strangulation or hanging. These fractures secondary to blunt trauma other than strangulation are rarely reported and discussed. This report discusses ten cases with hyoid bone or laryngeal fractures associated to blunt trauma.

Ten head and neck trauma cases in which the autopsy disclosed the presence of hyoid bone or laryngeal fractures were reviewed. These cases occurred within the period 2008-2009 and examined at the Puerto Rico Institute of Forensic Sciences. Cases with a diagnosis of strangulation or hanging were excluded.

The ten cases are summarized in Table 1.

Eight of ten cases were male and two were women. All cases corresponded to adults between 24 to 80 years. Half of the cases were older than 50 years. Eight out of ten cases corresponded to motor vehicle accidents; one case was a small plane crash accident and one case was a homicidal blunt trauma to the head with a concrete block. The motor vehicle accident cases included three motorcyclists, three pedestrians and two car drivers.

Common autopsy findings for all cases included the presence of hyoid bone and/or laryngeal fractures associated with craniomandibular trauma with maxilla and mandible fractures.

The most common fractured site was the joint between the left greater cornu with the left side of the body of the hyoid bone. Five cases had only one fracture at the left side and two cases had bilateral fractures. One case had a unilateral fracture at the right side. Fractures of the hyoid body were found in two cases, including one case with multiple fractures of the hyoid bone. Cases with thyroid cartilage fractures included one left superior cornu fracture and two cases with fractures of the right and left laminae. The cause of death for each of the ten cases was Blunt Force Injuries and the manner of death for nine of the cases was accident and one case was homicide.

Hyoid bone fractures secondary to trauma due to strangulation or hanging are rare. In the forensic literature, little information of laryngohyoid trauma in victims other than compression of the neck is available. Forensic pathologists look for a fractured hyoid bone as evidence of strangulation. There are several reasons contributing to the rarity of this fracture. The first is that the hyoid bone is well protected by the mandible. Most trauma to the face results in fracture of the mandible without hyoid bone fracture. The second is that hyoid bone is protected by its mobility in all directions, so the pressure may be cushioned. The third is that it is not completely ossified in younger patients allowing for more flexibility and decreased rigidity.

In laryngohyoid fractures, three mechanisms could be involved. The first involves a direct impact of the neck structures. The second involves an indirect muscle strain on the hyoid bone or thyroid cartilage resulting from hyperextension or hyperflexion of the neck or secondary to associated local trauma such as mandible fractures. The third is a combination of direct and indirect mechanisms.

These cases could represent similar mechanisms involved during a blunt trauma in which hyoid bone and laryngeal fractures are the result of high energy forces applied to the mandible strong enough to be transmitted by its anatomical contiguity. Strong muscle strains on the mylohyoid muscle could lead to hyoid bone lesions in case of mandible fracture where this muscle is inserted. This could explain the common association of hyoid bone fractures with mandible fractures in this report.

Table 1: Ten Laryngeal and Hyoid Bone Trauma Cases

Case #	Sex	Age(years)	Circumstances	Hyoid/thyroid trauma	Cartilage	Facial fractures	Cause/Manner of death
1	M	80	Hit on head with a concrete block	Midpoint of Hyoid body	Maxilla Mandible		BFI/Homicide
2	M	38	MVA: Motorcyclist	Left joint (body and greater cornu). Left lamina of thyroid	Mandible		BFI/Accident
3	M	69	MVA: Driver	Left joint (body and greater cornu)	Maxilla Mandible		BFI/Accident
4	M	27	MVA: Pedestrian	Hyoid Body - Right and Left joints (body and greater cornua)	Maxilla(L) Mandible		BFI/Accident
5	M	65	MVA: Pedestrian	Right joint (body and greater cornu). Right lamina of thyroid	Maxilla (R&L) Mandible		BFI/Accident
6	M	30	MVA: Motorcyclist	Left joint (body and greater cornu)	Maxilla(R) Mandible		BFI/Accident
7	F	72	MVA: Pedestrian	Left superior cornu of thyroid	Mandible		BFI/Accident
8	F	45	MVA: Driver	Left joint (body and greater cornu)	Mandible		BFI/Accident
9	M	24	MVA: Motorcyclist	Right and Left joints (body and greater cornua)	Mandible		BFI/Accident
10	M	52	Small Plane crash Pilot	Left joint (body and greater cornu)	Maxilla (R&L) Mandible		BFI/Accident

Hyoid Bone Fracture, Laryngeal Fracture, Mandible Fracture

G105 The Evolving Distribution of Cause and Manner of Death in HIV Positive Medical Legal Cases: Links Between ART and Traditional Categories of Chronic Disease

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The goal of this presentation to describe and evaluate the impact of HIV infection, obesity, and two linked diseases, diabetes mellitus (diabetes), and cardiovascular disease (CVD), on the forensic practice and public health roles of medical examiner/coroners. Attendees will receive an epidemiological analysis of these diseases in medicolegal (ML) cases presenting to a large urban-based medical examiner office. Specific emphasis will be placed on the interrelationships between HIV infection and traditional categories of chronic disease and on the implications of the study results for other medical examiner offices nationally.

This presentation will impact the forensic science community by illustrating the evolving status of HIV infection as a chronic disease and the effects of increased longevity of the HIV positive patient on the composition of medicolegal caseloads. The role of medical examiner offices as guardians of the public health and the practical aspects of public health reporting will be discussed.

In 2009 the Centers for Disease Control and Prevention (CDC) released the results of HIV/AIDS surveillance data collected from thirty four reporting states. An estimated 552,000 adults and adolescents were living with HIV/AIDS in these states in 2007, an increase of 16% over 2004.¹ The increase in persons living with HIV infection is well-documented in the literature and it is associated with the implementation of ART treatment (combined antiretroviral therapy and highly active antiretroviral therapy), prolonging the time interval from HIV infection to development of AIDS, and with increased HIV screening at point of care, which can lead to earlier treatment. HIV positive patients are living longer through better disease management. However, ART produces side effects that increase the HIV positive patient's susceptibility to obesity, (especially visceral fat around the waist), diabetes, hyperlipidemia and CVD.

The population sample for this retrospective study consists of ML cases investigated by the Harris County Medical Examiner's Office (HCMEO), Houston, Texas in 2008-2009 that fall within these parameters: 15+ years old, 60+ inches tall, and weight of 70+ pounds. Size limits are set to exclude young children and decedents in advanced decomposition. The incidence of CVD and diabetes is obtained from the primary and contributing causes of death, and HIV incidence from medical history and HCMEO serology results reported to the local health authority. The data presented here reflect 5794 ML cases received from January 1, 2008 through July 22, 2009. The balance of the 2009 cases and the biostatistics results will be included in the final analysis and presentation.

The population of Harris County, Texas is an ethnically diverse 3.9 million residents, of which 29% are obese (BMI >30) and the average BMI is 27-30. Approximately 8.3% of Harris County residents have been diagnosed with CVD, 7% with diabetes, and 0.5% with HIV.² In concordance with these data, 29% of the ML decedents have a BMI >30, with a range of 10-98 and an average BMI of 27, and in 7% of cases diabetes is the cause or contributing cause of death. Due to the nature of ML cases and the efficacy of autopsy diagnosis, the percentages of CVD and HIV in the sample are higher at 31% and 0.9%, respectively, even though these conditions may be under-reported in a forensic sample.

Among the fifty five HIV positive decedents, 13% (7) have a BMI >30. The average BMI is 24 and the range is 15-55. Examination photographs reveal that 42% (23) have a concentration of visceral fat in

the belly area. Review of the medical records is underway to determine the number of these decedents in ART at death. The racial/ethnic composition is 44% black, 42% white, 13% Hispanic, and 2% Asian. The age range is 18-81 years, with a median age of 47, a relatively middle-aged distribution. The leading causes of natural death are complications of AIDS (11) and CVD (11).

As these preliminary results show, improved treatment of HIV infection may lead to a higher number of deaths from CVD, fewer AIDS-related causes of death, and fewer infectious findings at autopsy that result in a request for an HIV serology by the forensic pathologist. Medical examiner/coroners can prevent a negative impact on public health surveillance of HIV infection in forensic cases through awareness of the changing epidemiology of HIV.

References:

- ¹ <http://www.cdc.gov/hiv/topics/surveillance/resources.htm>
- ² Texas Department of State Health Services Epidemiology and Surveillance Branch 2008 Annual Report

HIV, Medical Examiner, Epidemiology

G106 Death in a Wine Vat

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After attending this presentation, attendees will understand the necessity of good collaboration between the different institutions that work on an undetermined death crime scene and will become familiar with the autopsy presentation of death by inhalation of carbon dioxide (CO₂).

This presentation will impact the forensic science community by increasing understanding the need for collaboration between the different institutions (e.g., police, casualty department, national toxicology department, local eco-toxicology department, regional wine institute) to get the cause of death in a unclear case.

A 42-year-old man was found unresponsive by his father with the head and the left limb in a wine vat. The father could not remove the body, so he immediately called for a help. The emergency responders found him in asystole and pronounced him dead after twenty minutes of a resuscitation attempt.

The vat of 1,750 liters (455 gallons) was fuelled at 80% with grapes the day before. To give a better aroma and flavoring to the wine, 40 kg (88 pounds) of dry ice were added into the grapes. The worker had to then check the evolution of the must. For that, he had to regularly take samples to look at the color, to smell and to taste the must, especially during the period of fermentation of alcohol (about 15 days).

Autopsy showed cyanosis of the face and the neck, conjunctival petechiae, cerebral edema, and signs of acute anoxia into the brain. Toxicological analysis was negative. The National Toxicology Department suggested that it could be an intoxication by carbon dioxide, but could not prove it, because of the evaporation of the gas (CO₂).

The day after, the scene was visited with the police to try to understand the events. The Local Eco-Toxicology Department was asked to perform the analysis of the air on the top of the vat. They found 100% of CO₂. The Regional Wine Institute speculated that the addition of dry ice produce immediately a lot of CO₂ and not progressively as in a normal fermentation. In this case, if someone breaths inside the vat, loss of consciousness can come in a few seconds and then the death in a few minutes. Finally, as a result of the police investigations, a pair of glasses were found inside the vat when it was emptied after three months. It was concluded that the worker had lost his glasses into the vat and he tried to recover them.

The medical literature contain only a few cases of intoxications by carbon dioxide, occurring in ship holds, in the brewing industry, in silos,

tunnels, sewer shafts, and poultry plants that use dry ice, but rarely in wine industry.

The cause of death was not determined on the basis of the autopsy. But the information received from the different institutions allow the determination the cause of death as an acute intoxication by carbon dioxide and the manner of death as a accident, due to the loss of glasses in the vat.

Death, Wine Vat, Carbon Dioxide

G107 Nailing the Diagnosis: Features of Fatal Injury Inflicted By Unusual Projectiles and Firearms

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After attending this presentation, attendees will recognize the distinguishing features and potential diagnostic pitfalls of injuries inflicted by uncommon projectiles and firearms.

This presentation will impact the forensic science community by discussing the pertinent characteristics of a variety of wounds inflicted by atypical ammunition or firearms. A ten-year retrospective review of case files at the Cook County Office of the Medical Examiner and a regional collar county yielded seven cases of suicide committed with atypical projectiles or firearms. These include four cases of nail gun suicide and a case of an antique firearm loaded with Phillips head screws used to commit a double homicide-suicide. Additionally, two cases of accidental death involving aerial fireworks mortars were identified which are similar in many ways to two cases of suicidal fireworks injuries that have been previously reported in the literature.

The use of a nail gun to commit suicide is extremely rare, with fewer than ten cases detailed in the literature. It has been previously reported that nails recovered from individuals who have committed suicide remain straight upon entering the body. This is in contrast to reports of accidental nail gun injury where recovered steel nails have been observed to be curved or bent most commonly as a result of ricochet. It has been suggested that one may infer a given injury is accidental if the nails are bent and suicidal if the nails are straight. A case of nail gun suicide is reported with recovery of both bent and straight nails.

The external evidence of injury inflicted by nail guns may be subtle and easily overlooked, especially if the nail is not visible externally. Blood may be minimal or absent both on the body and at the scene. Not until the autopsy examination may the devastating extent of the injuries be appreciated. In three cases of nail gun suicide involving the head and one involving the chest, the injuries were small entrance wounds typically measuring 0.1 inch or less in diameter. The individual with self-inflicted chest wounds was dead at the scene and the three remaining cases had variable survival times.

In contrast to the injuries produced by nail guns, the cases involving the use of an antique firearm produced injuries deceptively similar to close-range or contact shotgun wounds. Radiographic examination identified the atypical nature of the projectiles, short Phillips head screws. Because the load was noncommercial, the number of projectiles (screws) varied between the cases. Additionally, from two cases, paper used as patching to contain the projectiles was recovered from within the wound track.

Atypical projectiles can, of course, produce atypical patterns of injury. Two cases of accidental death involving aerial fireworks mortars show that patterns of injury and soot deposition can be distinctive and, in the absence of additional information, may help identify the use of less common incendiary powders. Although no cases of suicide involving fireworks were found, two cases of accidental death involving fireworks were identified. Both occurred outdoors and had massive craniocerebral

injuries with complete or partial avulsion of the brain as well as thermal injury of the surrounding scalp and skin. The injuries were limited to the head. This pattern of injury is consistent with that seen in suicidal fireworks injuries as described in the literature and highlights the importance of a scene investigation when investigating these deaths.

Perhaps due to the ready availability of more conventional weaponry, suicide using atypical projectiles and firearms remains rare. Despite their infrequency, it is important to recognize the pertinent features of such cases. In nail gun suicide cases involving the head, both bent and straight nails were identified. Many of the wounds in these cases were very subtle and could easily be overlooked. In cases of firearms loaded with atypical ammunition, the external appearance may be that of a close-range or contact shotgun wound. Finally, cases of accidental fireworks deaths demonstrated injuries similar to those described in suicidal fireworks deaths. All of these cases emphasize the importance of obtaining a detailed history, radiographic studies, and performing a thorough scene investigation.

Nail Gun, Fireworks, Atypical Injury

G108 Please, Don't Get Angry! Two Fatal Cases of Emotional Stress-Related Death in Left Ventricular Apical Ballooning Syndrome (Tako Tsubo Cardiomyopathy)

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The goal of this presentation is to present two cases of death due to Tako Tsubo cardiomyopathy. The growing interest of the scientific community in understanding physiopathology, still far from a complete definition and the amazing of videos presented, makes the presentation absolutely peculiar.

This presentation will impact the forensic science community by highlighting characteristics of syndrome and the importance of a complete postmortem examination in rare fatal cases. This presentation demonstrates the typical histological signs of catecholamine toxicity (CBN), but further studies are still needed for further in-depth knowledge of TTC and stress-related cardiac physiopathology. In particular structural alteration of the contractile and cytoskeletal proteins could also be investigated.

Tako-tsubo cardiomyopathy (TTC) is also known as stress-induced cardiomyopathy (SICMP) or left ventricular apical ballooning syndrome (LVABS), broken heart syndrome, and ampulla cardiomyopathy. It was first described in the early 1990s in Japan in which patients (generally postmenopausal women) complained of chest pain and dyspnea, mimicking a coronary arterial disease. The name of "tako-tsubo" cardiomyopathy is derived from a pot with a short neck and a round bottom used for octopus fishing in the Japanese sea, as this resembles the left ventriculogram during the acute phase of the disease. It is characterized by a transient akinesia of the apex and compensatory basal hyperkinesis, triggered by marked psychological or physiological stress in the absence of significant epicardial coronary artery disease. TTC has been recently classified as primary, acquired cardiomyopathy and diagnostic criteria have been proposed: reversible akinesis or dyskinesis of the left ventricular apical and midventricular segments, with apical ballooning extending beyond a single epicardial vascular territory, new ECG ST-segment or T-wave abnormalities mimicking AMI, absence of exclusion criteria, including obstructive coronary disease or angiographic evidence of acute coronary plaque rupture, recent significant head trauma, etc. Although precipitating stress is not always identifiable, the stressful trigger could be emotional or physical. Multivessel epicardial spasm, myocardial dysfunction triggered by

excess of catecholamine levels, microvascular coronary spasm or dysfunction and neurologically mediated myocardial stunning have been proposed to explain TTC. Generally the prognosis is good but complications including death have been reported with an extremely low mortality rates. Deaths in these cases generally occur as a consequence of fatal ventricular arrhythmia (VF) or cardiogenic shock due to stress-related sudden severe ventricular dysfunction. Two fatal cases of TTC will be presented.

Case 1: A 52-year-old woman complained of thoracic pain and dyspnea after a quarrel with colleagues at the workplace. She had complained of the same symptoms a few months prior. Clinical examination on ED showed moderate high BP (160/90); pulse (90 bpm) and oxygen saturation (96%) were normal. A 12 lead ECG registration was immediately performed showing ST segment reduction mimicking myocardial infarction. Cardiac markers were elevated on lab test (CK 220, troponin 5.173). A severe ventricular failure was observed on echocardiography (EF < 30%). Cardiac catheterization was unremarkable for coronary obstruction. TTC was suspected, and confirmed at ventriculogram, where a typical systolic dysfunction involving left ventricular apex was recorded. Beta-blocker therapy was introduced but few hours after charge on cardiology department, death suddenly occurred in spite of resuscitation maneuvers.

Case 2: A young 30-year-old suddenly collapsed after a violent altercation with colleagues at the workplace and immediately presented to the emergency department of the local hospital. ECG was performed, showing ventricular fibrillation. The patient died few minutes after presentation. One week before, the young man complained thoracic pain and a 12 lead ECG was performed, showing ST segment reduction mimicking myocardial infarction. A complete postmortem examination was performed few days after death, in both cases. External examination was unremarkable. Internal examination showed mild cerebral edema and heavy lungs presenting white foam on the main bronchi, in both cases. Hearts were fixed in formalin. Cardiac sizes were normal, with conical shape. Macroscopic study (cut in cross-section 3 mm intervals) of coronary arteries were unremarkable, in both cases. Histological examination revealed polyvisceral stasis, mild cerebral edema; massive pulmonary edema was also detected. The pathological myocardial picture included multiple foci of contraction band necrosis; a few areas of patch interstitial fibrosis were also detected. Cardiac microscopic study was completed by means of immunohistochemistry by means of beta2 adrenergic receptor antibodies, showing expression on myocyte membranes in both cases. Confocal laser 3D scans of myocytes was also performed. No signs of cell death (apoptosis) was detected (TUNEL). Dosage of catecholamines and their metabolites on a blood and urine samples was performed, showing high levels of catecholamines, metanephrine and vanillyl-mandelic acid. Toxicological examination was negative. Clinical data, autopsy findings, data collected from immunoistochemical and CLSM study of myocytes and laboratory analysis, led us to conclude that cardiogenic shock after intense emotional stress complicated by malignant arrhythmia (VF) in Tako-tsubo cardiomyopathy was the main cause of death in both cases.

This research demonstrates typical histological signs of catecholamine toxicity (CBN) but further studies are still needed for further in-depth knowledge of TTC and stress-related cardiac physiopathology. In particular, structural alteration of the contractile and cytoskeletal proteins could be also be investigated.

Tako Tsubo Cardiomyopathy, Emotional Stress-Related Death, Cathecolamine Toxicity

G109 A Case of Anaphylactoid Syndrome of Pregnancy

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The goal of this presentation is to explain the use of the term anaphylactoid syndrome of pregnancy and the difficulties one can encounter in making a diagnosis of amniotic fluid embolus.

This presentation will impact the forensic science community by illustrating a case of anaphylactoid syndrome of pregnancy and will include a discussion of the autopsy procedures necessary for intrapartum deaths.

A 19-year-old G2P1 Hispanic female presented to the emergency room with spontaneous rupture of membranes at 33-6/7 weeks gestation. She had no prior medical history and had undergone routine prenatal care. Upon admission, fetal heart rate monitoring showed evidence of fetal distress, and a decision was made to deliver the fetus via Cesarean section (the decedent had undergone a Cesarean section for a prior delivery). During the C-section delivery with an epidural anesthetic, the patient suddenly became bradycardic and hypoxic at the point of fascial closure, following delivery of the fetus and placenta. Cardiopulmonary resuscitation efforts were unsuccessful, and she died in the operating room. The male fetus survived and had no complications.

At autopsy, she had an intact surgical site with no evidence of cardiac disease or pulmonary embolus related to deep venous thromboses. Microscopically, there were platelet and fibrin thrombi with admixed neutrophils filling the small pulmonary vasculature. Thorough sampling and special stains of the lungs failed to reveal squamous cells in the pulmonary vasculature, necessary for the diagnosis of amniotic fluid embolus. Examination of the placenta showed acute chorioamnionitis.

Even though the clinical features in this case pointed towards an amniotic fluid embolus (i.e., sudden intrapartum bradycardia and cardiopulmonary arrest), the diagnosis could not be made because squamous cells were not identified in the pulmonary vasculature. A review of the decedent's medical records indicates that intraoperatively her hemoglobin decreased from 9.0 to 5.2 to 4.5 gm/L. No source of hemorrhage was identified at autopsy; therefore, the decrease in hemoglobin and the pulmonary platelet and fibrin thrombi were likely related to disseminated intravascular coagulopathy (DIC). Instead of classifying the cause of death as "amniotic fluid embolism", the cause of death was classified as "intrapartum maternal demise with diffuse pulmonary fibrin and platelet thrombi complicating Cesarean section for fetal distress, with acute chorioamnionitis."

The clinical and hemodynamic manifestations of amniotic fluid embolism have been noted to be similar to those that are manifested in anaphylaxis and septic shock. The signs and symptoms include hypotension, fetal distress, cardiopulmonary arrest, coagulopathy, cyanosis, dyspnea, and seizures. The pathophysiological mechanism for the development of the amniotic fluid embolism begins with maternal intravascular exposure to fetal elements, when there is a breach in the barrier between amniotic fluid and maternal circulation. This in turn initiates an endogenous mediator response similar to an allergic reaction, with mast cell degranulation and activation of the complement pathway.

The diagnosis of amniotic fluid embolism has been traditionally made by identifying squamous cells in the pulmonary vasculature; however, fetal tissue or amniotic fluid components are not always found in the women who present with the clinical signs and symptoms of amniotic fluid embolism, as was the case in our autopsy. In light of the apparent pathophysiological mechanisms involved and because squamous cells may not always be identified in the pulmonary vasculature, the term "anaphylactoid syndrome of pregnancy" has been used to describe the syndrome of acute peripartum hypoxia,

hemodynamic collapse, and coagulopathy, which we believe this case represents.

The postmortem diagnosis of amniotic fluid embolism can be challenging to forensic pathologists. The gross findings are usually nonspecific and can include pulmonary edema and atelectasis, evidence of DIC, and pulmonary hyperinflation. Autopsy findings include fetal squamous cells in the pulmonary vasculature and masses of neutrophils and fibrin thrombi in the small pulmonary vessels. Special stains such as cytokeratin and mucin may be helpful. The autopsy should include a thorough sampling of the lungs, a proper evaluation of the uterine body looking for the possibility of wall tears as well as examination of the placenta. Thorough toxicology testing and a tryptase level are also important procedures in the evaluation of intrapartum deaths when an amniotic fluid embolism is suspected because the diagnosis is essentially one of exclusion, based on clinical presentation.

Amniotic Fluid Embolism, Anaphylactoid Syndrome of Pregnancy, Intrapartum Death

G110 Pheochromocytoma Causing Unexpected Death – Two Unusual Presentations

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After attending this presentation, attendees will be able to appreciate the postmortem pathology of pheochromocytomas and sudden death.

This presentation will impact the forensic science community by presenting the medicolegal significance and varied clinical presentation of adrenal and extraadrenal pheochromocytomas including sudden death, their histological features and the possible genetic implications of their diagnosis.

Pheochromocytomas are rare tumors of paraganglionic tissue. Paraganglionic tissue is distributed throughout the body and tumors may occur in multiple sites. Patients may present with severe headaches, nausea, excessive sweating, palpitations due to tachycardia and anxiety, tremors, pain in the lower chest and upper abdomen, and weight loss. These symptoms are due to the fact these tumors produce, store and secrete catecholamines (epinephrine, norepinephrine). Patients typically have hypertension, which may be intermittent. Clinical diagnosis is made by urinary and plasma catecholamine measurement, along with imaging. The tumors may present in the adrenal medulla and extra-adrenal sites. They may rarely be associated with sudden death, and catecholamine induced damage to the myocardium may be present, as the so called catecholamine cardiomyopathy.

Two cases of sudden death due to pheochromocytomas are presented. Both patients were 34-year-old males. In the first case, the male presented with abdominal pain. An ECG showed left bundle branch block and changes of an inferior myocardial infarction. He was variably hypertensive and hypotensive. He went into cardiac arrest while undergoing radiological investigation. At autopsy there was a suprarenal mass measuring 8.5 x 7.5 x 4.5 cm, with 700 mL of blood in the peritoneal cavity along with retroperitoneal hemorrhage. On histology, the tumor had the characteristic appearance of a pheochromocytoma. There were typical Zellballen. The tumor cells stained positively with neuroendocrine markers including chromogranin and synaptophysin. The supporting sustentacular cells showed some S100 positivity.

In the second case, the male had a witnessed collapse and died unexpectedly. He had been diagnosed as a non-insulin dependent diabetic five days previously. On the day of his death, he was described as well and his glucose level had been measured within the normal range.

At autopsy a mass was found adjacent to the kidney but below the adrenal gland 3.5 cm in diameter. Histology showed the characteristic appearance of a pheochromocytoma.

Pheochromocytomas secrete catecholamines which cause hypertension. They also modify glucose metabolism, which accounts for the hyperglycemia seen in the second case. Diagnosis depends on histology and the characteristic immunohistochemical appearance. Malignancy cannot be reliably diagnosed by morphological features. These tumors may also be associated with genetic syndromes – such as multiple endocrine neoplasia (MEN) syndromes. Although traditionally known as the 10% tumor because 10 % are extraadrenal and 10% malignant, a higher proportion of the cases, of the order of 25%, are malignant when associated with familial syndromes.

In the two cases, their clinical presentations alone may have resulted in their deaths being erroneously attributed to more common causes of sudden death, such as hypertensive or atherosclerotic cardiovascular disease. An appreciation of the clinical and pathological features of pheochromocytomas however properly diagnoses these cases. As such, surviving relatives can be informed and screened.

Pheochromocytoma, Sudden Death, Adrenal

G111 Digital UV/IR Photography for Tattoo Evaluation in Mummified Remains

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After attending this presentation, attendees will recognize an additional value of UV/IR imaging in the evaluation of mummified remains.

This presentation will impact the forensic community by providing an additional tool for postmortem identification.

The presence and location of tattoos can be an important component in the identification of remains in the extended postmortem period when remnants of skin persist. However, when there is significant mummification, elucidation of tattoos can be technically difficult due to skin discoloration and dehydration. Many methods have been proposed to increase the visibility of tattoos in the extended postmortem interval, including rehydration, hydrogen peroxide, and exposing subdural tissue. All have some, but limited applicability.

The use of ultraviolet and infrared photography has been of significant interest in forensic science in general and of cyclical published interest in forensic pathology and odontology. A large number of articles were published in the 1990s investigating the use of so-called “alternate light” methods, including narrow band illumination, fluorescence, and UV/IR photography for the evaluation of bite marks and trauma. There has been limited publication in the use of such methods for tattoo evaluation in the extended postmortem interval. One study found utility in evaluating fluorescence of ink using narrow band illumination. This study noted that infrared photographic evaluation, while slightly more useful than hydrogen peroxide, has traditionally been of limited utility because it “required photographic skills and was difficult and time consuming.” Others have noted that the use of ultraviolet photography was difficult because it is impossible to see what is being photographed. With the use of film photography, the opportunity for quick feedback and fine-tuning of photographic parameters was not available. The photographs were, literally, taken blind.

In recent years, relatively inexpensive cameras sensitive to infrared and ultraviolet light have been marketed for forensic use. Many low-cost consumer digital cameras are sensitive to the infrared or ultraviolet spectrum, and incorporate blocking filters for standard use. An aftermarket has developed to market these cameras with the filters

removed. The availability of these relatively inexpensive cameras has spawned an active hobby market in artistic infrared and ultraviolet photography.

In this report, a commercial forensic camera sensitive in the UV/IR range was used to visualize a tattoo that was not perceptible in the visible spectrum.

The nude body of an adult female was found prone unburied in the woods. A missing person's report had been filed in a nearby city approximately two months earlier and police investigators suspected these were the missing person's remains. At autopsy, the body was largely skeletonized, with mummification of the skin of the back and upper extremities. Anthropological evaluation was consistent with the age, sex, and race of the missing person. Dental evaluation was consistent with the missing person, but was limited to do postmortem loss of teeth, which defied efforts at recovery. By history, the decedent was known to have a small tattoo of a heart on the back of her left hand, though the exact location was uncertain.

Examination of the left hand revealed marked mummification, but the skin of the dorsal surface of the hand was intact. Visual examination of the hand did not reveal any evidence of a tattoo. Attempts to increase visualization by rehydration and washing were unsuccessful. Hydrogen peroxide was not applied.

Under both UV and IR photography, a small heart-shaped tattoo was noted between the metacarpals of the thumb and index finger. The detail of the tattoo was visually similar in both spectra, though the UV provided a more subjectively "realistic" appearance of the texture of the skin.

This case demonstrates that at least with some inks, tattoos are clearly discernible using UV and IR photography. The almost immediate feedback provided by digital photography allowed evaluation of each image as taken to provide the optimum exposure.

The development of relatively inexpensive commercial digital UV/IR cameras allows the immediate evaluation and optimization of UV/IR photographs of postmortem tattoos. This, in turn, may make a previously rather esoteric method practical.

Ultraviolet, Infrared, Tattoo

G112 Undiagnosed, Untreated Acute Promyelocytic Leukemia Presenting as Suspicious Sudden Death

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Leukemia as a cause of sudden death is rare, because symptoms are usually present and treatment is initiated prior to death. After attending this presentation, attendees can expect to learn about a rare differential diagnosis of criminal death.

This presentation will impact the forensic science community by presenting a differential diagnosis of criminal death and reveals an aspect of the French medicolegal system which can be unknown to the American audience and in competence as it enlightens the importance of bone marrow removal during the autopsy.

Introduction: An autopsy case with acute promyelocytic leukemia is reported in which foul play had been initially suspected.

Case Report: A 40-year-old male who was found dead in his bedroom will be presented. He was working for the Brazilian Army and was in France for a training period. He had a two-month history of lower

back pain. A complete blood count was normal one month before his death. At scene, the police noticed multiple bruises of markedly different colors on the body. A forensic autopsy was requested by the Chief Prosecutor because foul play was suspected. The external examination revealed multiple subcutaneous hemorrhages of different ages covering the whole body. The autopsy showed subarachnoid hemorrhage without any skull fracture. There was no other significant finding. Toxicology was negative. Histology revealed right-sided subarachnoid hemorrhage and a cerebellar hematoma. As foul play was initially suspected, the hyoid bone was removed. Histologic examination of the bone marrow showed no normal hematopoietic cells. Myeloperoxidase staining revealed the diagnosis of acute promyelocytic leukemia (APL). Death was attributed to acute intracranial hemorrhage due to APL. The manner of death was ruled natural.

Discussion: According to the literature, the most common tumors causing sudden unexpected death in adults include bronchogenic carcinoma, acute leukemia, gastric adenocarcinoma and adenocarcinoma of the urinary bladder. Death is usually attributed to a variety of mechanisms, including hemorrhage, thromboembolism and widespread dissemination. APL is characterized by the proliferation of abnormal promyelocytes and is classified as type M3 in the French-American-British (FAB) leukemia system. APL comprises approximately ten percent of the acute myeloblastic leukemias in adults. Because of the complicating disseminated intravascular coagulation and the likelihood of threatening hemorrhage, APL is usually regarded as a medical emergency. This disease leads to a high rate of mortality, primarily from intracranial hemorrhage. There could be a tendency to overlook the diagnosis of this disease when a deceased presents multiple bruises that seem consistent with injuries. However, the French medicolegal system is different from the American system. In France, the decision to perform toxicology or histology after the autopsy is made by the office of the prosecutor and not by the pathologist. Due to financial considerations, it is quite frequent that no complimentary analyzes are made, even if the pathologist thinks it is necessary to determine the cause of death. In our case, the circumstances of death and external examination at the autopsy did not raise the diagnosis of a malignant neoplasm in the hemopoietic system. This type of case points out the importance of a thorough autopsy, including microscopic examination to protect innocent people from unwarranted prosecution. It is also important to retain bone marrow to enable the testing to be done and to confirm the diagnosis if required.

Forensic Pathology, Sudden Death, Acute Promyelocytic Leukemia

G113 Death of a Bodybuilder: A Case Report of Mixed Drug Overdose With Lethal Gamma-Hydroxybutyrate Level

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After attending this presentation, attendees will learn an approach to evaluation of a multi-drug overdose primarily due to gamma-hydroxybutyrate (GHB) with complex history and presentation; and, be able to recognize the symptoms and signs of GHB poisoning when combined with lower levels of multiple other drugs. Consideration of the changes in drug levels possible with decomposition; and be able to evaluate the role of confounding causes of death such as the possibility of heat-related death in an enclosed car in a parking lot in the sun.

This presentation will impact the forensic science community by assisting attendees to be able to recognize the signs and symptoms of gamma-hydroxybutyrate use, abuse, and overdose, particularly when exacerbated by the presence of multiple other drugs; compare to other

drug signs and symptoms when assessing a multi-drug overdose; and evaluate the confounding effect of perimortem heat exposure with onset of decomposition.

A 29-year-old male bodybuilder with a history of utilizing gamma-hydroxybutyrate (GHB or GBH) for its anabolic effect, was found dead in the passenger seat of a car in an airport short-term parking lot, at 2:00 p.m. during the month of May. The windows of the car were closed. Although it had been slightly more than seven hours since he was last seen alive, the decedent was in the early stages of decomposition.

The decedent had mentioned use of GHB to his employer as an event that occurred in the past. His father was also aware of his GHB abuse, but believed it to have ended. In April, a drug screening had not found any drugs in his system. He was known to have an intermittent problem with alcohol abuse and had recently signed up for rehab. He had sustained a significant fall not long before his death, for which he was treated and released; he had multiple healing injuries. He was also on regularly prescribed medications for a recent problem with sleep. These medications included zolpidem, alprazolam, and mixed amphetamine salts.

The week before his death, he hosted a friend from out of state, who was a physician. The night before death, which was also the last night of his friend's stay, the two of them went to a party which lasted for most of the night. In the early morning hours, they had an argument. The victim called another friend asking for intervention; this friend noted that he seemed somewhat groggy on the phone. The other friend was not able to provide intervention. A neighbor saw the victim's car depart in the early morning with two men in it, but could not identify them through the windows. It is possible that the friend who needed to go to the airport was driving the car, with the victim in the passenger's seat, where he was found dead more than seven hours later.

At autopsy, he was well developed and very muscular (5'8", 236 lbs; BMI = 35.9). The BMI classification into "obese" is likely incorrect as the body fat percentage was probably low, based on body habitus. The body showed evidence of early decomposition, with rigor passed, livor fixed in a pattern consistent with his position slumped forward in his seat, and extensive skin slip along the upper back. Small amounts of decomposition fluid in the body cavities were found on internal examination, and tissues were moderately autolyzed on histologic examination.

The only autopsy findings besides decomposition were healing injuries of the face, hands, toes, heels, and left flank, which were nonsignificant in death; and minor heart hypertrophy, which was probably physiologic (exercise-related), as he was known to do extensive exercising, and there were no hypertensive changes to the myocardium on histology. Of note, the gastric mucosa was free of small hemorrhages.

Toxicology provided the answer. There was present in his system more than enough GHB to be lethal. There were also small amounts of four other drugs, amphetamine (likely due to Adderall), citalopram (prescribed for depression), diphenhydramine (over-the-counter antihistamine, sometimes used as a sleep aid), and trazodone (another antidepressant). These four drugs likely contributed to death and likely contributed by making him sleepy, so that he did not exit the car nor telephone to seek help. Amphetamine likely made him more vulnerable to a cardiac arrhythmia in the setting of a lethal dose of GHB causing respiratory depression. Of note, no alcohol was present. The role of perimortem heat in accelerating his death could not be definitively determined by autopsy; this was a point of considerable significance to the family, who were of the opinion that the physician friend was culpable for allowing the groggy victim to remain in the car with the windows rolled up when it was time for him to catch his plane.

The time sequence of GHB intoxication, its effects in use, abuse, and overdose, and the likely mitigating or exacerbating effects of the other drugs present, are considered in relation to the findings in this case

of fatal GHB overdose in a setting of multidrug use in a decedent who was otherwise probably healthier than the average person.

Gamma-Hydroxybutyrate, Perimortem Heat Exposure, Multi-Drug Overdose

G114 Hara-Kiri or Homicide?

Wendy M. Gunther, MD, Office of the Chief Medical Examiner, Tidewater District, 830 Southampton Avenue, Suite 100, Norfolk, VA 23510-1046*

After attending this presentation, attendees will be able to recognize factors from scene investigation, history, and autopsy which may help in differentiating stab wound suicides from homicides.

This presentation will impact the forensic science community by reviewing an in-depth case presentation some of the factors that assist in differentiation of stab wound suicide from homicide.

The body of a 49-year-old white male was found collapsed face down on the carpet of his bedroom during the afternoon of a Saturday in April, about twenty hours after he had last been seen alive.

The front door was secure, but the back door to the residence was unlocked and propped ajar. The decedent had been seen mowing his back yard on the evening prior to death, and all his mowing equipment was still out in the back yard. He was found clad in gray shorts without shirt or shoes, appropriate for mowing. He was known to drink heavily when he mowed.

He was last seen alive by his girlfriend, with whom he had made arrangements to grill steaks on Saturday. She came to his house at the prearranged time, found the front door locked, knocked and called out for some time, but was unable to reach him; she did not think to check the back door. She left the scene, but continued to feel concern, and at last contacted police for a welfare check. Police found the body at shortly after 1600h; emergency medical services pronounced him dead on the scene at 1643h.

On initial examination, officers found a small fluctuant discolored mass protruding from the left lower side of his abdomen, and guessed that it might be a tumor eroding through the skin. There was a small amount of brown fluid on the carpet near the mass, but no blood. Based on this information and on history that the decedent carried the diagnosis of an unspecified aneurysm, while his twin had died prematurely at age thirty four of a myocardial infarct, the decedent's doctor initially agreed to sign the death certificate. It was not until a senior officer recognized the fluctuant mass as a loop of bowel protruding through a stab wound that patrol officers realized they should contact homicide detectives.

The house was immaculate. The decedent was a martial artist, and the first floor of the house contained a room dedicated to multiple displays of numerous Eastern swords and daggers. As far as police could ascertain, no swords were missing. There was no obvious blood staining or spatter, but there were too many swords in the room to ascertain on the day of death whether any had blood smears, or had been wiped.

There had been no 911 call nor was there any sign of a struggle. A beagle dog in the house seemed to be in no distress, and had not been heard barking. Cash and expensive watches were in place where they had been laid out with care equidistant and parallel on top of a dresser in the bedroom. The only item out of place was a box cutter, with a possible bloodstain on the blade, which was lying on the counter in the upstairs bathroom about eight feet from where the decedent was found collapsed. In the bedroom, about the same distance from him there was a tray table at the foot of the bed, on which was a tray with three sheathed knives laid out carefully equidistant and parallel. Investigation showed wiped blood smear on one of the sheathed blades.

At autopsy, the decedent was muscular and slightly obese at 65" and 183 lbs. There were no defense injuries on his arms or hands. The fingernails were very cyanotic, but short and even, without chips or tears. There were scabbed healing superficial abrasions on the backs of the 2nd and 3rd fingers, by the proximal interphalangeal joints. A number of linear scars were identified on the arms and hands. Scars on the backs of the hands appeared consistent with martial arts practice, but three transverse superficial linear scars across the wrist suggested self-incision, and there were overlapping linear scars on the anterior left upper arm which also suggested self-cutting. A 3½" linear scar on the outer aspect of the left upper arm was initially attributed to an assault he told family he sustained many years prior.

The only sign of injury was a complex stab wound overlain by incised wounds in the left lower quadrant. The abdominal wall showed internal characteristics of perforation by more than one blade. The wound, which was 1" long and about 6" deep, and therefore not consistent with the box cutter in the bathroom, perforated the abdominal aorta and ended its course in the anterior ligament of the lumbar spine; it caused death by internal bleeding. There was an extensive and bulging retroperitoneal hematoma, as well as 1400 cc of liquid blood and clots forming casts of the right and left colonic gutters. The blade passed very close but without injury to the loop of bowel which eviscerated through the stab wound. Evisceration had blocked the exit of blood through the wound and was responsible for the lack of blood on the carpet at the scene. Toxicology showed an ethanol level of 0.19% by weight by volume in blood, 0.23% in vitreous humor. Of note, no aneurysm of the cerebral, coronary, or aortic circulation was identified.

In the trash can in the bedroom was a letter to his girlfriend in his handwriting. The letter was not a suicide note. It appeared to be an angry letter of accusation. However, it had been crumpled and discarded without signing.

The decedent's complex history, involving decades of training in martial arts, samurai stories and films, alcoholism, divorce, current plans for remarriage, and the absence of support for his remote story of assault, caused a scenario to develop suggesting that he had attempted to commit hara-kiri as an honorable way out of an intolerable emotional situation. The story unraveled at last when the family reported on reading years of his journals, at which time a manner of death could be pronounced.

This complex history is presented in light of the autopsy findings and scene investigation to illustrate why this case of attempted hara-kiri was adjudged to be suicide rather than homicide.

Hara-Kiri, Stab Wound, Manner of Death

G115 Two Cases of Novel Influenza A (H1N1) Virus (“Swine Flu”) Infection: Clinical Presentations, Autopsy Protocol With Findings, and Review of Literature

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After attending this presentation attendees will be familiar about the origins, spread, autopsy procedures, and findings in seven cases of H1N1 virus infection, that is currently designated a global pandemic.

This presentation will impact the forensic science community by organizing its preparation for a mass disaster situation involving a biological agent. The lessons learned from the way the nation and the world has responded will also be reviewed.

This novel infection, which has undergone a series of nomenclature changes (including new influenza virus, swine-like influenza virus,

swine-origin influenza virus, and known colloquially as “swine flu”) is now labeled a novel form of influenza. A virus resulting from a combination of genes derived from two types of swine influenza, one of which was in turn a “reassortment” of human, avian, and swine influenza A strains.

The initial spike of cases started in La Gloria, Mexico, generally regarded as the ground zero of this epidemic. The United States of America soon after became the epicenter of this rapidly spreading epidemic with a distinct pattern of disease incidence in relation to the usually seasonal variety of Influenza. On June 11, 2009, the WHO proclaimed the H1N1 infection as a global pandemic, based on its spread in several continents, especially in the southern hemisphere. Now in early November, North America has become the epicenter of the disease. As of the of November 1, 2009, there have been more than 480 thousand laboratory confirmed cases of pandemic influenza worldwide and over six thousand deaths reported to the World Health Organization. The week of October 25 to 31 saw spike of at least eighteen flu related pediatric deaths, of which fifteen death were confirmed 2009 H1N1 and three were not sub-typed.

Described in this presentation is the experience with cases evaluated in two counties in Central New York. The clinical history, hospital course and autopsy precautions and protocol followed, and diagnostic testing in cases seen by us are summarized in this Table # 1.

Table # 1.

#	Age	Sex	Major risk factor(s)	Clinical progression	Autopsy	Diagnosis	Major pathological findings	Other pathological findings	Major non-pathological findings
				Onset to Admit to death					
1	36	Male	Morbid Obesity BMI 46.3	05/22/09 – 3 days - 9	Yes	RT-PCR	Diffuse Alveolar Damage	Patchy alveolar hemorrhage	Congestive heart failure
2	46	Female	Chronic Ethanol abuse	05/31/09 – 0 days - 5	Yes	RT-PCR	Diffuse Alveolar Damage	Acute bronchopneumonia	Steatohepatitis remote brain injury
3	13	Female	Asthma, Spina Bifida	06/26/09 – 5 days - 7	No	RT-PCR	Diffuse lung disease	Pneumo-mediastinum	
4	44	Female	Morbid Obesity BMI 52.2	06/30/09 – 7 days - 0	Yes	RT-PCR	Intravascular hemorrhage	Aleactasis	Passive venous congestion liver
5	22	Female	Pregnancy	08/23/09 – 6 days - 4	Yes	RT-PCR	Diffuse Alveolar Damage	Pregnancy changes to liver	Uterus early involucral change
6	20	Male	Asthma, Spina Bifida	09/04/09 – 1 day - 7	Yes	RT-PCR	Diffuse Alveolar Damage	Consolidation	Sub emphysema, Pleural effusion
7	47	Female	Developmental delay, Asthma	10/18/09 – 4 days - 3	Yes	Surrogate	Consolidation		

Besides the variation in risk factors, the H1N1 infection itself has raised many changes in business (loss of earning by the pig industry), changes in social mores, religious rituals and public behavior. It has also raised questions, including how one defines epidemic and pandemic, and to what extent preventive strategies should be allowed to disrupt normal life and economic activity. In New York State the Public Health Department had promulgated laws mandating all health care workers to receive the Seasonal and Novel Influenza vaccinations. Onondaga County expanded the requirement to include all medical examiner Personnel as well. These were later rescinded, and shortages of the vaccines became the dominant theme for conversation. Meanwhile there are reports that the virus has mutated and developed resistance to commonly used anti retroviral medications.

This presentation will also review the most recent publications, monitor and update the latest information about the spread of the infection as well as evaluate the public health response and lessons learned from the epidemic/pandemic. The main focus of this presentation will be to review the role of medical examiners/forensic pathologists monitoring sentinel events which adversely influencing public health.

Swine Flu, Bronchopneumonia, H1N1 Virus

G116 An Unusual Case of “Piggyback” Sandwiched Projectiles Caused by a Round-Nose Bullet Shot Through a Door

Geoffrey P. Smith, MD, Kelly L. Rose, MD*, and Randy L. Hanzlick, MD, Fulton County Medical Exam Center, 430 Pryor Street, Southwest, Atlanta, GA 30312

The goal of this presentation is to reinforce with an unusual example, the concept of intermediate targets and secondary projectiles as they relate to gunshot injuries and in addition, to highlight the importance of correlating scene investigation with autopsy findings.

This presentation will impact the forensic science community by reinforcing the concept of secondary projectiles and highlighting the importance of correlating scene investigation with autopsy findings.

The concept of an intermediate target and secondary projectiles causing bodily injuries has been well documented in relation to gunshot wounds. An unusual case is presented in which a round-nose, copper jacketed .40 caliber projectile perforated a foam-filled metal door and carried two disc-like pieces of metal from the inner and outer lining of the door to the victim's body. Autopsy showed a distant type gunshot entry wound to the left front shoulder area and an adjacent superficial laceration, as well as a second small laceration of the left flank. The overlying clothing had corresponding defects from the bullet and fragments. On the adjacent skin and under the clothing, two metallic, essentially circular, concave pieces of thin metal were found. A round-nose, copper jacketed .40 caliber bullet had perforated the spinal cord and was retrieved from the spine. The nose of the bullet was slightly flattened. The two disc-like pieces of metal were very close in diameter to the bullet's diameter and fit nicely on top of each other on the flattened nose of the bullet, having the same, slightly out-of-round shape as the underlying bullet nose. The fragments also had a similar thickness as the metal surfaces on the door. Scene investigation and findings suggested that the man was shot through the door and the bullet carried the two metal discs “piggyback” on its flattened nose toward the victim, then the fragments perforated the clothing causing the small lacerations. Wounds caused by materials from intermediate targets have been well described, but we have found no case reports of piggyback sandwiched fragments carried on a round nose bullet such as we have described. By thoroughly analyzing the scene and the bullet, we were able to determine that the door fragments piggybacked on the bullet's nose to the decedent. Therefore, this case highlights the importance of correlating scene investigation with autopsy findings and shows the benefit of maintaining persistence when trying to explain discovered peculiarities.

Bullet Wounds, Intermediate Targets, Projectiles

G117 Newborn Kidnapping by Crude Cesarean Section

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The goal of this presentation is to illustrate an unusual case of fetal abduction via crude cesarean section.

This presentation will impact the forensic science community by illustrating the need for close collaboration between the forensic pathologist and the forensic laboratory when dealing with cases that involve kidnapping, drugging and restraining.

Introduction: The number of missing children reported each year in the United States remains astronomical. Between the years 1983 and 2008, 256 infant abductions occurred in the United States. The first documented case of a newborn kidnapping by cesarean section occurred

in 1987. Currently, there are a total of eleven reported cases in which the fetus was abducted by a prenatal fetal snatcher between the years 1987 and 2008.

Materials and Methods: This case involves an 18-year-old African-American female who was 38 weeks pregnant. The victim became acquainted with the abductor, a 38 year old African-American female, while visiting their respective male partners at the jail. On July 15, 2008, the women saw each other again at the jail and engaged in conversation. The victim never returned to her home that evening. On the next day, the abductor presented to a local hospital claiming that she just gave birth in her apartment to a healthy baby boy.

Results: The scene of the crime is a third floor apartment in Wilkinsburg, PA. There was a foul order coming from the apartment. There were numerous flies around the windows. The decedent's body was located in an alcove off of the bedroom hidden by a mattress and head board. The body was that of a decomposing black female who was wrapped in a comforter. Upon inspection, it was noted that the hands were bound behind the back with duct tape and the ankles were bound together also with duct tape. The head was completely wrapped in duct tape with a plastic bag and duct tape totally occluding the airway. There was an incised wound of the abdominal area with clearly exposed intestine and uterus. The placenta was clearly visible.

Further inspection of the apartment revealed a roll of duct tape with a bloody fingerprint and a roll of plastic wrap. Loose pills were found on a shelf. All the above evidence was collected and submitted to the forensic laboratory.

The autopsy revealed a well developed, well nourished African-American female in a state of moderate decomposition. The body was identified via fingerprint comparison. The postmortem examination revealed a crude jagged edged incision of the lower pelvis and abdomen. There was exposure of a gravid uterus with a vertical incision over its anterior aspect. Loops of small intestine were exposed. A placenta was recovered from the comforter that covered the body. The distal edge of the umbilical cord revealed a dog-eared cut surface. Inspection of the cervix revealed that it was not dilated.

There were no other pathologic abnormalities or trauma identified during the autopsy.

Conclusions: The pills that were recovered from the scene were identified as Gabapentin. The decedent's blood along with a sample of the newborn baby's urine was found to contain elevated levels of Gabapentin. The abductor's fingerprints were recovered from the rolls of duct tape and plastic wrap. Investigation revealed that the abductor recently had a miscarriage and had recently faked another pregnancy going so far as to have a baby shower weeks before the abduction. The cause of death was certified as asphyxiation due to smothering by plastic bag and duct tape with contributing conditions of exsanguination due to partial evisceration of abdominal and pelvic contents and the presence of Gabapentin in the victim's blood.

Pregnancy, Kidnapping, Cesarean Section

G118 An Unusual Case of Accidental Poisoning: Fatal Methadone Inhalation

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After attending this presentation attendees will gain insight on a case of unusual accidental poisoning with methadone, occurring in a 38-year-old man who inhaled a white powder bought on the black market.

This presentation will impact the forensic science community by presenting the dangers from using “home-made” drug preparations. To date and to our knowledge, no case of accidental death following

methadone inhalation has been previously described up to the case herein presented.

Methadone hydrochloride (3-heptanone, 6-(dimethylamino)-4, 4-diphenyl-, hydrochloride) is a white, essentially odorless, bitter-tasting crystalline powder. It is very soluble in water.

It is a synthetic, long-lasting opioid with pharmacologic actions qualitatively similar to morphine and is active by oral and parenteral routes of administration. It is primarily used for relief of moderate to severe pain. It is also used in the detoxification and maintenance of patients who are dependent on opiates, particularly heroin. Recreationally, it is abused for its sedative and analgesic effects.

Methadone was synthesized by Ehrhart and Schaumann in Germany in 1941 in the Hoechst Laboratories and came into clinical use after the war. The use of methadone as a maintenance drug in heroin addicts began only in 1964, when Dr Vincent Dole and Dr. Marie Nyswander pioneered the use of a particular form of synthetic opiate for narcotic maintenance.

It is primarily a μ -receptor agonist and may mimic endogenous opioids and affect the release of other neurotransmitters (acetylcholine, norepinephrine, substance P and dopamine). This accounts for its analgesic and antitussive properties, respiratory depression, sedation, decrease in bowel motility, increase in biliary tone, hormone regulation and increase of prolactin and growth hormone release, miotic pupils, nausea, and hypotension.

As well as being an opioid receptor agonist, methadone acts as an antagonist at the N-methyl-D-aspartate (NMDA) receptor. The NMDA receptor system is a major excitatory central nervous system pathway involved in the neurobiology of pain. Methadone's ability to antagonize the NMDA receptor system may explain its superior analgesic behavior and why it can have effects in morphine resistant pain.

Unlike other opiates, methadone is primarily administered orally because of its good gastrointestinal absorption. It has high oral bioavailability and minimally lower rectal bioavailability. It is commercially available in liquid form. Most pharmacies, however, manufacture solutions, capsules or suppositories from less costly methadone powder.

Methadone hydrochloride powder is for oral administration only and is used in the preparation of a liquid by dissolving the powder in an appropriate vehicle. This preparation must not be injected.

The first fatality from methadone was recorded by Bieter and Hirsch (1948) in a 54-year-old man, who was given hypodermic injections of methadone (50 mg) in three doses over eight hours and who developed cyanosis and hypotension. They also recorded severe respiration depression in a 15-year-old boy who was given, by mistake, a 25 mg methadone hypodermic injection.

After inhaling methadone powder, he developed a cardiopulmonary arrest. Cardiac activity was restored only after prolonged resuscitative efforts. He was admitted to the local hospital and died after twenty-four hours of intensive care due to cardiac arrest.

An autopsy was performed at the University Center of Legal Medicine in Lausanne. At external examination there were only signs of medical treatment. Internal examination showed congestion of internal organs and cerebral and pulmonary edema. Histological examination showed moderate generalized congestion and hepatic steatosis.

Toxicological tests included blood ethanol levels and screening for common drugs and illegal substances by gas chromatography and mass spectrometry. This presentation will impact the forensic science community by showing the dangers of using "home-made" drug preparations. To date, case presentations of accidental death following methadone inhalation have not been previously described.

Conclusion: The cause of death was determined to be methadone intoxication, whose effects have been enhanced by the presence of ethanol.

Substance Abuse, Methadone, Intoxication

G119 Fatalities Occurring With Ingestion of Ibogaine

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After attending this presentation, attendees will understand ibogaine, its uses, and issues that may arise with the investigation of these deaths.

This presentation will impact the forensic pathology and toxicology communities by increasing knowledge of ibogaine's use, detection, and risk of death.

The psychoactive indole alkaloid ibogaine is the focus of an alternative medical subculture in which it is used most often for opioid detoxification, as well for individuals seeking psychotherapeutic insight or religious experience. Eighteen fatalities were reviewed that are reported to have occurred since 1990 in individuals within seventy six hours of taking ibogaine. These deaths occurred in numerous countries and we reviewed all available autopsy, toxicologic, and investigative reports.

There were fourteen males and four females with a mean age of 39 years (range 24-54) years. Fourteen individuals took ibogaine for the indication of acute opioid withdrawal and 3 individuals were non-addicts who used it for spiritual/psychological reasons. The circumstances were unknown in one decedent. Ibogaine was given as the HCl form in nine instances at doses ranging from 4.5 to 29 mg/kg, and as an alkaloid extract in four. The concentrations determined in ten decedents ranged from 0.24 to 6.6 mg/L. The time interval from the most recent ingestion of ibogaine until death ranged from 1.5 to 76 hours. In addition, commonly abused drugs (including benzodiazepines, cocaine, opiates, and methadone) were detected in eight of eleven decedents. Seven of the decedents had co-morbidities including: cirrhosis, hypertensive and atherosclerotic cardiovascular disease, and obesity. Among the two decedents in which no other drugs of abuse were detected in postmortem toxicology analysis, one had advanced heart disease and another had cirrhosis of the liver. Full toxicology and autopsy results were not available in seven and three decedents, respectively. Among these 18 decedents, the involved countries included the United States (5), Mexico (4), France (4), the Netherlands (2), Germany (1), the United Kingdom (1), and South Africa (1).

The uncontrolled settings in which ibogaine is given make the causes of these deaths difficult to evaluate, and little is known regarding toxic concentrations of ibogaine in humans. Contributing causes of some of these deaths appear to have involved drug use during treatment and preexisting cardiovascular disease. There appeared to be no clinical or postmortem evidence suggestive of a characteristic syndrome of neurotoxicity. Cardiac monitoring may be a more important safety issue in view of published observations of bradycardia in animals and a recent case report of QT prolongation in an alcohol dependent woman following the ingestion of alkaloid extract, as well the common use of pretreatment EKGs and cardiac exclusion criteria, and in some medical settings, implementation of cardiac monitoring during ibogaine treatment.

Ibogaine, Intoxication, Substance Abuse

G120 Acetaminophen Induced Death of a Fetus With Maternal Survival: An Unusual Case of a Suicide Attempt Resulting in Fetal Death

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After attending this presentation attendees will learn about an unusual case of a suicide attempt with unexpected complications to an unborn child.

This presentation will impact the forensic community by illustrating the risks of acetaminophen overdose on fetal survival.

Introduction: Suicide represents one of the most common causes of death in young women. Acetaminophen overdose represents one of the most common methods used to attempt suicide. Suicide rates among pregnant women are fortunately rare by comparison. However, poisoning deaths, both suicidal and unintentional are rising.

Material and Methods: The subject of this case is a 32-year-old caucasian woman who was pregnant with a healthy 35 week, 5 day gestation fetus. The subject has a history of depression and is prescribed Zoloft, although she was not compliant with her medications. She has no prior suicide attempts or ideations. She had a fight with her husband and exhibited increasing depressive symptoms. She stated to her husband that she had taken 'all her medicine', but she refused medical attention for approximately thirty six hours. Upon admission to the hospital, she was found to be in liver failure. She was treated with n-acetylcysteine. The next day, she started having uterine contractions. She was not able to clot her blood due to acetaminophen toxicity and liver failure, precluding a Cesarean section. Attempts to delay the delivery were unsuccessful. The fetus became increasingly bradycardic with labor progression and died shortly before spontaneous vaginal delivery (approximately four and one half days after the initial overdose event).

Results: The external and internal examination of the fetus was consistent with a gestational age of 36 weeks. There were no gross malformations, anomalies or evidence of external trauma to either the fetus or to the placenta. Likewise, metabolic screening was negative and postmortem tissue cultures were not helpful. Histologic sections of the fetal tissue were unremarkable with no signs of placental abnormalities or liver necrosis. Neuropathology of the brain revealed findings consistent with fetal distress and hypoxia. Postmortem toxicology on the fetal blood revealed an acetaminophen level of 8.55 mcg/ml.

Conclusion: The cause of death in the previously healthy fetus is attributed directly to the high levels of maternal acetaminophen. In an adult, an intake of 7000 mg or more is associated with death via liver failure in the absence of treatment. The maternal intake in this case is estimated to include 60 tablets of 500 mg each. Acetaminophen readily crosses the placental barrier to alter the function of the immature fetal liver which has only minimal abilities to safely metabolize the drug. The fetus is thus placed at greater comparative risk by acetaminophen than is the maternal source in cases of an acetaminophen overdose.

The mother ultimately survived, although she was placed on full liver support for coagulopathy. She is currently on the liver transplantation list. The fetus, despite survival to within minutes of delivery, died in utero secondary to fetal distress complicated by maternal acetaminophen toxicity.

Suicide, Acetaminophen Overdose, Fetal Complications



PATHOLOGY/BIOLOGY



G1 Exertional Collapse in a Youth With Hemoglobin SE

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After attending this presentation, attendees will understand one of the potentially lethal sequelae of hemoglobinopathy SE.

This presentation will impact the forensic community by helping forensic pathologists recognize occurrences of exertional death in compound heterozygous SE hemoglobinopathy.

Hemoglobin S is the most common abnormal hemoglobin. It occurs in 10% of North Americans of West African descent. Hemoglobin E is the second most frequent abnormal hemoglobin and is found in persons of Southeast Asian ancestry. Because of the wide geographic separation of the original epicenters for these genotypes, the double heterozygous and manifesting as hemoglobinopathy SE is uncommon with less than 30 cases reported. Hemoglobinopathy SE is typically asymptomatic. A twelve-year-old American boy was participating in football practice in the sun in summer when he collapsed ill on the ground. When the paramedics arrived, he was alert, hypotensive and in sinus tachycardia. His temperature was 97.3 degrees Fahrenheit. During transportation to the hospital his heart was unstable and several sternal rubs were performed. He initially responded to the treatment but his heart rate dropped suddenly. He became unresponsive with pulseless electrical activity followed by asystole. Resuscitation efforts started by the paramedics and continued in the Emergency Room were unsuccessful. On gross examination the spleen, lungs, brain, liver, and heart were unremarkable. Microscopically the cerebellum, heart, and kidney had sickled erythrocytes. Hemoglobin electrophoresis revealed 0.9% hemoglobin F, 57.4% hemoglobin S, 34.2% hemoglobin E, and 7.5% other. Follow-up investigation determined that the decedent's father was of West African ancestry and his mother had Thai ancestry. This is an example of exertional collapse in a person with hemoglobinopathy SE with a clinical presentation similar to that sometimes observed in persons with sickle cell trait. The pathophysiology of sickling in persons heterozygous for hemoglobin S is discussed with particular reference to the mitigating and aggravating effects of other abnormal hemoglobin haplotypes.

Hemoglobinopathy SE, Exertional Collapse, Sudden Death

G2 Machinery-Related Occupational Death: The Relevance of Workplace Investigation and Antemortem Radiological Data in Forensic Reconstruction

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After attending this presentation, attendees will have a clear example of the utility of radiological data and workplace investigations in reconstructing work-related deaths.

This presentation will impact the forensic community by demonstrating the importance of taking into consideration radiological data (x-rays, computed tomography or nuclear magnetic resonance) obtained at hospital admission and of performing a detailed work-place investigation when a work-related incident must be investigated.

A "work-related death" is defined as "A person who was fatally injured as a result of, or who died of a fatal condition caused by, exposure to their own or others' activity or work factors; or who was fatally injured whilst travelling to or from work."

In 2002, 1,478 Italian workers died from work-related injuries. In the same year 5,475 United States workers died due to traumatic injuries related to their work.

There are many potential contributing factors to any work-related incidents, including aspects or characteristics of the working systems, the equipment and material used, the environment, and the worker. For these reasons it is very important to verify if any malfunctioning equipments or any lack in safety measures have played a role in the occupational injuries.

In many cases reconstructing the event can be difficult because of the lack of detailed information about the circumstances of the incident and the design description of the machinery. Furthermore, the victim may not die at the workplace, but is admitted to the hospital and undergoes neurosurgery. In such cases neurosurgeons, removing skull fragments and generating new fracture lines, can complicate forensic examination and sometimes prevent a clear identification of the etiology of the lesions.

A case of a 40-year-old man who was involved in an injury while performing his job in a manufacturing industry will be presented. The victim, found unconscious by a colleague, was immediately transported to the general hospital. In the emergency room he presented with severe cranial trauma with bilateral skull fractures, a subarachnoid hemorrhage, and multiple cortical and intraparenchymal contusions. Despite urgent craniotomy and neurosurgical treatment the man died due to increased intracranial pressure.

Forensic autopsy revealed:

- the laceration of the right ear;
- a curved surgical sutured incision at the left side of the head;
- a lack of part of the left parietal bone due to the craniectomy;
- a linear fracture of the right parietal bone;
- massive subarachnoid and fourth ventricular hemorrhage;
- hemorrhagic necrosis of the pons and medulla oblongata.

There were no witnesses watching the accident and the pictures of the work place did not help the reconstruction. Moreover, the findings

collected at autopsy did not allow investigators to establish whether the skull had been struck by a blunt object or had hit the ground violently, preventing a clear identification of the etiology of the cranial fractures.

To analyze the morphology of the fractures and their location a three-dimensional (3D) reconstruction (surface shaded display, SSD) based on CT scans performed at admission to the emergency room was employed. The analysis revealed a depressed skull fracture involving the left sphenoid and temporal bones with penetration of bone fragments in the left temporal lobe.

With the new information gained from the 3D-CT reconstruction of the skull, a second work-area investigation was performed. The fit-matching analysis between the components of the machinery and the depressed skull fracture permitted to identify a metal parallelepiped as the cause of the cranial staving and to reconstruct the event.

This case underlines the importance of taking into consideration radiological data (x-rays, computed tomography, or nuclear magnetic resonance) obtained during hospital admission and of performing a detailed work-place investigation when a work-related incident must be investigated and reconstructed.

Machinery-Related Occupational Death, Forensic Radiology, Work-Place Investigation

G3 Impetigo Contagiosa Simulating Non-Accidental Injuries in a Pregnant Woman Using Intravenous Drug

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After attending this presentation, attendees will understand the possibility of pitfalls when distinguishing between pathological and traumatic injuries.

This case presentation will impact the forensic science community by emphasizing the possibility of these pitfalls when distinguishing between pathological and inflicted injuries.

This case confirms that for subjects using intravenous drugs, a fulminating course of endocarditis by *Staphylococcus aureus* that involves the left cardiac valves in association with systemic embolism of cutaneous vessels may cause dermal lesions simulating non-accidental injuries.

Even though it is well known how the use of intravenous drug increases the risk of endocarditis, available data about the clinical aspects related to the involved site and bacteriological characterization seem to be controversial. *Staphylococcus aureus* represents the most frequently implicated microorganism (i.e., 76% of cases) that significantly impacts the tricuspid valve. Different from the other etiologic forms, the endocarditis by *S. aureus* generally starts with symptoms of sepsis and pulmonary embolism linked to a past use of intravenous drug which defines the so-called "diagnostic triad" of the tricuspid valve endocarditis. Cardiac insufficiency and neurological signs are not usual symptoms. In endocarditis cases resulting from *S. aureus*, a fulminating course has been observed only if the left cardiac valves were involved, with systemic embolism and/or cardiac decompensation. The course is favorable in the remaining cases.

Case: A young woman, at the 32.2 week of amenorrhea was assisted by first aid and admitted to the hospital with a diagnosis of

"labor of preterm fetus." At the clinical exam, the woman was in a very bad general condition and not awake. She had widespread signs of acupuncture, ecchymoses and bruises in the forearms, bruises and scrubs on both the thighs and the vulva. The fetus was in cephalic presentation and the membranes were broken and very bad smelling. The woman was assisted during labor. However, the fetus, a male weighing 1,530g, was terminal. Immediately after the labor, the woman exhibited cyanosis, marked hypocapnia, hypotension, and hypothermia. She was transferred to the intensive care unit where she arrived unconscious with tachypnea, tachycardia, hypotension, metabolic acidosis, hyperkalemia, and hypercreatinemia. Despite intubation, a sudden bradycardia arose evolving into asystole after about four hours. Resuscitation was attempted but the patient died by electro-mechanical cardiac dissociation. The external exam of the decedent showed extended bruises and abrasive injuries on the thighs and on the vulva, resulting in the hypothesis that the woman could have been a victim of violence. The judicial authority, considering the clinical evolution of the patient and the hypothesis of personal violence, ordered the autopsy of the woman and fetus.

The autopsy and histological examinations revealed tricuspid valve acute vegetating endocarditis by *S. aureus*, multiple septic pulmonary, renal, encephalic, cardiac and cutaneous emboli, impetigo contagiosa causing apparent cutaneous abrasions, ecchymoses, and consumption coagulopathy. Similarly, the fetal autopsy showed that the cause of death was a sepsis by *S. aureus*.

This case emphasizes the possibility of pitfalls in distinguishing between pathological and traumatic injuries.

Impetigo Contagiosa, Non-Accidental Injuries, Cutaneous Emboli

G4 HPLC Analysis of Benzocaine in "Green Products"

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After attending this presentation, attendees will understand some principles of analyzing condoms that contains benzocaine as a desensitizer. Such a condom is commonly known as a "Benzocaine condom." Benzocaine is a compound that is prepared from 4-aminobenzoic acid and ethanol. It is also the active ingredient in many over-the-counter anesthetic ointments and is indicated for general use as a lubricant and topical anesthetic on intratracheal catheters, pharyngeal and nasal airways, sigmoidoscopes and vaginal specula.

A benzocaine condom is a completely unique condom in itself. These condoms have a small amount of benzocaine lubricant cream in the tip. This cream helps to disperse the heat of the body. The main role of benzocaine is to desensitize the tip of the penis and prolongs the act of lovemaking between couples. Benzocaine binds to sodium channel and reversibly stabilizes the neuronal membrane which decreases its permeability to sodium ions. Depolarization of the neuronal membrane is inhibited thereby blocking the initiation and conduction of nerve impulses, thus making the sexual encounter last longer.

The condom is a widely used mechanical barrier contraceptive. It is one of the oldest methods of birth control. They are available over the counter as a non-prescription product and are procured very easily by sexual offenders. Sexual offenders often use condoms in the commission of sexual assaults in order to prevent identification through deposited biological material. Even the detection of DNA is inhibited in cases of sexual assault involving condom use. In such circumstances trace evidence, including condom lubricant residues viz. PEG, PDMS, benzocaine, etc. provides the crucial associative evidence. The seminal fluid residue containing sperm, proteins, blood grouping factors, and DNA helps in identification of sexual assault offenders. However, perpetrators of sex crimes using condoms during the commission of sexual assaults prevent identification through deposited biological

material. However, when assailants use condoms, they leave behind other valuable evidence.

Benzocaine, HPLC, Condom

G5 Child Deaths Due to Television Falls With Injury Patterns That Mimic Child Abuse

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After attending this presentation, attendees will have learned about two cases illustrating the types of injuries sustained when televisions fall on small children and their similarity to inflicted child abuse trauma.

This presentation will impact the forensic community by explaining how blunt trauma secondary to falling televisions is occasionally reported in the clinical literature; however, descriptive reports of the patterns of such injuries are limited and such cases may mimic those considered “typical” of inflicted trauma.

Data from the CDC indicate that accidents and inflicted trauma account for 33 percent and 5-8 percent of childhood deaths, respectively. Blunt trauma secondary to falling televisions is occasionally reported in the clinical literature, however, descriptive reports of the patterns of such injuries at autopsy is limited. Data from the clinical literature indicate that under such circumstances, blunt head trauma is far more common than blunt chest or abdominal trauma. The severity and patterns of injury identified in such cases may mimic those considered ‘typical’ of inflicted trauma. As such, careful integration of data collected from the death scene (including witness statements), from hospital records, and all components of the autopsy is necessary to ensure accurate and defensible determination of cause and manner of death. Two cases will be presented to illustrate the types of injuries sustained when televisions fall on small children.

Case #1: A 13-month-old male was at his aunt’s house, playing with other children. A family member heard a loud crash, after which he observed a 21-inch cathode ray tube-type television lying on the child’s head. Emergency Medical Services (EMS) was summoned, and the child was transported to the nearest Emergency Department (ED). After initial evaluation, he was admitted to the Intensive Care Unit (ICU). A computed tomography (CT) scan revealed left-side calvarial skull fractures, left orbital skull fracture with slight proptosis, laceration of the left transverse dural venous sinus, and expansile intracerebellar hematoma, for which he underwent suboccipital craniotomy. Despite supportive measures, he expired 15 days after hospital admission. Pertinent autopsy findings included posterior scalp abrasions; frontotemporoparietal and occipital scalp and subgaleal hemorrhages; simple linear, minimally displaced fractures of the left lateral aspect of the frontal bone and orbital shelf; complex comminuted fractures of the left sphenoid and temporal bones; extensive comminuted fractures of the squamous portion of the occipital bone; subdural and subarachnoid hemorrhages; cerebral edema; cerebellar sequelae of neurosurgical evacuation of intraparenchymal hematoma; bilateral optic nerve sheath hemorrhages; no retinal hemorrhages. Evaluation of 3-dimensional reconstructions of the admission head CT scan demonstrated that many of the fractures identified at autopsy were altered (and thus appeared worse) by brain swelling, and sutural diastasis along a Mendosal suture. The cause and manner of death were certified as *blunt head trauma and accident*, respectively.

Case #2: A 32-month-old female was at home with her father and four other children; she was unsupervised while watching television.

The father heard a crash, after which he entered the room and found the child face-up on the floor with a 27-inch cathode ray tube-type television on the floor next to the child. EMS were summoned, the child was transported to a local ED, and admitted to the ICU. An admission CT scan demonstrated complex comminuted multifocal left-side skull base fractures, epi- and subdural hemorrhages, massive cerebral edema with midline shift, and brainstem hemorrhage. Despite supportive measures, her neurologic condition rapidly declined, and a determination of brain death was supported by clinical evaluation. She died two days after hospital admission. Pertinent autopsy findings included bilateral bulbar and palpebral conjunctival ecchymoses; left frontal scalp contusion; frontal and occipital subgaleal hemorrhages; large right epidural hematoma; cerebral edema with bilateral uncal herniation; fragmentation of the cerebellar folia; multifocal cerebral and brainstem hemorrhages; left periorbital soft tissue hemorrhage; scant right perioptic nerve sheath hemorrhage; no retinal hemorrhages. The cause and manner of death were certified as *blunt force injuries to the head and accident*, respectively.

Child Abuse, Accident, Television

G6 Application of Forensic Engineering for the Reconstruction of Manner of Death: A Nautical Accident

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Attendees of this presentation will be presented with a case where the application of forensic engineering helped in reconstructing manner of death and mode of lesion production in a nautical accident.

This presentation will impact the forensic community by showing how the application of forensic engineering to cases may result in obtaining more precise data concerning the reconstruction of events.

In forensic pathology it is sometimes necessary to reconstruct the manner in which a victim fell or was hit, stabbed, or shot in order to verify the compatibility between the pattern of distribution of lesions and the dynamics of the lethal event. Reconstruction aids in acquiring information which may help in determining homicide, accident, or suicide. More and more in these cases, forensic engineering assists the forensic pathologist. This case shows the importance of forensic engineering in the reconstruction of events. The case concerns an unmarried couple on a boating trip. One morning the man woke up to find his partner overboard in the water tied at the waist by a security rope. He later reported that she must have fallen in the water during the night, when it had been her turn to steer and check on the boat. The woman underwent postmortem examination, which showed typical signs of drowning, such as foam in the airways, overinflated lungs, and water in the stomach. Authorities initially classified the death as accidental. The woman’s family remained suspicious that the partner was responsible for the death since he had recently been made the sole beneficiary of her will. Their accusations led to the exhumation of the corpse and a new autopsy was performed, which highlighted typical signs of blunt trauma, such as bruises distributed to the head, right thorax, right hand and shoulder, back, and linear abrasions on the abdomen.

Microscopic analysis of the lungs showed signs of drowning, such as oedema and expansion of the alveoli. Unfortunately no diatoms could be found (only fragmentary). The cause of death was identified as mechanical asphyxia by drowning. Although the cutaneous signs of blunt trauma observed during the postmortem examination could not

justify death by a traumatic cause, they could have been the signs of an aggression which may have caused the fall of the victim into the water. The main question was: could a simple fall from that boat explain the pattern of lesions (anterior and posterior), or did they indicate an aggression? Initial experiments were performed with a dummy and a boat of the same model. Different manners of precipitation in different positions were then simulated, which provided the first general data concerning the mechanisms of the fall. A more precise analysis was then conducted with computer-simulation software in order to obtain more reliable data concerning the physical characteristics of the boat and dummy model as well as the mutual interactions between the two. After recording every physical characteristic which may have had importance in the reference system and the virtual reconstruction of the environment, different simulations of the fall were reconstructed. The position of skin lesions were considered as points of contact between the body and boat during the fall. Three hypotheses of falling were then considered and simulated. In the first case, the victim was facing the sea, in the second she had the sea to her right, and in the third she had the sea behind her. In the first case, the simulation was concordant with all the lesions described but for the bruise on her back. In the second case the fall could explain only the lesion on her right hand. The third type of fall explained all lesions.

Results showed therefore that the pattern of lesions could be consistent with an accidental fall and may not have necessarily been caused by an aggression. This experience strengthens the importance of forensic engineering in the reconstruction of events.

Forensic Pathology, Forensic Engineering, Nautical Accident

G7 Homicide, Suicide, and the Missing Mother: The Mysterious and Tragic Deaths of a Latino Family

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After attending this presentation, attendees will have a better appreciation of the importance of joint investigation of complicated cases involving skeletonized and decomposed remains by forensic pathologists and anthropologists. In addition, the importance of proper recovery techniques at a burial site to insure complete recovery of all skeletal remains and associated evidence will be discussed. Strong emphasis will be placed on the importance of DNA maternal and fraternal posterior testing when known antemortem DNA comparative samples of a deceased parent are unavailable.

This presentation will impact the forensic community by enforcing among forensic scientist to utilize a group approach when dealing with complicated homicides involving decomposed and skeletonized remains. Utilizing of individuals representing various forensic specialties can greatly increase the rate of success in an investigation. Use of anthropological skeletal markers such as parturitional pitting of the pelvic bones can be very useful in possibly determining the status of a female as one who has given birth to children vs. a woman who has not given birth to a child. Such information can be extremely useful to law enforcement when trying to identify a female victim.

In late March of 2007 a gruesome discovery was made by police in Frederick, MD as they entered a local residence. Discovered in the house was the body of an adult Latino male who was suspended by a noose ligature along the stairwell leading up the upstairs level of the residence. A continued search of the residence led to the discovery of four children, ages one, three, four and nine. All four of the children were found deceased and in an advanced state of decomposition. One pair of the children was discovered in a single bed covered by blankets,

and the other pair in a single bed in a separate bedroom covered by blankets. Placed above the bodies of the deceased children in each room were religious pictures. An extensive search of the residence by police failed to locate the mother of the children. Autopsy and forensic examination of the adult male who was identified as the father of the children determined the cause of death to be asphyxiation and the manner of death suicide by means of hanging. Autopsy results for three of the children found death to have resulted from suffocation and the fourth child to have died as the result of blunt force trauma. All four deaths of the children were determined to be homicides at the hands of their father. Initially it was thought that the reasoning behind the murder and suicide by the father was that he was despondent over his wife being kidnapped, or possibly leaving him for another man.

As these seemingly senseless killings shocked the community, police were baffled as to the whereabouts of the missing mother. Various speculations surfaced in the news media concerning the disappearance of the mother. Some individuals suspected she abandoned her family and ran off with another man, others claimed that she had been abducted by a Latino gang as retribution for not paying them for illegal assistance she may have received in entering the US. Reports had even been received from her sister who lived in the same community that she had returned to her native El Salvador. The case of the missing mother and the tragic deaths of the father and children received so much media attention that the FBI was called in to assist in the investigation. Law enforcement officials were contacted in El Salvador who later reported possible sightings of the mother in their country as well as bordering Honduras. The plausible leads and high profile nature of the case prompted the FBI to send agents to El Salvador to investigate the sightings. Based on the primary evidence gathered by law enforcement it was believed that the mother had been kidnapped. An intensive national media blitz was conducted to provide leads to police and the FBI in order to locate the mother.

Human skeletal remains were discovered at a clandestine burial site located in the same county in which the deceased family had resided almost a year after the horrific discovery of the murdered children and their father's suicide. The grave was located by a local real estate agent who was conducting a survey of a four acre parcel of land located along the edge of a major highway. While walking the property the real estate agent discovered a skull and partial lower limbs exposed within the grave. Also discovered lying directly next to the grave was a snow shovel and a large digging pick. The Office of the Chief Medical Examiner was immediately called to the scene where the remains were carefully recovered.

During the initial recovery of the remains anthropological analysis determined that the remains represented a Mongoloid / Hispanic female who was in her early twenties at the time of death. Examination of the bones of the pelvis at the scene also determined that the deceased had given birth vaginally to multiple children as indicated by the presence of deep and extended parturitional pitting along the ventral surfaces of the pubic bones of the inomites. Several jewelry items were located with the remains which included a gold religious symbol common to Central American coastal countries. Examination of the gravesite revealed it to be an incomplete burial, as the body was never fully covered possibly due to its close proximity and visibility from the highway, and the non-retrieval of the digging tools.

Anthropological examination of the skeletal remains found them consistent with the biological profile for the missing mother. Due to the lack of antemortem dental or radiographic records, DNA analysis was conducted on the skeleton. Positive identification of the remains was established by comparing the postmortem DNA profiles obtained from the children and the husband to that obtained from the bones of the deceased in question. No skeletal injuries were noted on the remains therefore cause of death was undetermined but manner signed out as homicide. Continued investigation of the case revealed that the woman and her husband had been having marital problems which arose from the wife seeing other men. As a result of the martial unrest it is believed that

the husband murdered his wife and buried her body along the interstate. Possibly despondent over his actions the father, knowing he would be imprisoned and the deleterious affect it would have on his children, he chose to kill the children and then commit suicide.

Asphyxia, Buried Remains, Parturitional Pitting

G8 Sudden Death in Epilepsy: A Review of 51 Consecutive Cases

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After attending this presentation, attendees will be able to list the risk factors for sudden death in epilepsy, discuss pathophysiological mechanisms for sudden death in epilepsy, and address the role neuropathological examination in epilepsy cases.

The presentation will impact the forensic community by providing a broader understanding of the role of seizures in sudden death as well as the role of detailed neuropathological examination in characterizing such cases. The presentation will also identify two additional subgroups of epilepsy patients and provide attendees of an enhanced understanding of causes of death in epilepsy patients in general.

Sudden unexpected death in epilepsy (SUDEP) is a well-known but poorly understood phenomenon. While certain risk factors are consistently associated with SUDEP, the pathophysiological mechanism for sudden death remains speculative. Autopsy data from 51 consecutive cases with a history of "seizures" and who underwent complete autopsy, including toxicology and neuropathological examination were reviewed. A board-certified neuropathologist completed the neuropathological examination in 50 of the 51 cases. Of 51 cases, 24 (47%) met criteria for SUDEP (history of epilepsy, sudden unexpected death, no other cause of death, no status epilepticus). Of the cases meeting criteria for SUDEP, 15 (63%) were male and nine (37%) were female, with a mean age of 32.4. Fourteen were found in bed, none were found outside, and eight were lying prone. Seven (29%) had evidence of tongue biting. Fourteen were treated with a single antiepileptic drug. Two were receiving polytherapy. General autopsy revealed pulmonary edema in 17 (71 %) cases. Twelve of 19 cases had childhood onset of epilepsy. Neuropathological examination revealed significant abnormalities in 67%. Among these were remote contusions, vascular malformations, hamartomas, mesial temporal sclerosis, and migration disturbances. Of cases excluded from the SUDEP category, two groups were apparent: one with complex neurological disorders in children complicated by seizures (CND-S), and the second with atherosclerotic cardiovascular disease in older decedents complicated by seizures (ASCVD-S). No acute cause of death was apparent in a number of these cases, raising the possibility that seizures could have played a role. In conclusion: 1) cases discussed indicate general SUDEP risk factors consistent with the published literature; 2) the percentage of cases with significant neuropathological findings is higher than indicated in other studies, emphasizing the need for detailed neuropathological examination (formalin fixation and examination by a neuropathologist); and 3) two additional subgroups, ASCVD-S and CND-S, are in need of further study regarding the role of seizures in sudden death.

Epilepsy, Sudden Death, Seizures

G9 Spontaneous Coronary Artery Dissection – An Isolated Eosinophilic Vasculitis?: Report of Two Sudden Death Cases

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After attending this presentation, attendees will understand two cases of spontaneous coronary artery dissection, recognize them as a cause of sudden death, and discuss the role of an adequate gross recognition and histological examination with emphasis on the presence and significance of the eosinophilic infiltrate that is frequently associated to this disorder.

This presentation will impact the forensic community by increasing the awareness of the existence of this rare natural disorder and demonstrating its pathological characteristics emphasizing in the gross recognition and histological presentation.

Spontaneous dissection of the coronary artery is a rare entity. It has an increased prevalence in women, especially in the peripartum state. It is defined as hemorrhagic separation of the media of the coronary artery with creation of a false lumen, in the absence of chest trauma, extension of aortic dissection or iatrogenic trauma.

The first case involved a 55-year-old woman with no personal or family history of heart disease. History was also negative for systemic disease, recent trauma, or drug abuse. She was last seen in her usual state of good health a few hours before her death. She was found unresponsive by family members at her apartment where she was pronounced dead after unsuccessful resuscitative measures.

At autopsy the decedent was 167 cm tall and weighed 72 kg. Externally there were no signs of natural disease or trauma. The heart weighed 370 g without ventricular hypertrophy or gross ischemia. The coronary arteries were free of atherosclerosis and had a normal distribution. The left anterior descending coronary artery (LAD) had a focal dissection within the media with a hematoma surrounding and compressing the wall causing total occlusion of the lumen. The total length of the dissection was 2 cm, and it started 3 cm from the origin of the LAD.

The second case involved a 43-year-old woman whose medical history was relevant for back pain, occasional episodes of tachycardia and shortness of breath. She had no history of recent trauma or drug abuse. She was in her usual state of health when she complained of increased back pain and shortness of breath. She was taken to the emergency room by family members but was pronounced dead on arrival. At autopsy the decedent was 165 cm tall and weighed 67 kg. Externally there were no signs of natural disease or trauma. The heart weighed 310 g without ventricular hypertrophy or gross ischemia. The coronary arteries had a normal distribution with minimal atherosclerosis. The LAD showed a focal dissection within the media with a hematoma compressing and occluding the lumen of the artery. The total length of the dissection was 1.5 cm at the distal third of the LAD.

A common histological finding for both cases was a dense focal infiltration of the adventitia and the outer media of the dissected coronary artery by inflammatory cells of predominantly eosinophilic granulocytes with a few lymphocytes and mononuclear histiocytes. Polymorphonuclear granulocytes were infrequent. The inflammation did not involve the inner media or intima. The non-dissected portions of the LAD, the rest of the coronary arteries and the myocardium were free of inflammatory infiltrates in both cases. No myocyte hypertrophy, myocardial scarring, or small vessel disease was present.

Spontaneous Coronary Artery Dissection is a rare entity whose precise incidence, etiology and pathogenesis have not been clearly established. Periadventitial and medial wall eosinophilic inflammation have been commonly observed, generating the hypothesis of an underlying localized inflammatory or vasculitic process that predisposes to this condition. This primary process could cause weakening of the arterial wall and subsequent dissection. However it has also been proposed that such inflammation could be a consequence of dissection, rather than its cause.

These two cases illustrate that a detailed examination of not only the affected coronary artery but also the rest of the vasculature and myocardial tissue is essential to identify and understand this process. In order to clarify the pathogenesis of this entity, it is necessary to perform future studies including cases of non-spontaneous dissection of the coronary artery. These cases are presented and discussed with a review of the literature available to date.

Spontaneous Coronary Artery Dissection, Sudden Death, Eosinophilic Inflammation

G10 Fibromuscular Dysplasia of Pulmonary Arteries: Report of Two Cases

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After attending this presentation, attendees will learn of a case showing complications of fibromuscular dysplasia (FMD) (aneurysmatic dissection, arterial obstruction) most likely triggered by chest trauma and by possible cardiotoxicity due to association local/general anesthesia.

FMD is a non-atherosclerotic and non-inflammatory vascular disease, with a familiarity of 10% (inheritance dominante autosomica), and is characterized by fibrous or muscular or both types proliferation subverting normal architecture of the arterial wall. Etiology of FMD is unknown although various hormonal and mechanical factors have been suggested. Fibromuscular dysplasia generally affects women (94%) in their fertile age; it is frequently associated with pregnancy or hyperestrinism, but FMD can occur in any age, infancy included.

Clinical manifestations of FMD depend on involved arterial segment, histological type, and complications (obstructions, aneurysm rupture; embolism; sudden death). FMD commonly affects renal and carotid arteries, and less frequently it's observed in other small and medium arteries; pulmonary localization is rare. Prevalence of symptomatic renal FMD is about 4/1000 cases, twice as to that observed in carotid arteries. Histologically, FMD has been classified into three distinct types: intimal fibroplasia; fibromuscular medial dysplasia (medial hyperplasia, perimedial fibroplasia), and periarterial (adventitial) fibroplasia. Angiographic classification includes multifocal type, related with histological variant "medial fibromuscular dysplasia"; tubular and focal types, both no related with specific histological type.

In this study, two cases of unknown FDM involving pulmonary arteries are described. Clinical manifestation occurred in one case following a road accident related trauma and, in another case, following an anaesthetic induction and local anesthesia before surgical procedure.

Case 1: A 52-year-old obese man while driving a car got into an accident and suffered severe multiple trauma. He was taken to the Emergency Room where he presented coherent and breathing (SpO₂ 92%), with SBP/DBP 150/90 and CF 92b/m.

Chest x-ray showed several rib fractures on the right side, associated with bilateral hydrothorax, upper pneumomediastinum; mild

right pneumothorax. After the first day the patient refused hospital care and discharged himself but a few hours later, he went to another hospital due to persistent pain. When he arrived was mildly dyspnoic and had bilateral basal pleural effusion. During his second hospitalization, he received antibiotics, anti-thromboembolic, anti-hypertensive, and gastroprotective therapies, and had progressive improvement of his clinical conditions. Six days after release, the patient suffered cardio-respiratory arrest and was not responsive to rescue procedures. Autoptic histological finding were mainly in the lungs that showed conspicuous bilateral pulmonary hemorrhage associated with perimedial fibroplasia variant of FDM, with aneurysmatic and dissectant patterns, in lack of pulmonary embolism.

Case 2: A 31-year-old female patient was scheduled for rhinoplasty. Presurgical hematochemical and cardiovascular examinations were normal and anesthesiological risk class was ASA1. Twelve minutes after general anaesthesia induction and immediately after infiltration of nasal mucosa with mepivacaina and adrenalina, a rapid decrease of both oxygen saturation and cardiac frequency occurred until there was irreversible cardiocirculatory arrest, and no response to rescue procedures. Autoptic histological finding were mainly in the lungs that showed vascular congestion and acute focally hemorrhagic edema, associated with FDM, perimedial fibroplasia type. Chemical-toxicological analysis for research of Mepivacaina levels showed non-toxic concentration.

Conclusions: In both described cases death was referable to complications of FMD (aneurysmatic dissection, arterial obstruction) most likely triggered by chest trauma in the first case and by possible cardiotoxicity due to association local/general anesthesia.

Fibromuscular Dysplasia, Pulmonary Arteries, Histopathology

G11 Sudden Death From Arteritis Involving a Surgically Repaired Coronary Artery - Right Atrium Fistula

Marc A. Krouse, MD, Tarrant County Medical Examiner, 200 Feliks Gwozdz Place, Fort Worth, TX 76104-4919*

After attending this presentation, attendees will be informed of the possibility of late complication of a repaired congenital coronary artery anomaly by an independent pathologic process.

This presentation will impact the forensic science community by revealing an unusual complication of surgically treated congenital cardiac malformation, specifically coronary artery - right atrium fistula.

After attending this presentation attendees will appreciate that an anomalous coronary artery (coronary artery - right atrium fistula), successfully repaired many years prior, may be involved by independently occurring disease processes such as pan-arteritis and may prove a cause of morbidity or mortality despite successful earlier treatment.

The subject of this presentation was an 11-year-old male who had a diagnosis of coronary artery - right atrium fistula some eight years prior. The anomalous vessel was ligated at the distal (right atrium) end and he was followed, without complication, for a period of some two years. He was well and active until the day prior to his collapse and demise with no complaints that could be related to cardiac disease. In early morning hours his family members responded to sounds of distress, he collapsed and began dry vomiting before becoming unresponsive. Resuscitation efforts, including ACLS protocol and emergency department treatment, were unsuccessful and he was declared dead less than two hours after onset. His history of previous surgery was initially reported (incorrectly) as repair of an abnormal right coronary artery.

At necropsy examination the body was normally developed. There were diffuse pericardial adhesions over the anterior and left side of the heart. Serial sectioning of the left coronary artery circulation revealed a

slightly large (4-5 mm) left main coronary artery with a similar size anomalous branch passing posterior to the aortic root between the atria. In this area the vessel was markedly dilated (up to 2 cm) and filled with layered, clotted blood. The firmer clot had propagated retrograde and gelatinous, acute clot was found throughout the proximal part of the anomalous artery, into and occluding the left main coronary artery. The left coronary artery ostium was also large, some 1 cm. Microscopic sections of the coronary arteries and coronary artery fistula were notable for active pan-arteritis and healed arteritis in the dilated area of the fistula as well as layered blood clot without notable organization. There was no gross or microscopic evidence of ischemic myocardial injury.

The gross appearance of the artery fistula was reminiscent of Kawasaki disease and the pan-arteritis points to a similar pathogenesis of the vascular injury, aneurismal dilation and eventual thrombosis of the injured vessel. His recent medical history included only an episode of acute sinusitis with a four day course of an unknown prescribed medication, but in interviews with family a previous episode of a viral illness some four months prior was elicited.

This case study is presented to inform forensic and/or pediatric pathologists of the possibility of a late complication of a successfully repaired anomalous coronary artery, presumably by an immune-mediated vascular injury indistinguishable from typical Kawasaki disease.

Coronary Artery Fistula, Arteritis, Sudden Death

G12 Ephemeral Petechial-Like Spots in a Victim of a House Fire

Russell T. Alexander, MD, and David R. Fowler, MD, Office of the Chief Medical Examiner, 111 Penn Street, Baltimore, MD 21201*

After attending this presentation, attendees will be familiar with a case of short-lived petechial-like spots on a woman who died due to inhalation of soot and smoke in a house fire.

This presentation will impact the forensic community by discussing the occurrence of transient petechial-like spots in fire related deaths.

A 33-year-old black female was found deceased within her apartment after a house fire. Per report, she had been drinking alcohol that evening with a girlfriend. At approximately 3:25 a.m., her daughter heard the fire detector within their apartment go off. She opened her bedroom door, saw thick black smoke, and then exited the apartment through her bedroom window. The fire department responded and was informed by the daughter that no one else was in the apartment because she thought her mother was still out drinking. The fire department extinguished a "small" fire in a loveseat located on the east end of the living room. Extensive soot was deposited throughout the residence except for the daughter's bedroom. The decedent was found "hiding" behind a chair in the northwest corner of the living room. Her keys were found underneath the burned loveseat. An ashtray with four cigarette butts was on an end table within the living room. An investigation of the fire revealed no evidence of foul play.

At autopsy, soot was densely deposited on the face, within the nares and on the tongue. Less dense soot was deposited over much of the body. Partial thickness burns involved approximately a third of the body surface area. Internally, dense soot was deposited in the airways. No thermal fixation was noted to the airways. The level of carboxyhemoglobin in iliac blood was 62.2%. The iliac blood alcohol content was 0.14 mg/dl. No other drugs were detected on a comprehensive drug screen.

Washing of the body revealed a petechial-like rash on the eyelids, face, shoulders, and back in areas where the epidermis was wiped away during cleaning. The spots appeared to have a follicular or peri-adnexal distribution. A similar though quite subtle pattern of spots was on adjacent areas where the epidermis was intact. Reexamination of the body two hours later revealed that the petechial-like rash had often faded

to a blotchy red-purple area of drying skin, though some faint spots remained. When intact epidermis along the edges of denuded skin was wiped away at this time, a new crop of petechial-like spots emerged. Two hours later, the second set of spots had faded similar to the first. Wiping away more epidermis made a third round of spots apparent. A histologic section of skin showed congested dermal blood vessels, particularly adjacent to hair follicles.

Conjunctival and facial petechiae are thought to be due to increased cephalic venous pressure resulting in rupture of small blood vessels and extravasation of blood; morphologically similar "Tardieu Spots" are formed in areas of livor mortis when engorged blood vessels in dependent portions of the body rupture (Ely and Hirsch, 1999). A literature review found only a single reference to petechiae in a fire victim (Rao and Wetli, 1988). The petechial-like spots in the present case are not related to lividity since they were equally prominent along the anterior and posterior surfaces of the body. The fading of the spots demonstrates that they are due to a congestive process and not vasculature rupture; a finding confirmed by histologic examination. It is possible that rubbing the skin created physical traction that drew blood into the vasculature further accentuating the pattern. Blood flow out of intact vessels into surrounding tissues caused the spots to fade.

This case demonstrates that inhalation of soot and smoke in a house fire can be associated with congestion of peri-follicular and adnexal blood vessels resulting in a subtle petechial-like rash that will be accentuated by wiping away of the epidermis. Furthermore, rupture of capillaries and venules with extravasation of blood is not necessary for the formation of petechial-like spots.

Fire, Petechiae, Autopsy

G13 Forensic Identification of Microbial Mixtures Via ESI-TOF Mass Spectrometry

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After attending this presentation, attendees will learn the basics of ESI MS, the basic problems with current identification methods of unknown microbes, and how ESI-TOF can correctly identify microbes based on DNA base composition.

This presentation will impact the forensic community by explaining a novel method of identifying unknown microbes in a complex sample.

The growing threat of bioterror events is a significant problem for the security of individuals worldwide. When an unknown biological agent is released, identification can be delayed due to complexity and number of samples required. Whole genome sequencing (WGS) is a possible solution; however this can be costly for complex mixtures. Targeted methodologies search for specific bacterial agents and can be limited by the requirement to determine if the agent of interest is present within the sample. An alternative to WGS and targeted methodologies was developed by Ibis BioSciences using mass spectrometry (MS). This new MS-based method allows an analyst to determine initially which species are present in the sample, rather than asking if a certain species of bacteria is present. Further delineation is then possible by fine-tuning the assay. The DNA base composition can be determined by mass measurements using high resolution MS, which can detect differences in DNA and allow strains of bacteria to be identified. A primary goal of this research is to determine the level of strain delineation possible amidst other strains of a select microbe using this MS-based method.

Broadly conserved genes in bacteria were selected for amplification with specifically designed forward and reverse primers to *Bacillus*

subtilis. Genomic DNA was extracted from *B. subtilis* and amplified using PCR. These selected amplicons were analyzed via Electrospray Ionization Time of Flight (ESI-TOF) MS. Using an integrated fluidics system, DNA samples could be introduced to the ESI source at a high flow rate but then electrosprayed at a slower flow rate to improve resolution. After deconvoluting the information from the mass spectrometer, the organism can be identified by comparison to a library using abundance estimation, joint maximum likelihood, and base composition analysis. The molecular weights from multiple strands, when combined, provide a unique molecular fingerprint which allows an organism to be identified down to the species and strain-level.

A binary set of strains from *B. subtilis* were mixed at various concentration levels to evaluate this MS-based approach in terms of speed and accuracy. An internal mass standard sequence of DNA was used to allow the concentrations of microbial DNA to be calculated after amplification. When using single-stranded oligonucleotides, more than 1200 base compositions could be reported. However, using the complement strand at low concentrations has shown to reduce complexity and error in the data, improving the accuracy of the result.

An expansion and variation of the number of bacterial species and strains tested will occur as time permits for this presentation. As a bioterror event could result in thousands of organisms present in a sample, there will continue to be a need for methods which can select the correct organism, especially in the case of a novel strain for forensic studies.

ESI-TOF, Unknown Microbes, Base Composition

G14 Environmental Scanning Electron Microscopy and Other Techniques in Cutting Crime Investigation: Case Report and Review of the Literature

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After attending this presentation, attendees will understand some principles of investigation of a dismembered body concerning the cause of death and the identification of the tools used to separate arms and legs from the trunk.

This presentation will impact the forensic community by suggesting a novel approach for the analysis of cutting crimes in general and dismembering in particular.

Herein investigators present the case of a 40-year-old female killed by throat cutting and consequently dismembered. She was found cut into 30 pieces inside three plastic bags in a garage.

Dismemberment is the act of cutting, tearing, pulling, wrenching, or otherwise removing the limbs from the trunk of a living or deceased object. It may be practiced upon human beings as a form of capital punishment, a result of a traumatic accident, or in connection with murder, suicide, or cannibalism. After killing the victim, the murderer uses a very sharp cutting weapon (a saw, knife, axe, etc.) to sever the limbs and cut the body into pieces. The operation is generally carried out immediately after the crime, although more rarely a long time may pass between the two events. There are two types of dismemberment that are commonly seen: localized, such as the removal of the head or hands in an attempt to hinder identification of the victim, or generalized at multiple sites (commonly bisection of limbs or disarticulation of the joints) to aid in the disposal of the body. In these cases a new pattern of investigation must support classical techniques to solve the following forensic issues:

- The evaluation of the time since death and of the time since dismemberment. Indeed, exsanguinations and dismemberment of the body prevent an accurate evaluation of lividities and rigidity.
- The identification of the tools used to cut the body. Careful, thorough investigation is a key point to ensure that potential physical evidence is not tainted or destroyed. In particular it is essential to identify any potential sharp cutting weapons at the crime scene. Moreover, when saws are used to cut the body, characteristic tool marks are left on the bone. The nature of the marks depends on the size, shape, width of the saw, and on the sawing action of the user.

Environmental Scanning Electron Microscopy (ESEM) may help in identifying the specific saw that has been used in the act of dismemberment. ESEM can detect and measure different types of striations, paint traces (such as rust inhibitor paints) or metal residues remaining on the bone after the cutting.

In the case presented, the determination of potassium levels in the vitreous humour and their time changes showed that the victim had been killed 20 – 25 hours before the death scene investigation.

The absence of lividities combined to histological and immunohistochemical investigation of the skin let investigators classify the dismembering injuries as non-vital wounds and to estimate the time interval between the death and the dismembering.

However, the most interesting finding was the identification of the tools used to cut the soft tissues and the bones of the victim. Morphological and morphometrical analysis of the skin lesions pointed out that the arms and the legs were cut with a sharp knife, whereas the head was removed from the trunk by a woodworker saw. ESEM analysis determined that the bone injuries were produced by a particular type of saw covered by rust-inhibitor paint.

Cutting Crime, ESEM, Dismembering

G15 Exploration of Non-Cardiogenic Pulmonary Edema With Chronic Opiate Use: Case Studies and Scientific Review

Marrah E. Lachowicz, MFS, University of California Davis, One Shields Avenue, UCDSOM, Tupper Hall 4112, Davis, CA 95616-8643*

After attending this presentation, attendees will learn how to characterize non-cardiogenic pulmonary edema during autopsy caused by opiate use. Additionally, attendees will learn about alternative opiate sources which may lead to cases of non-cardiogenic pulmonary edema. Such cases may present during autopsy and potentially lead to classification of a secondary cause of death or change in the classification of manner of death.

This presentation will impact the forensic community by providing potential answers to cases in which underlying chronic opiate use potentiates mortality. Chronic opiate use may synergistically lead to fatal pathology not readily recognized when secondary to diseased states in the lung. The presentation focuses on the reliability of diagnosing cause and manner of death during autopsy with the goal of increasing the validity of techniques, processes, and methods used in forensic medicine.

Use of opiate variants, including pain management medications such as morphine and street drugs such as heroin, have all been implicated in causing acute respiratory distress marked by non-cardiogenic pulmonary edema (NCPE). Despite efforts to treat patients who develop NCPE through chronic use or acute over-dose; presentation of NCPE stills has a mortality rate of 30-50%. With significant mortality and the rise in cases, development of NCPE is increasingly significant to the forensic community. The molecular and cellular mechanisms by which opiates induce non-cardiogenic pulmonary edema (NCPE) remain elusive. NCPE is a clinical hallmark of opiate use in long-term drug

users as well as patients treated with narcotics for chronic pain. Sporadic cases of NCPE were recently reported with use of other medications: primarily drugs used to treat other forms of edema, regulate blood volume, or blood pressure.

Although the pathogenesis of NCPE is largely unknown it thought to be dose related—thus maybe a presentation of an abhorrent cardiorespiratory response. Acute or chronic opiate use causes acute respiratory distress syndrome (ARDS) marked with pulmonary capillary leak and exudation leading to NCPE. Data shows us of opiates, primarily heroin, is the primary cause of NCPE in patients under 40. As many as 50% of these patients are clinically defined as an overdose with as much as 20% of these cases will be fatal. Previous animal models and marginal human studies identified three active opioid receptors ($\delta\mu\kappa$) varying in distribution throughout the respiratory tract. The lung is a very complicated microenvironment. Several hypotheses regarding the pathogenesis of NCPE indicate involvement of various cell and tissue types throughout the respiratory tract. Local changes may cause alterations to the alveolar epithelium direct or have effects on the pulmonary capillary bed resulting in NCPE. The lung parenchyma co-exists with the alveolar terminal air space where gas exchange occurs. Studies indicate there are two distinct H³-morphine binding sites—with the most abundant binding localized within alveolar walls. Therefore, this is the site implicated as responsible for fluid clearance in the lungs. The exact mechanism by which activation of opiate receptors in this region leads to fluid influx is largely unknown. It is possible alveolar tissue plays a role in the release of soluble mediators or recruitment of inflammatory cells leading to a cascade of events contributing to the pathogenesis of NCPE. Dysregulation of solute and fluid clearance by the alveolar epithelium itself may be altered by opiate receptor activation. Finally, long-term or acute activation of opiate receptors with may lead to significant alterations in the epithelial surface that are the basis local changes conducive to the onset of NCPE.

With underlying disease in the lungs or other chronic conditions which require use of opiates, these changes may not be easily recognizable during autopsy. The goal of this poster is to demonstrate how opiate toxicology may induce local effects in the respiratory tract which ultimately results in direct changes to the pulmonary alveolar epithelium contributing to underlying disease. Secondary pathology may contribute to cause and manner of death in forensic cases. Understanding how opiates contribute to altered pathology will enhance the methods by which forensic pathologists diagnose NCPE postmortem.

Autopsy, Forensic Pathology, Pulmonary Toxicology

G16 Is Toxicological Analysis Necessary in Postmortem External Examinations?

D. Kimberley Molina, MD, Bexar County, Medical Examiner's Office, 7337 Louis Pasteur Drive, San Antonio, TX 78229; and Meredith A. Lann, MD*, UCDHSC, AIP - Department of Pathology, 12605 East 16th Avenue, Room 3026, Aurora, CO 80045*

After attending the presentation, the attendee will understand the decision process of performing an external examination versus a complete or partial autopsy in medicolegal cases and the potential ramifications of not ordering a full toxicologic panel on cases where a postmortem external examination was performed.

The presentation will impact the forensic community by serving as a critical part in the decision making process of medical examiners in deciding how to analyze medicolegal cases and will serve to augment the literature used to establish the standard of practice for the performance of external examinations.

In many jurisdictions, external examinations are performed rather than complete autopsy examinations in certain types of medicolegal cases. Deaths in elderly patients or deaths after a fall are just a couple examples which may be included in such cases. In many of these cases,

the cause of death appears to be readily apparent from the medical records and/ or circumstances of death and toxicology is not performed.

A retrospective review of all external examinations performed at the Bexar County Medical Examiner's Office during a five year period (2003 - 2007) was undertaken comparing cases in which: toxicology was not performed; toxicology was performed but did not alter the cause and manner of death; and toxicology was performed and altered the cause and manner of death.

It was found that in cases where toxicology was performed, the toxicology results altered the cause and/ or manner of death in an average of 1.8% of cases. If toxicology had been routinely ordered on all external examinations at the BCMEO, it would have theoretically altered approximately 21 additional cases during the five- year period.

Toxicology, External Examination, Cause and Manner of Death

G17 TASER® Wound Progression in Two Deployment Modes

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After attending this presentation, attendees will have a better understanding of the wounds created by the TASER® X26 device.

This presentation will impact the forensic community by assisting in the identification of characteristic wound patterns created by the TASER® X26, the most commonly used conducted electrical weapon.

Introduction: Conducted electrical weapons are used by law enforcement to control violently resistive subjects. The TASER® X26 is the most commonly used conducted electrical weapon. It can be used in the probe-deployment mode in which probes are fired from the device at the subject, or it can be used in the drive-stun deployment mode in which the device is physically touched to the subject. The two deployment strategies can create different signature wound marks. To date, there is no study that has attempted to catalogue and describe these marks.

Methods: Subjects were recruited from police training classes for the study. The subjects were to receive an exposure from a TASER X26 as part of their training class. Subjects were allowed to choose between the two deployment modes depending on the rules of their class. Subjects completed a screening questionnaire that included the Fitzpatrick scale. The exposures were five seconds or less. Subjects had photographs of the wounds taken after the exposure immediately, and at 24, 48, and 72 hours, as well as at one month.

Results: The two deployment strategies left differing marks. The probe deployment mode generally created circular superficial partial thickness burns. The drive-stun mode created variable marks depending on the movement of the subject which included irregular superficial partial thickness burns that may be paired at about 40 mm (the distance between the metal contact points on the device), but not necessarily so. This mode also created abrasions and contusions. Some subjects had persistent hyperpigmented marks at one month.

Conclusions: The two probe deployment modes left different marks. It may be important for forensic examiners to be able to distinguish these marks from other minor skin trauma. Studies such as these will help in this.

TASER®, Wound, Burns

G18 Rat Bite Fever: A Fatal Case of *Streptobacillus moniliformis* Infection in a 14-Month-Old Boy

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After attending this presentation, attendees will understand the features of *Streptobacillus moniliformis*, are, under recognized infection as they apply to a forensic setting through an autopsy case presentation.

This presentation will impact the forensic sciences community by highlighting the key features of *S. moniliformis* infection including the clinical presentation, postmortem diagnosis of *S. moniliformis* infection, and risk factors as they relate to a particular forensic autopsy case.

After viewing this presentation attendees will understand the features of *S. moniliformis*, a rare, under recognized infection as they apply to a forensic setting through an autopsy case presentation.

Rat Bite Fever, caused by *S. moniliformis* infection, is an acute syndrome of fever, rash, and migratory polyarthritis. In the United States, primarily children under the age of 12 years are infected with a total of less than 200 cases reported. Common vectors include rats and mice, which are natural reservoirs. Transmission is predominantly from a bite or scratch, but contact with or ingestion of food contaminated with feces or saliva has also been reported.

A previously healthy 14-month-boy died after a rapid decline after onset of fever and a diffuse rash over his face, trunk, and extremities. Crime scene investigation revealed a disheveled, cluttered bedroom where the child's crib was located. Several markedly soiled animal cages were adjacent to the crib containing rabbits and ferrets. The room was also infested with roaches, flies, and ticks over the floor, walls, ceilings, and all of the bedding. A complete autopsy, including laboratory testing, revealed a well-developed and well-nourished white male infant with normal age-adjusted height and weight. A red-pink macular and mostly confluent rash covered almost the entire body surface with prominence on the head including the scalp, neck, anterior and posterior torso, anogenital region, and portions of the thighs without mucosal involvement. There was sparing of the bilateral legs, soles, palms and portions of the forearms, nose and mouth, except the left lateral corner of the mouth. The rash did not involve the buccal mucosa or gums. The right knee had a donut-shaped bite rash suspicious for a bite mark. Internal examination revealed a mildly enlarged, congested liver and enlarged mesenteric lymph nodes. Microscopic examination of the lungs showed interstitial pneumonitis with rare neutrophils and edema. There were focal areas of gastric aspiration without associated vital reaction. The kidneys had fibrin micro-thrombi with focal fibrinoid necrosis of the tubules, consistent with Disseminated Intravascular Coagulopathy. Microbiologic culture of cerebrospinal fluid was positive for *S. moniliformis* while routine blood cultures were negative. Viral cultures were also negative. Routine toxicologic analysis of heart blood and liver revealed diphenhydramine administered during resuscitation.

In the United States, 55% of cases of Rat Bite Fever occur in children less than 12 years of age. The demographics of the victims have broadened to include children, pet store workers, and laboratory technicians, because the rats have become popular pets and study animals. The infection is associated with a mortality rate of 7-13%, if untreated. The actual rate of infection may be much higher, because it is not a reportable disease. Although easily treatable with antibiotics, the diagnosis and treatment can be delayed due to a broad differential diagnosis which includes meningococcemia, *Staphylococcus aureus* or *Streptococcus pyogenes* septicemia, Rocky Mountain Spotted Fever, or other Rickettsial diseases, enterovirus infection, disseminated gonorrhea, Lyme disease, ehrlichiosis, brucellosis, leptospirosis, and secondary syphilis. Given this differential of more common entities, laboratory

identification is essential to proper diagnosis. This paper shows the importance of considering *S. moniliformis* as an etiology

In all suspected cases, a complete autopsy should be performed and the microbiology lab should be contacted for guidance in submitting blood, cerebrospinal fluid, and probably synovial fluid in appropriate media supplemented with 20% blood serum or ascitic fluid to prevent growth inhibition of *S. moniliformis*.

Rat Bite Fever, Streptobacillus moniliformis, Actinobacillus muris

G19 Contributions From Forensic Imaging to the Investigation of Fatal Upper Cervical Fractures

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After attending this presentation, attendees will understand the value of advanced diagnostic imaging procedures in forensic medical investigations of upper cervical spine fractures following trauma.

This presentation will impact the forensic community by showing how upper cervical spine fractures are frequently seen in relation to fatal trauma to the head and neck, and where this anatomical region may be difficult to evaluate during medicolegal autopsy, the contributions from advanced diagnostic imaging procedures may be of great importance to the investigation.

The purpose of this presentation is to present the value of advanced diagnostic imaging procedures in the forensic medical investigations of upper cervical spine fractures following trauma.

Upper cervical spine fractures are frequently seen in relation to fatal trauma to the head and neck and, where this anatomical region may be difficult to evaluate during medicolegal autopsy, the contributions from advanced diagnostic imaging procedures may be of great importance to the investigation.

The upper cervical spine is clinically a very important anatomical region, where the high degree of mobility is obtained on the expense of poor stability. Several types of fractures are possible at the atlas (C1) and axis (C2) vertebrae. Five cases have been retrieved where different types of trauma, (e.g., road traffic crash collisions, fall, blow to the head from moving objects), had occurred causing fractures to the upper cervical vertebrae. Each of the deceased was examined using advanced computed tomography, an in-house Siemens Definition 64 slice dual-energy scanner facility, as adjunct to the medicolegal autopsy. The upper cervical spine was reconstructed using sub-millimeter slice thicknesses and all images were examined in three planes (horizontal, coronal, and axial) as well as using 3-dimensional reconstructions. The findings from the CT-scanning were correlated with the findings from the medicolegal autopsy and the contributions from the forensic imaging procedures to the medicolegal investigations were evaluated.

The review of five unique cases with upper cervical spine fractures showed that forensic imaging procedures in combination with medicolegal autopsy allow very detailed evaluation and categorization of fractures. Although fractures of the odontoid process were readily identified during autopsy, the exact classification according to the system by Anderson and D'Alonzo was made possible by examination of the CT-images. The fractures of the atlas were more difficult to visualize during the medicolegal autopsy, particularly at the posterior arch, whereas the diagnostic imaging procedures allowed clear identification as well as classification of the fractures according to the system proposed by Jefferson.

This presentation of five trauma cases showed that advanced diagnostic imaging procedures contributes significantly to the forensic medical investigations of upper cervical spine fractures following trauma. This is important as implementation of such adjunct procedures

to the medicolegal autopsy may strengthen the degree of detail of the investigation. Although this is a small group of selected trauma cases, this presentation highlights some of the major advantages achieved by expanding the forensic investigations to also include forensic imaging procedures.

A number of cases that have in common the presence of upper cervical spine fractures will be discussed. The contributions to the medicolegal investigations from advanced computed-tomography scanning will be presented and it is recommended that forensic specialists become familiar with the potential of advanced imaging procedures to the medicolegal investigations.

Cervical Fracture, Forensic Imaging, Postmortem Autopsy

G20 Ankylosing Spondylitis in Traumatic Death: A Case Report

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After attending this presentation, attendees will have a better understanding of the possible impact of pre-existing structural skeletal disease in traumatic death, illustrated by a case report.

This presentation will impact the forensic community by reminding it of the importance of taking all natural disease into account when investigating deaths, even those diseases not normally considered fatal. Furthermore, it will present the possibilities of advanced radiological imaging as a facilitator in death investigation in the evaluation of the mechanism and manner of death.

Ankylosing spondylitis is a rheumatic disease which is associated with tissue type HLA-B27 and is considered non-fatal. Main structural features in severely affected individuals are osseous fusion of the sacroiliac joints, and rigidity of the spinal column caused by bone bridging between vertebral bodies (syndesmophyte formation). Due to this rigidity there is an increased risk of spinal fractures, especially cervical fractures, even from low energy trauma.

A middle-aged man rode his bike home from a bar while intoxicated. A witness saw him swaying and at low speed riding the bike into a curbstone. During the crash he went over the handlebars and collided with the pavement face first. His breathing ceased immediately, soon followed by cardiac arrest. Resuscitation efforts at the scene were unsuccessful. Due to the rapidity of the cardiac arrest, the attending emergency physician ruled that it was a natural death caused by a cardiovascular event secondary to the fall from the bike. According to the antemortem information obtained from the police report and the general practitioner, the deceased was healthy without prior cardiovascular disease. Postmortem computed tomography scanning revealed multiple fractures of the spine, including a fracture of the odontoid process of C2, disco-vertebral avulsion through C3-C4, and Th10-Th11. Associated with the upper cervical fractures there was displacement of fragments into the spinal canal affecting the spinal cord. Furthermore, there were ankylosing changes of the anterior longitudinal ligament throughout the spinal column with extensive syndesmophyte formation bilaterally, also known as bamboo spine configuration, particularly in the lumbar spine. The sacroiliac joints were closed by osseous fusion. All the radiological findings were in agreement with the diagnosis of ankylosing spondylitis. The medicolegal autopsy showed abrasions in the face, on the back, on hands, and legs; bleeding in and around the spinal fractures; rib fractures with sparse bleeding; bone bridging of the intervertebral joints; an enlarged heart, insignificant atherosclerosis; a fatty liver, and an enlarged spleen. Blood alcohol was 189 mg/dl. The microscopical examination revealed hypoxic changes in the brain, granuloma formation in the lungs consistent with sarcoidosis, and bone marrow emboli in the pulmonary arteries. The bone marrow

emboli were thought to come from the primary spinal fractures or the secondary rib fractures caused by the resuscitation efforts.

Further investigation into the medical history, by requesting relevant hospital records, revealed that the deceased had received treatment in an outpatient clinic nine years prior, due to ankylosing spondylitis with rigidity of the spine. He had furthermore been under evaluation for lung sarcoidosis. The cause of death was ruled to be upper cervical spinal cord injury due to upper cervical spine fractures, complicated by spinal rigidity secondary to ankylosing spondylitis. The manner of death was ruled to be accidental.

This case report illustrates the fatal outcome of spinal injuries in an individual who suffered from a structural skeletal disease, where the ankylosing spondylitic changes acted as predisposing factors leading to his death. Thus, knowledge of pre-existing skeletal disease is important in the medicolegal evaluation, as diseases that are considered non-fatal can contribute to the cause of death. In this case report the understanding of the conditions leading to death was recognized and supported by the postmortem computed tomography.

This presentation will impact the forensic community by reminding it of the importance of taking all natural disease into account when investigating deaths, even those that are not normally considered fatal. Furthermore, it will present the possibilities of advanced radiological imaging as a facilitator in death investigation in the evaluation of the mechanism and manner of death.

Ankylosing Spondylitis, Postmortem Examination, Forensic Imaging

G21 An Unsolved Cold Case in Iowa: A Probable Case of Dragging

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After attending this presentation, attendees will learn about differential diagnosis for trauma due to dragging. Dragging injuries to human remains is rarely described in the literature and is limited to accidental long-range towing behind large vehicles.

This presentation will impact the forensic community by describing the skeletal morphological changes associated with dragging from a different context than is currently found in the literature.

Dragging injuries to human remains is rarely described in the literature and is limited to accidental long-range towing behind large vehicles. The goal of this presentation is to provide a differential diagnosis for trauma due to dragging. This presentation will impact the forensic community by describing the skeletal morphological changes associated with dragging from a different context than is currently found in the literature.

On October 4, 1978, decomposed human remains were found lying face down in a ditch in a rural portion of Northwestern Iowa. The female victim was partially clad in knee-high white "go-go" boots with her panties and pants bunched up under the torso. Her arms were stretched over her head and her ankles were tied together with a knotted rope. An autopsy the following day revealed no obvious traumatic injuries to the soft tissue or skeleton other than damage to the maxilla that was originally attributed to animal gnawing. The hands were retained and the skull, clavicles, pubic symphyses and possibly other bones were sent to a forensic anthropologist for analysis. Ultimately the identity of the victim and the cause of death were unknown and the case became "cold."

Interest in the case was renewed nearly two decades later when, in January 2006, the victim's fingerprints were matched to those on a

fingerprint card of a woman arrested in California in 1973. Mitochondrial DNA tests of metacarpal bones of the victim positively matched the mtDNA of a known daughter of the California woman. The victim was identified as a 23-year old prostitute from California who was last seen in Georgia in February of 1978. Throughout 2006 investigators created a list suspects, including the victims' ex-husband, but most of these individuals were deceased or could not be found for questioning. In 2007 the remains were exhumed, the bones that had been sent to other anthropologists were returned, and a new autopsy was ordered to further investigate the cause of death.

The soft tissue of the dorsal aspect of the entire body was remarkably well preserved while the ventral aspect (which had been in contact with the ground) was skeletonized. A comprehensive drug panel on decomposed skeletal muscle was positive only for caffeine and cotinine. Following the forensic pathological examination the bones were macerated in warm water with detergent and examined by the anthropologist. Bone loss of the maxillary alveolar bone, hard palate, anterior nasal spine, and nasal aperture was extensive. Adherent bone fragments, radiating fractures, tool marks, or animal gnawing were absent and the morphology was most consistent with abrasion. Similarly, abrasion injuries were apparent on the medial aspects of both elbows (distal humeri and proximal ulnae) and the anterior iliac spine of the right ilium. No bony modifications were observed below the pelvis.

The abrasion injuries are consistent with dragging in a prone position with the arms over the head as the lower face, medial elbows and one or both ilia would be in contact with the ground. The mandible and anterior rib cage are also expected to be affected but unfortunately these elements were not retained from the original autopsy. Only two known cases of dragging are published in the literature and these involve dragging behind or under a vehicle for significant distances (at least 2.5 miles). One case (Klintschar et al. 2003) reports a body dragged prone by one foot with the arms over the head such that the medial aspect of the elbows faced outwards. The medial humeri and ulnae as well as the lower teeth were extensively abraded. In the current case the injury pattern, the position of the pants (pulled up under the torso), the position of the ligature around the ankles and the final resting position of the body in the ditch suggest the victim was pulled by the feet while in a prone position such that the legs were off the ground and the arms over the head. The remote location and terrain implies the victim may have been dragged by a vehicle down a gravel road but most likely was pulled by hand. While coffin abrasion cannot be completely ruled out, these particular bones were not observed to be in direct contact with the metal sides when the coffin was unsealed. Thus, a mechanism of manual dragging is proposed to explain the morphology and distribution of the skeletal injuries.

Trauma, Forensic Pathology, Forensic Anthropology

G22 An Unusual Death Involving a Sensory Deprivation Tank

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After attending this presentation, attendees will understand the intended use of sensory deprivation tanks and understand possible risks associated with improper use. A practical investigative approach to similar deaths involving water tanks and spas will be discussed.

This presentation will impact the forensic community by familiarizing the forensic community about the use of sensory deprivation or flotation tanks, as well as risks associated with improper use.

Deaths involving sensory deprivation tanks, also called flotation tanks, are very rare. A thorough literature search using PubMed and

Ovid MEDLINE search engines yielded no such cases; however, recently a preliminary report on a similar case from Berkshire, UK was reported online in late 2007. This is the first known death associated with a flotation tank to be reported in the medical literature.

Flotation REST (Reduced Environmental Stimulation Therapy) is used by some as a modality for stress-reduction or for behavioral modification programs. REST was initially a research tool for neuropsychiatric studies in the 1960s, but became more popular in the United States in 1970s-1980s when the tanks became available for commercial and personal use. Most recently some medical practitioners ascribe to its use as an alternative therapy for various medical illnesses, as it may reduce hypertension and alleviate chronic pain. The medical literature discusses the effects of chamber REST for many psychiatric, behavioral and addiction disorders; however controlled studies using flotation REST are very limited.

A unique case in which a previously healthy 50-year-old woman apparently died while floating in a sensory deprivation tank within the basement of her own home will be described. The deceased reportedly had not previously used the tank, although had purchased it approximately three years previously, and was likely not familiar with the proper use of the tank. At the time of the scene investigation the unit's filtration system, which was situated close to the flotation tank, was noted to be on and running. The temperature of the water in the flotation tank was elevated at 116 deg F, approximately 20 deg F higher than the usual target temperature for flotation sessions. Examination of the tank and accessories found all components operating within specifications, with no malfunctions or electrical hazards identified. There was no evidence the decedent drowned, as the nose and mouth were not submerged. A full medicolegal autopsy was performed. No anatomic cause of death was identified at autopsy. Postmortem laboratory studies demonstrated a vitreous creatinine of 5.2 mg/dl, a blood ethanol level of 0.270%, an elevated blood doxylamine level, and the presence of sertraline and diphenhydramine. It has been concluded that the deceased inadvertently left the pump on during her flotation session, which resulted in the elevation of water temperature after she fell asleep during the session. The cause of death was determined as due to acute mixed drug and ethanol toxicity with probable hyperthermia contributing. Manner was ruled as accident.

It is recommended that mind-altering or CNS depressant drugs including alcohol not be used during flotation REST sessions. This case report and discussion will help the forensic community understand the use of flotation tanks and the risks associated with improper use. Investigation of deaths involving these units or similar devices such as bathtubs or spas should include special precautions aimed to prevent harm to the investigation crew. In addition, full examination of the tank and accessories should be performed by professionals familiar with the equipment to confirm any product malfunctions or other potential safety hazards.

Sensory Deprivation Tank, Flotation Tank, Intoxication

G23 Preliminary Analyses of Carrion Colonization of Necrophagous Flies (Diptera: Calliphoridae) in Central Oklahoma

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After attending this presentation, attendees will have a better understanding of the colonization of carrion by necrophagous flies in two suburban habitats in central Oklahoma. In addition, attendees will

better understand factors that impact necrophagous fly colonization of carrion and their diversity suburban habitat.

From this presentation, the forensic community will attain a better appreciation for carrion insects in central Oklahoma and environmental conditions for postmortem interval (PMI) estimations of human remains based on associated arthropod fauna.

This presentation will impact the forensic community by demonstrating the potential influence of environmental factors on carrion colonization by necrophagous flies and vertebrate carcass recycling in non-vegetated habitats in central Oklahoma, and the importance of insular suburban woodlots as a refuge and species pool for dipteran decomposers. With the possible onset of global warming and the continuing expansion of human habitation, maintaining suburban woodlots and vegetated green zones may prove critical for the preservation of terrestrial decomposer populations and other wildlife.

Necrophagous flies are important ecologically and forensically. Ecologically, carrion frequenting flies (Diptera: Calliphoridae) are dominant members of the terrestrial decomposer community and, as such, play a significant role in the recycling of vertebrate remains, improving public health. Additionally, analyses of immature and adult flies colonizing remains can provide a broad spectrum of forensically meaningful information, including estimates of the minimum postmortem interval (PMI). Central to an understanding of the ecological and forensic significance of necrophagous Diptera is knowledge of the environmental factors potentially limiting carrion detection, access, and colonization. This study examined the impact of high temperatures and surface winds on the colonization of carrion (liver) by necrophagous Diptera in two suburban Oklahoma habitats. Standardized samples of beef liver (uniformed attractant) were placed in a suburban woodlot and turf grass field in Central Oklahoma. Wind speed, wind direction, and temperature were measured at each site and correlated with carrion fly colonization rates and species diversity. Over 100 replicates were conducted over the course of 8 weeks. Fly colonization patterns were compared with commercial flytrap (Pherotech ®) and rodent carcass trials.

Study results indicated a clear difference between habitats, with the turf field characterized by stronger winds, higher temperatures, more rapid carrion desiccation, reduced fly colonization rates, and lower species abundance and diversity. Additionally, the turf field habitat was characterized by a significantly greater number of days devoid of carcass colonization by carrion flies. Vegetative stratification, characteristic of the suburban woodlot habitat, provided mediation of wind and heat effects and facilitated increased carrion fly abundance, diversity, and activity.

The study demonstrates the potential influence of environmental factors on carrion colonization by necrophagous flies and vertebrate carcass recycling in non-vegetated habitats in central Oklahoma, and the importance of insular suburban woodlots as a refuge and species pool for dipteran decomposers. With the possible onset of global warming and the continuing expansion of human habitation, maintaining suburban woodlots and vegetated green zones may prove critical to the preservation of terrestrial decomposer populations and other wildlife.

Forensic Entomology, Carrion Colonization, Necrophagous Diptera

G24 Two Fatal Cases of Hidden Pneumonia in Young People

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The goal of this presentation is to review two fatal cases of hidden pneumonia in young people.

This presentation will impact the forensic science community by demonstrating how acute respiratory distress syndrome (ARDS) can result in death. Also young people generally, in cases of pneumonia, can be treated and consequently prevent death. Therefore, these cases illustrate the importance of early diagnosis of this condition.

ARDS is a severe lung disease characterized by inflammation of the lung parenchyma leading to impaired gas exchange with concomitant systemic release of cytokines and inflammatory mediators frequently resulting in multiple organ failure (MOF). This condition usually requires a rapid application of mechanical ventilation and admission to an intensive care unit.

When the endothelium of lung capillaries and the alveolar epithelium are damaged, plasma and blood spread in the interstitial and intralveolar spaces. Such a change induces decreased lung compliance, pulmonary hypertension, reduced functional capacity, modified ventilation/perfusion ratio, and hypoxemia. ARDS can occur within 24 to 48 hours of an attack of acute illness. In such a case the patient usually has shortness of breath and tachypnea.

Typical histological presentation involves diffuse alveolar damage (DAD) and hyaline membrane formation in alveolar walls.

If the underlying disease is not diagnosed and treated, the condition of the patient will worsen resulting in shock and/or MOF potentially resulting in sepsis.

Supposedly over 30% of ARDS cases are due to "sepsis syndrome," which is characterized by leukocytosis or leukopenia, fever, hypotension and leading to the identification of a potential source of systemic infection via positive blood culture for pathogenic agents.

The rate of survival in case of severe ARDS with appropriate and early treatment is 50%. However, if the severe ARDS induced hypoxemia is not recognized or treated, or if the disease reaches is not diagnosed until the terminal phase, cardio-respiratory arrest occurs in more than 90% of patients.

Case 1: A 29-year-old man was found lifeless at home by his girlfriend. Death scene investigation was unremarkable. He took psychotropic drugs, and he was known to be an abuser of alcohol and drugs. Family history was negative for sudden death. A complete postmortem examination was performed four days after death. External examination was insignificant. The internal examination revealed polyvisceral congestion, microthrombosis, cerebral and pulmonary oedema. Free citrine liquid was found on both sides of the pleural cavities.

Marked congestion and release of foamy material on sectioning of both lungs was observed. Hydrostatic docimasia for large and small fragments was positive in all fields such as an index of bilateral consolidation. The histological lung examination, performed with routine haematoxylin-eosin staining, revealed diffuse alveolar damage, endobronchial and endoalveolar infiltrates of polymorphonuclear neutrophilic leukocytes and focal emphysema. No fungal infections

were detected using slides by PAS and Grocott staining. Gram staining didn't reveal evidence of bacteria. Toxicology was negative for drugs and alcohol.

Case #2: A 31-year-old man was with a history of pharyngodinia, fever, and cough taken to the hospital. The clinical symptoms progressed to acute onset of increasing shortness of breath rapidly progressing to acute respiratory failure with haemoptysis. Chest x-ray demonstrated bilateral diffuse airspace opacification; the high resolution CT confirmed the presence of bilateral diffuse airspace consolidation associated with liquid in pleural cavities. The patient, with a severe leukopenia, was admitted to the intensive care unit, but died after a few hours. Two blood cultures were positive for group A beta-hemolytic *Streptococcus*. No other pathogenic agents were present. An autopsy was performed within 48 hours. The internal examination revealed an increase in lung weight and findings were consistent with intense congestion attributable to a bilateral pneumonia. The histological examination of lung specimens showed a pattern of diffuse alveolar damage and the presence of intralveolar bacterial and fungal colonies. In the kidneys a thrombotic microangiopathy compatible with DIC was found.

In conclusion, the cause of death was, in both cases an acute cardio-respiratory failure secondary to acute bilateral pneumonia with DAD and consequently ARDS, sepsis and DIC.

Hidden Pneumonia, Diffuse Alveolar Damage, Adult Respiratory Distress Syndrome

G25 Methodologies for Heteroplasmy Identification

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After attending this presentation, attendees will receive information about the detection and study of heteroplasmy in the forensic field.

This presentation will impact the forensic community because it shows two caseworks in which different techniques were implemented to achieve good results.

Mitochondrial DNA (mtDNA) sequencing has been considered a useful tool for forensic analysis, and it is typed routinely in forensic analyses to assist in determining the source of old bones, teeth, hair shafts, and other biological samples where nuclear DNA content is too low or degraded to genotype by analyzing autosomal short tandem repeat (STR) loci.

Typically, forensic mtDNA data are obtained by sequencing (i.e. Sanger method, followed by electrophoresis and fluorescent detection) the two hypervariable regions (HV1 and HV2) of the noncoding control region of the human mtDNA genome. Traditionally, sequencing has been the method of choice because all polymorphisms contained within the amplified fragment can be detected. The definition of heteroplasmy is the existence of two types of mtDNA within an individual. It is known that the sensitivity of heteroplasmy detection is method-dependent, and the most fundamental approach to sampling the individual mtDNA present in an individual is achieved through cloning.

The most common form of heteroplasmy observed in the mtDNA control region is length heteroplasmy. Depending on its extent, length heteroplasmy may result in an inability to read or interpret sequence data and must be compensated for with alternative sequencing strategies. There are different methods to evaluate the mutation load of defective mtDNAs: primer extension, TTGE, RT-PCR, restriction fragment analysis and SSCP. In addition heteroplasmy using SSO typing, DHPLC/nuclear loci and DGGE can be detected. These methods are highly sensitive and can detect and sometimes quantitate heteroplasmy at levels lower than 1%. In this study, information regarding the management of different cases using clonage and DHPLC respectively

will be presented. In both cases heteroplasmies were present. The aim of this work is to demonstrate the utility of these two techniques showing the main indications and advantages for the forensic community.

mtDNA, Heteroplasmy, Clonage vs. DHPLC

G26 Internal Validation of Quantifiler™ DUO DNA Quantification Kit and AmpFℓSTR® Yfiler™ PCR Amplification Kit

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After attending this presentation, attendees will learn about the methods and results from the validation study of two Y specific kits performed at the Institute of Forensic Science of Puerto Rico.

This presentation will impact the forensic community by communicating the methods and results from a validation study of two available forensic kits. Y-locus specific kits are an important forensic tool to aid in the discrimination of the male contribution in a sample, such as rape cases.

The DNA-Serology Laboratory of the Institute of Forensic Sciences of Puerto Rico is the only Latin American laboratory accredited by ASCLD-LAB. Y-STR's have become an important forensic tool in cases in which male-male or male-female mixtures arise, such as rape cases. Y-locus STR's have also gained importance in the clarification of erroneous Amelogenin tests from autosomal STR amplification kits. Quantitation of human male DNA and Y-STR analysis are not currently performed in-house. Therefore, this study was designed to validate two commercially available forensic kits, Quantifiler® Duo DNA Quantification, and AmpFℓSTR® Yfiler™ PCR Amplification for in-house quantitation of human male DNA and Y-STR detection. These kits were validated for use with one real-time PCR instrument model for DNA quantitation (ABI Prism® 7500 Sequence Detection System) and two capillary electrophoresis instrument models (ABI Prism® 3130xl and 3100-Avant Genetic Analyzers) for Y-STR detection.

Quantifiler® Duo DNA Quantification Kit is designed to simultaneously quantify the total amount of amplifiable human DNA and human male DNA in one reaction. The quantification assay combines three 5' nuclease assays, namely: target-specific human DNA assay, target-specific human male DNA assay, plus an internal PCR control (IPC). The human target is Ribonuclease P RNA Component H1 (RPPH1) located at 14q11.2 and 140 bases long is detected by TaqMan® MGB probe labeled with VIC dye. The male target is the sex-determining region Y (SRY) located at Yp11.3 and 130 bases long is detected by TaqMan® MGB probe labeled with FAM dye. The internal PCR control is a synthetic sequence not found in nature. It is 130 bases long and is detected by TaqMan® MGB probe labeled with NED dye. AmpFℓSTR® Yfiler™ PCR amplification kit is a short tandem repeat multiplex for human male-specific DNA amplification that includes the European minimal haplotype loci (DYS19, DYS385a/b, DYS389I/II, DYS390, DYS391, DYS392, and DYS 393), the SWGDAM recommended loci (DYS 438 and DYS439), and additional highly polymorphic loci (DYS437, DYS448, DYS456, DYS458, DYS635, and Y GATA H4) for a total of 17 Y-STR loci in a single PCR reaction.

Internal validation studies included: precision, accuracy, sensitivity, male:male mixture evaluation, female:male mixture evaluation, stutter determination for each locus, as well as forensic casework. Forensic

casework includes a double-rape case, an incest case, a proficiency test from Collaborative Testing Services, Inc., and a case with null Amelogenin typed with AmpF[®]STR IdentifilerTM PCR Amplification kit. In addition to these studies, 106 samples were used to create a Y-STR database for Puerto Rico. All validation study data is being analyzed and will be discussed.

Internal validation of available DNA typing kits for human identification allows for the evaluation of a procedure's efficiency, reliability, performance characteristics, and limitations. The internal validation of the Y-locus specific kits (AmpF[®]STR YfilerTM and Quantifiler[®] Duo) will allow the Puerto Rico Institute of Forensic Science DNA laboratory to save time and money, as well as the ability to offer reliable male DNA typing services.

Y-STR, Male Quantitation, YfilerTM

G27 The Effect of Clothing on Scavenger Visits and Decomposition

Amanda J. Marshall, BS, Jennifer R. Simon, BS*, and Phillip L. Watson, PhD*, Ferris State University, Department of Biology, 2004 ASC, 808 Campus Drive, Big Rapids, MI 49307*

After attending this presentation, attendees will learn the differences clothing can make on the timing and frequency of scavenger visits to remains. Clothing will be shown to significantly affect when scavengers visit and alter the death event.

This presentation will impact the forensic community by demonstrating how time of death is determined by many factors, the presence or absence of clothing does affect the timing of visits.

The presence or absence of clothing can alter the decomposition rate (Anderson 2001, Kelly 2006). Quantifying the decomposition rate is difficult and complicated by the potential differences in timing of scavenger visits and alterations to the death scene by those visits. This study, which is a follow-up to one conducted in 2007, examined the rate of decomposition on a clothed and unclothed pig as a function of summer environmental conditions, but includes motion sensor cameras to capture scavengers frequenting the sites. Insects were collected twice a day until the dry remain stage occurred. Cameras were secured and pictures were obtained as motion was sensed by the camera. Temperature, relative humidity, rainfall, and wind speed data were collected on an hourly basis. The data show increased activity of forensically important insects as a function of temperature and clothing. The delay of the clothed victim to reach the dry remains stage was significantly different from the delay for the victim without clothing. The development stages of larvae collected from the clothed victim were also significantly smaller than the unclothed victim at all collection dates until the unclothed victim was no longer attractive to forensically important flies. The scavenger visits were significantly different between the two test animals in terms of time and abundance as determine by motion sensor cameras. How scavengers may be useful in determining state of decomposition will be discussed.

Data to be discussed will be the differences in larva size, insect species composition on each pig over time and identity, frequency and timing of scavenger visits. Comparisons were done as an ANOVA test and a species diversity comparison for all days. Results will be used to set up teaching mock crime scenes to illustrate the effects of clothing on PMI calculations.

Scavengers, Clothing, Insects

G28 Foreign Bodies: Three Cases of Projectile Maintenance Without Complications

Duarte N.P. Vieira, PhD, Carlos Abreu, MD, and Cristina Cordeiro, MSci, Instituto Nacional de Medicina Legal, Largo da Sé Nova, Coimbra, LB 3000-213, PORTUGAL*

After attending this presentation, attendees will learn about the possibility of retention of foreign bodies, like projectiles, in the body during long periods of time without any symptoms or evident complications, and that are only accidentally discovered during an autopsy performed due to another cause of death. However, there are some cases where problems may occur, being the bullets the cause of several symptoms and even sudden death. Thus, a regular follow up of the victim must be done in these situations and sometimes a surgical removal is needed.

This presentation will impact the forensic community by showing three cases where projectiles were maintained in the body for several years, due to previous gunshot injuries. In one of these cases, the projectile was found during the autopsy of a traffic accident victim. Surprisingly it had remained in the pericardial cavity for 12 years! In the other two cases, concerning living persons, the projectiles stayed in the corpse of a dorsal vertebra and in the sphenoid sinus, respectively, for many years.

The possible complications and risks of bullets maintenance in victim's bodies are reviewed and the authors stress the particular attention that these situations demand during the medical forensic assessment of these individuals.

The retention of projectiles in the body is an unusual situation. Sometimes these projectiles are maintained for life in the body without any symptoms or evident complications, and are only accidentally discovered during an autopsy performed due to another cause of death.

Foreign Bodies, Projectiles, Autopsy

G29 The Persistence of an Elevated Concentration of Ninhydrin-Reactive Nitrogen in Grave Soil

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After attending this presentation, attendees will understand that the concentration of ninhydrin-reactive nitrogen (NRN) in grave soil increases during the first year of decomposition while grave soil pH decreases.

This presentation will impact the forensic community by serving as a fundamental investigation into the estimation of extended PMI.

As time progresses, however, NRN concentrations fluctuate less making it difficult to estimate postmortem interval (PMI) over an extended period of time. This presentation will impact the forensic community by serving as a fundamental investigation into the estimation of extended PMI. Accurate estimates of extended PMI are currently difficult to achieve.

Although several methods to estimate postmortem interval (PMI) have been developed, there is no one method that can be used in all scenarios. Most of these methods focus on estimating early PMI (<30 days). As a consequence, relatively few methods have been developed to estimate extended PMI (>30 days). Recent investigations have shown that the decomposition of a body can have a significant effect on the chemistry of associated soil (grave soil) that persists into the extended

PMI. One effect is an increase in the concentration of materials (organic nitrogen and ammonium) that react with ninhydrin. This material is referred to here as ninhydrin-reactive nitrogen (NRN). Eventually, (NRN) concentrations will return to basal levels and it is believed that this can be used to estimate PMI. To determine how long NRN persists in soil, and develop a tool to estimate extended PMI, the NRN concentrations of grave soil associated with decomposing cadavers (after 0, 1 or 3 years) were measured.

The experimental site was located at the University of Nebraska Agricultural Research Development Center located approximately 48 km north of Lincoln, Nebraska, USA. The site is a pasture that is intermittently grazed by cattle and horses. The soil at the site is a deep silty clay loam of the Yutan series (Mollie Hapludalf). The climate is temperate midcontinental characterized by hot summers, cold winters, and moderately strong surface winds. Average annual precipitation is 695 mm. Approximately 75% of the precipitation occurs between April and September. Mean annual temperature is 9.8°C with mean minimum and maximum temperatures ranging from 0°C (January) to 31°C (July). The vegetation at site is dominated by non-native grass (smooth brougham) and forb (white clover) with some native vegetation, including daisy fleabane, yellowwood sorrel nut sedge, and pasture rose.

Swine (*Sus scrofa*) carcasses (~40 kg) plus a control (no cadaver) were used. Swine were killed with blunt force trauma to the cranium and placed on their right side on the soil surface facing west. Soil samples were collected (0-5 cm depth) from adjacent to the cadaver following 0 years, 1 year, and 3 years of decomposition and analyzed for NRN and pH. This experiment was replicated three times, which resulted in a total of six swine cadavers.

A significantly ($P < 0.01$) greater concentration of NRN was observed in grave soil after one year but not after three years. Also, a significantly ($P < 0.01$) lower pH was observed in grave soil after one year but not after three years. The current results demonstrate that the concentration of grave soil NRN and soil pH associated with a 40 kg cadaver can return to basal levels between one and three years postmortem. Thus, the maximum PMI that can be estimated using an increase in grave soil NRN or a decrease in grave soil pH is one year. Further research should be conducted to increase the accuracy of these approaches. In addition, other compounds and elements in grave soil should be investigated for their use in estimating PMI greater than one year.

Forensic Taphonomy, Extended Postmortem Interval, Decomposition

G30 The Application of DNA Identification Technology to Large Wildlife Carnivore Attacks on Humans

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The goal of this presentation is to demonstrate the use of DNA typing to confirm the identity of wildlife predators in attacks on humans.

The growth and encroachment of human populations into rural areas, and the consequences of several years of drought, especially in the western United States, has resulted in more frequent contact with large predators such as mountain lions and bears, with sometimes fatal consequences for one or both. Correct identification of the species and individual animal is essential to ensuring public safety with minimal loss of endangered wildlife. The application of modern DNA technology to a fatal mountain lion and non-fatal mountain lion and a recent bear attack on humans with two-way and one-way transfers of DNA that enabled certain identification of the predator will be presented.

Forensic DNA, STR, Puma

G31 Sudden Unexplained Death Due to Disseminated Malaria

Ritesh G. Menezes, MD, Kasturba Medical College, Mangalore, India, Department of Forensic Medicine, Light House Hill Road, Mangalore, Karnataka 575001, INDIA*

After attending this presentation, attendees will understand that the demonstration of parasitized red blood cells with malarial pigment in the blood capillaries of internal organs by histopathology is a reliable and easy method of postmortem diagnosis of disseminated malaria.

This presentation will impact the forensic community by understanding the possibility of disseminated malaria as a cause of sudden unexplained death in malaria-endemic regions.

Sudden unexplained deaths are mainly attributed to the cardiovascular system and the respiratory system. A case study of sudden unexplained death due to disseminated malaria in an apparently healthy individual will be presented. In the present case, histopathological examination demonstrated the presence of parasitized red blood cells with malarial pigment in the blood capillaries in the brain, myocardium, pericardium, lungs, kidneys, liver, and the spleen.

Sudden Death, Disseminated Malaria, Forensic Histopathology

G32 Chloride Levels of Sphenoid Sinus Fluid in Salt and Fresh Water Drownings on the Island of Oahu, Hawaii

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After attending this presentation, attendees will walk away with better knowledge of how chloride levels of sphenoid sinus fluid can help support pathologist's diagnosis of drowning as the cause of death.

This presentation will impact the forensic community by broadening research about chloride levels of sphenoid sinus fluid in salt and fresh water drownings.

There are many potential criteria to be evaluated in the pathologist's diagnosis of drowning as the cause of death. One of these involves the analysis of the sphenoid sinus fluid. In the drownings reported from the island of Oahu, Hawaii, chloride levels of sphenoid sinus fluid in salt water drownings are typically greater than 140 mmol/L and for fresh water drownings they are normally less than 65 mmol/L, however, to date there has been little research on the topic. During July 2007 through July 2008, there were 37 drownings reported on the island of Oahu. Nineteen of these had sphenoid sinus fluid removed and analyzed for the chloride content, 14 salt water and five fresh water. Eight of the 14 salt water cases had the expected chloride readings of greater than 140

* Presenting Author

mmol/L. Due to specific circumstances, including decomposition, the other six presented different results. Of the five fresh water cases, two presented the expected chloride levels of less than 65 mmol/L, while three had concentrations greater than 65 mmol/L. Of these, two were recovered from chlorinated swimming pools. Other factors that must be taken into consideration for all cases include: time elapsed between death/discovery of the individual and collection of samples; and hospitalization following discovery with death occurring later during hospitalization.

Drowning, Sphenoid Sinus Fluid, Chloride Level

G33 Recovery of Transplantable Organs After Cardiac Arrest in France

Nathalie Jousset, MD, Arnaud Gaudin, MD, Damien Mauillon, MD, and Clotilde G. Rougé-Maillart, MD, CHU, Service de Médecine Légale, 4 rue Larrey, Angers, 49000, FRANCE*

After attending this presentation, attendees see an explanation of French legislation and summarize ethical problems linked to transplantation of organs coming from non-heart beating donors (NHBD).

This presentation will impact the forensic community by comparing situations, legislation, ethical problems, between countries concerning NHBD transplantation.

After being abandoned around the end of the 1960s, the transplantation of an allograft recovered after cardiac arrest has been resumed again in France in 2006 (decree of 2 August 2005: art R.1232-4-1,2 and 3 of the public health code).

Recently, according to the international scale, five situations that could lead to the recovery of transplantable organs after cardiac arrest were identified according to a classification called "Maastricht" which describes the potential donors. In France, the donors of class III (cessation of all medical care) were excluded.

To achieve an effective transplantation, the donor has to be legally dead in the eyes of the law, and the organs still viable medically. A legal definition of death, in the purpose of the recovery of the transplantable organs of the "dead" donors comes up against this contradiction.

In front of this issue, certain countries recommend against giving a legal definition of the death criteria. It is not the orientation chosen by France that continues to attempt to define a legal framework in order to obtain the society acceptance of the recovery of transplantable organs of "dead" donors.

Despite this, ethical questions arise. Are criteria adopted to define death enough? What is the place of non-heart beating donor transplantation with new technical resuscitation as extracorporeal life support for prolonged cardiac arrest? How does family and medical staff support this protocol?

Non-Heart Beating Donors, Legislation, Ethical Reflection

G34 Veterinary Forensic Science: Documentation, Processing, and Interpretation of Physical Evidence at Scenes of Animal Crimes

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After attending this presentation, attendees will gain an understanding of the current issues faced by prosecutors, judges, law enforcement officials, and veterinarians when attempting to bring cases of animal cruelty and death to trial in the courtroom. Participants will also gain a more detailed understanding of how modern forensic science as practiced at scenes of human death can be readily applied to the animal crime scene.

This presentation will impact the forensic community by giving a more detailed description of current problems and issues involved in the application of forensic science techniques to scenes of animal crime. Additionally, the participant will gain an improved understanding of the needs within the veterinary community and will be better prepared to utilize their own knowledge and forensic specialty to provide assistance to those in the veterinary forensic science community.

With the passage of many animal cruelty laws, the need to apply current forensic science methodologies to these investigations has increased dramatically. Animals have many similarities to humans in their response to traumatic injury with some noted exceptions. Forensic science techniques utilized at human crime scenes and applied human victims can often be easily applied to scenes involving cruelty or death to animals. This symposium will address the application of forensic techniques developed for the investigation of human death to animal cases and unique findings at animal crime scenes.

Veterinary Science, Veterinary Forensics, Animal Cruelty

G35 Natural Causes of Sudden Unexpected Infant Death: A Seven Year Retrospective Forensic Autopsy Study in Hubei, China

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After attending this presentation, attendees will become familiar with the common natural causes of sudden unexpected infant death in Hubei province, China and will better understand the difference in the diagnosis of sudden infant death between China and western countries.

This presentation will have an impact on the forensic science community as it suggests that further studies are needed to focus on the differences in the diagnosis of sudden infant death between developing countries and developed countries.

The importance of a forensic investigation and autopsy in cases of sudden infant death has only recently received attention in China. An analysis of forensic autopsy data on sudden infant deaths in Hubei, China has never been undertaken. This report describes the epidemiological characteristics and pathological findings of sudden infant death cases investigated by the Department of Forensic Medicine at the Tongji Medical College in Hubei, China from 1999 to 2006.

A retrospective study of forensic autopsy cases conducted at the Department of Forensic Medicine, Tongji Medical College in China over a seven year period between 1999 and 2005 yielded a total of 68 infants who died suddenly and unexpectedly in Hubei province. The age ranged between newborn and 12 months. A total of 41 cases (60%) of the deaths occurred in the neonatal period, 13 (22%) infants in the first six months of life, and the remaining 12 cases (18%) in the age between seven months and one year. There were 54 males and 14 females (M: F = 3.8:1). The most common cause of sudden neonatal death was pneumonia (N=14), followed by congenital abnormalities (N=9); asphyxia due to amniotic fluid aspiration (N=7); respiratory distress of newborn (N=3); intrauterine hypoxia and birth asphyxia (N=3); complications of prematurity (N=2); newborn affected by complications of cord (N=1), birth trauma (N=1); and tetanus (n=1); and one death with undetermined cause.

The three leading causes of sudden death in infants, age 1 to 12 months were pneumonia (N=11), congenital heart disease (N=3), and meningitis (N=2). Only one infant was diagnosed as SIDS death.

Infectious diseases are a frequent cause of death in infants who died suddenly and unexpectedly in Hubei, China. These findings contrast with those from developed countries in which Sudden Infant Death Syndrome is the commonest cause of sudden unexpected death in infancy. This study demonstrates that it is important to document autopsy-based data such as these in the planning of medical services in a developing country.

Sudden Infant Death, Forensic Investigation, Autopsy

G36 Biomedical Engineering in Root Cause Analysis – Example: Assessing Infant Apnea-Related Deaths

Bruce H. Barkalow, PhD, William E. Grant, MA, and Farrah J. Curran, BS, B.H. Barkalow, PC, 490 Quarterline St., Newaygo, MI 49337-9125*

After attending this presentation, attendees will gain a better understanding by example of how Biomedical Engineering can assist in root cause analysis by examining how testing of subject apnea monitors and analyses of downloaded patient data can be useful in determining device failure versus human error.

This presentation will impact the forensic community by demonstrating how Biomedical Engineering analysis can shed light on important information involving medical devices. In this example, testing of subject apnea monitors and analyses of downloaded patient data can be useful in determining whether such devices have failed, or whether other factors (including human error) led to infant deaths.

Infants (primarily those of low birth weight) who are at risk for Sudden Infant Death Syndrome (SIDS) are often prescribed apnea monitors for at-home use. Infant apnea monitors are designed to alert caregivers if a child has become apneic and/or has heart rate changes outside of the preset limits. These monitors are not fool proof, however, and every year some children who are being monitored die. When this happens, it is the responsibility of the Medical Examiner to ascertain why the death occurred. Biomedical Engineers trained in this technology can play a vital role in these death investigations.

Apnea in neonates and infants occurs most likely because of immaturity of their respiratory and neurologic systems. Though it is common for infants to pause in their breathing for short periods, pauses lasting longer than 20 seconds are cause for concern, as are pauses of shorter duration accompanied by decreased heart rate. Infant apnea monitors are designed to detect increases and decreases in heart rate along with pauses in breathing, and sound an alarm if they occur. This is accomplished by attaching a belt with a series of electrodes around the infant's chest. The electrodes are attached to the monitoring unit itself. Monitors should have a battery backup, a remote alarm, a power loss alarm, a battery charge or AC power indicator, a sibling alarm as well as an internal memory for event and physiological data storage.

In cases where a child monitored with one of these devices has unexpectedly expired, a technical analysis should be performed by a trained Biomedical Engineer. A physical examination of the monitor itself should be conducted, along with an assessment of the electrical circuitry and analysis of monitor-downloaded data. A combination of downloaded patient and monitoring compliance data from the apnea monitor memory can be cross-correlated with events, such as feeding schedules or EMS run sheets. Deaths of monitored infants have been related to such issues as monitor hardware and software failures, obstructive apnea (often not detected), parental monitoring compliance, inability to hear the alarms, cardiac artifact in the transthoracic impedance signal, or electromagnetic interference, to name a few. If an apnea monitor is sent to the Medical Examiner's office along with an infant who has expired, it should be maintained as evidence, and the stored data downloaded and analyzed along with statements of the caregivers.

Case material corresponding to several of these failure-related issues will be presented to illustrate how a root cause approach can assist in making sense of why such tragic events may have occurred.

Biomedical Engineering, Infant Apnea Monitor, Sudden Infant Death Syndrome (SIDS)

G37 In Utero Traumatic Head Injuries During a Motor Vehicle Collision: Case-Report and Review of the Literature

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After attending this presentation, attendees will understand the importance of fetal brain injury in utero after a motor vehicle collision which can lead to hypoxia, direct impact and acceleration-deceleration injuries. A discussion of maternal restraint will also be presented.

This presentation will impact the forensic community by highlighting the possible neurologic complications associated with motor vehicle collision and the fetal brain in utero, especially in relation to acceleration-deceleration forces

Fetal brains differ from neonatal and infantile brains in development and the environment surrounding them, namely the protection offered by the amniotic fluid, uterus, and maternal abdominal wall. Head injuries inflicted during motor vehicle collision result from both direct impact and from acceleration-deceleration forces. The effects of these forces on the fetal brain and eyes are poorly described in the literature. The American College of Obstetrician and Gynecologists and the National Highway Traffic Safety Administration recommend that pregnant women use a 3-point restraint system with the lap belt positioned under the uterus based on the hypothesis that the amount of fetal head acceleration and abdominal force is significantly reduced.

A 32-week pregnant, 31-year-old Hispanic woman was the restrained front seat passenger in a mini van that was rear-ended by a full sized tractor-trailer. Following the collision she was alive but in a deep coma, tachycardiac and with a blood pressure of 119/62. She was intubated in the field and transported to the hospital. Fetal heart monitoring revealed 40 beats per minute. An emergency C-section was performed slightly more than one hour following the impact, and a 1,580 gram baby girl with Apgar scores of 0, 0 and 0 was retrieved. Examination of the uterus revealed placental abruption. Maternal injuries detected by CT included a complete torso passenger-site shoulder and lap seat-belt contusion with the lap section located on the pelvis, C4-C5 fractures with bilateral internal carotid injuries, fractured ribs, pneumo and hemothoraces, liver lacerations, fractured T3 and L1 through L5 vertebrae, retroperitoneal hematoma and acetabular fractures. The mother was pronounced dead two and a half hours after the collision. A complete postmortem examination of the stillborn female was performed including neuropathologic and ophthalmic pathologic assessment. The findings obtained at the autopsy of the stillborn, which will be presented, included the external and internal traumatic injuries, head and spinal injuries, including direct impact and acceleration-deceleration injuries to the brain, spinal cord, and eyes, grossly and microscopically. These findings will be discussed in relation to previous literature reports and the seat-belt recommendations for pregnant women.

Hypoxia, direct impact, and acceleration-deceleration forces are the usual components producing complex neuropathologic injuries. The resulting lesions depend on the age of the victim; the susceptibility of the immature brain to trauma and the resulting pattern of injuries differ between fetal, childhood and adult brains. There are few reports in the literature of traumatic fetal brain injuries resulting from motor vehicle collision, rare reports including autopsy or eye pathology findings. In addition, findings are correlated with the use of a 3-point restraint system with the lap belt positioned under the uterus as recommended.

Fetus, Brain, Traumatic

G38 Return of an Old Acquaintance - A Case of Septic Abortion

Karen B. Looman, DO, Hamilton County Coroner's Office, 3159 Eden Avenue, Cincinnati, OH 45219*

After attending this presentation, attendees will become acquainted, or reacquainted, with septic abortion and some of the associated anatomical and microscopic findings.

This presentation will impact the forensic community by reminding everyone of a time when illegal abortions, septicemia and death were more common in the United States. After Roe vs. Wade, the frequency of cases dwindled. New and seasoned medical examiners may benefit from a reminder of what to expect in a septic abortion case, especially in an ever changing political arena.

On January 22, 1973, the Supreme Court decision regarding Roe vs. Wade allowed women to have legal medical abortions in the United States. In the past, women who were seeking an abortion for a reason other than to protect the health of the mother were limited to often questionably sterile and clandestine procedures. Cases of septic deaths from improperly performed procedures and post-operative infections were high. The numbers of such cases dropped off dramatically after the landmark legal decision. Some of the more experienced medical examiners may remember physical and microscopic findings in such cases. Less experienced doctors should be aware of some of the possible findings in a septic abortion case.

A 31-year-old married woman, with four living children, was rushed to a local hospital after becoming hypotensive at a small medical clinic. She was presented to the clinic with a complaint of food poisoning which included nausea, vomiting, diarrhea, and malaise. The clinic diagnosed pyelonephritis and gave her intramuscular ceftriaxone. Within minutes, the woman complained of tongue swelling, shortness of breath, and hypotension likely indicating an allergic reaction.

The question of an allergic reaction to the antibiotics was never specifically addressed during her emergent stay in the hospital. The emergency room doctors noted erythema and tense swelling of the woman's lower extremities. A serum pregnancy test was positive with a human chorionic gonadotropin (hCG) level of 6124 mIU/ml (2-3 week gestation). She was transported to the intensive care unit in extremis. She was intubated and went into cardiac arrest. She was resuscitated once, but a second cardiac arrest was fatal.

Significant medical history went back approximately one month prior when the woman was involved in a motor vehicle collision and broke her foot. On her two week follow up, her primary doctor asked her if she had had a pregnancy test in the ER at the time of the accident. The woman said yes and that she had been on her menses. A thorough record check did not show a pregnancy test was performed. On the day of the terminal event, she had a tampon in place, noted on the pelvic exam.

The woman's mother reported that her daughter was going through a "mid-life" crisis and acting wildly. She got several new tattoos and was having an affair. The mother stated it was entirely possible she became pregnant while having the affair because her husband had a vasectomy.

At autopsy, the tense swelling and erythema of the lower extremities was noted to be in a trouser distribution. The legs had a crepitus-like feel to them. Internal examination of the pelvis found that the uterus had a slightly purple and erythematous fundus but no perforation. The endometrial cavity was full of hemorrhagic debris but no obvious fetal tissue was seen grossly. Microscopic examination of the debris revealed extensive autolysis with a few fragments resembling placental villi. Blood cultures had been performed at the hospital prior to the cardiac arrest. Despite having received one dose of antibiotics at the medical clinic, one of the blood cultures grew *Clostridium perfringens*, which can produce gas gangrene.

Putting the story together, it appeared the woman got pregnant and either had an abortion or a spontaneous miscarriage with retention of products of conception. There was no history she had been to any doctor

for an abortion. Neither her mother, friends, nor family knew anything about her being pregnant. If the decedent did get an abortion through a clinic or through personal instrumentation, there were complications that were not addressed. If the uterine contents were retained products of conception from a miscarriage, the sepsis would be explained. There is no confirmation of her pregnancy before the last ER visit because a pregnancy test was not performed at the time of her car accident. The sepsis caused a trouser distribution of swelling and erythema of her lower extremities. The crepitus-like feel of the legs may be indicative of gas gangrene from Clostridium. Cause of death in this case is acute sepsis due to uterine infection.

It is important to note that it would be unusual to find identifiable fetal or placental tissue in a case such as this. The time that is required for the development of the sepsis is long enough for all such tissues to autolyze and be unidentifiable under the microscope. Interviews with family and friends regarding medical and social history are very important in understanding the background of the illness. Also helpful, are discussions with other medical examiners with more experience that have seen a few of these cases. Their wisdom is invaluable.

Abortion, Miscarriage, Septicemia

G39 Fatal Rupture of Splenic Artery Aneurysm in a Pregnant Woman With Portal Hypertension

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By attending this presentation, attendees will learn about important pathological characteristics of splenic artery aneurysms, their causative correlation with pregnancy and portal hypertension, as well as clinical and medicolegal aspects of cases where their rupture leads to a fatal outcome.

This presentation will impact the forensic community by demonstrating how development of splenic artery aneurysm may be connected with pregnancy and portal hypertension; it is a potential source of profuse abdominal hemorrhage and sudden unexpected death, sometimes in previously apparently healthy individuals. Also of importance in this particular case is the patient's intention to hide a known disease from the attending physician, which may cause serious and potentially fatal errors in medical treatment.

Fatal complications of pregnancy and childbirth always attract special public and medical attention and are usually a serious challenge for forensic pathologists, especially if death occurs suddenly and unexpectedly in a previously apparently healthy woman. This case concerns a 30-year-old female, five months pregnant with her first child, who was found dead in her flat. According to the statement of the husband, cited in the initial police report, she had regular check-ups with her obstetrician. During pregnancy she did not complain of abdominal pain or any other discomfort. On the day in question the husband left the flat at 7:00 p.m. while she stayed at home preparing a meal. When he came back one hour later he found her lifeless, lying on the bed in their

bedroom. He immediately called an ambulance; they arrived promptly and attempted CPR but to no avail; she was declared dead at the scene. The cause and manner of death were undetermined and the examining magistrate requested a medicolegal autopsy.

The postmortem examination showed a female of moderate physique, 167cm in height, with external signs of pregnancy in keeping with the gestational age of five months. The skin and conjunctivae were very pale and hypostasis was poorly developed. There was evidence of attempted resuscitation. There was no evidence of external trauma. Internal examination of the cranial and chest cavities revealed only pallor of all organs and tissues, but no other significant pathological findings. Opening of the abdomen showed about 4500 ml of blood in the peritoneal cavity. Examination of the uterus and adnexa showed no evidence of ruptures or other possible source of bleeding. Within the uterine cavity was a dead female fetus, normally developed according to gestational age. The other possible site of hemorrhage was an extremely enlarged spleen, which weighed 780 g, but showed no evidence of rupture. Finally, the source of bleeding was discovered by examination of the splenic artery, which was dilated throughout its course (with a circumference measuring up to 1.5 cm), tortuous, with one 1 cm long fusiform and two big saccular aneurysms, measuring 4 cm and 2 cm in diameter. The larger of the two saccular aneurysms showed a 0.5 cm long rupture, while attached to the smaller of the two was an accessory spleen, measuring 1 cm in diameter. There were several further accessory spleens in the vicinity, with a diameter varying between 0.5 cm and 1.5 cm. The portal vein was almost completely obliterated by an old partly calcified thrombus. Death was deemed natural, caused by exsanguination due to a ruptured splenic artery aneurysm. During interview with the deceased's husband it became apparent that all the above mentioned severe pathological changes involving the splenic artery, spleen and portal vein, with portal hypertension, had been diagnosed both radiologically and clinically two years prior to the fatal outcome. According to the deceased's medical records, this important anamnestic information had not been disclosed to the obstetrician who controlled her pregnancy.

The important pathological, clinical, and medicolegal issues concerning the reported case, mainly the causative relationship between pregnancy, portal hypertension, and splenic artery aneurysm, clinical recommendations regarding pregnancy in women with diagnosed splenic artery aneurysm as well as medicolegal problems connected to patient-physician relationship, and potential accusations of medical negligence and malpractice will be discussed.

Splenic Artery Aneurysm, Pregnancy, Portal Hypertension

G40 How Often is Pre-Existing Disease Found in Child Deaths?

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After attending this presentation, attendees will be able to describe the frequency of finding pre-existing disease in a group of child death investigations and discuss the potential significance of such findings in individual cases.

This presentation will impact the forensic community by demonstrating why the forensic science community needs a scientific basis for comparison of individual cases to a larger group of child deaths when providing information to triers of fact.

Forensic pathologists are often asked whether injured children have pre-existing diseases when discussing findings in death investigations. Commonly the pathologist is then asked to compare individual case

findings with findings in a larger population of children. The objective of this study was to review a series of child death investigations and determine the frequency of identifying pre-existing disease in the group.

A prospective study focused on the deaths of 169 of approximately 400 child deaths investigated by the Southwestern Institute of Forensic Sciences (SWIFS) in Dallas, TX from 1981-1989. Investigation of these deaths included information about the circumstances of death or collapse, prior medical and social history, autopsy examination with ocular examination, toxicologic investigation, radiography when indicated, and additional investigations when questions remained. The study has been previously described and included: 19 asphyxial, 80 closed head injury, 13 trunk injury, 13 central nervous system disease, 13 sudden infant death syndrome, 21 other natural deaths, and 10 deaths with undetermined cause and manner. The central nervous system diseases included meningitis, seizure disorders, spontaneous intraventricular and subarachnoid hemorrhages, and a brain tumor. The other natural deaths included respiratory tract illnesses, sepsis, congenital heart disease, myocarditis, a volvulus, and a dehydration death. Demographics were similar to the child deaths investigated at SWIFS: 78% were two years of age and under; 98 were white, 51 black, 16 Latino, and 4 other ancestry. Over half, 59%, were boys. Pre-existing disease was defined as diseases found at autopsy whether the disease contributed to death or not. However, children with diseases resulting from cardiovascular collapse were not included in the pre-existing disease group. Bronchopneumonia, myocardial ischemia, or watershed infarcts were found in some of the children who were well until an injury event occurred. These diseases were considered consequences of the collapse event and not included. Analysis of the data regarding bronchopneumonia has previously been reported for this study population. Review of the 169 deaths identified 60 children with pre-existing diseases and 109 without such diseases.

The group was further subdivided by the mechanism of the immediate cause of death. The distribution of pre-existing disease among unnatural, natural, and undetermined causes revealed:

Manner of Death	Pre-Existing Disease Present	Pre-Existing Disease Absent	Total	% of Subgroup with Pre-Existing Disease
Inadvertent	6	30	36	17%
Intentional	16	60	76	21%
Natural	34	13	47	72%
Undetermined	4	6	10	40%

Pre-existing disease was uncommon among injured children. For some of the intentional injury deaths investigation suggested that otitis media or retardation may have been a factor in increasing the caregiver's frustration with the child. The pre-existing diseases did not appear to increase the risk of injury in the inadvertent injury deaths and appeared to be incidental findings. The deaths attributed to natural causes identified diseases sufficient to account for the children's deaths, and, as such, had the greatest frequency of pre-existing disease by the definition used in this study. The 13 with no pre-existing disease included nine of the SIDS deaths which did not have sufficient disease or injury to account for deaths. Review of scene and circumstances, medical records, and search for social service involvement revealed no concerns. In the 1980s such non-suspicious deaths were attributed to Sudden Infant Death Syndrome at SWIFS. The other four natural deaths with no pre-existing disease were diseases resulting from a prior remote injury from which the child had at least partially recovered. Undetermined deaths in this study had neither adequate natural disease nor injury to account for the deaths and suspicious scenes, circumstances, medical records, or social service histories.

Review of a series of child deaths including both natural and unnatural causes and manners of deaths revealed that most natural deaths occurred in children with pre-existing disease and most unnatural deaths occurred in otherwise healthy children. Reporting such findings provides a scientific basis for comparison of individual cases to a larger group of child deaths.

Child Death, Child Abuse, Pre-Existing Disease

G41 Lymphogenic Cardiomyopathy: A Possible Cause of Non-Immune Fetal Hydrops

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After attending this presentation, attendees will gain knowledge of three particular cases of congenital and isolated cardiac lymphangiectasia manifested *in utero* with cardiac failure and hydrops.

This presentation will impact the forensic community by exploring how cardiac isolated lymphangiectasia might represent a new nosological entity that should be included among the primary cardiomyopathies (lymphogenic cardiomyopathy). Consequently, this entity should be investigated among the possible causes of non-immune hydrops foetalis (HF).

It is the intent of this presentation that cardiac isolated lymphangiectasia might represent a new nosological entity that should be included among the primary cardiomyopathies (lymphogenic cardiomyopathy). Consequently, this entity should be investigated among the possible causes of non-immune hydrops foetalis.

HF is an aspecific and terminal sign of many fetal diseases that could be observed at any time during pregnancy. In fully developed HF, there is subcutaneous oedema with fluid accumulations in peritoneal, pleural, and pericardial cavities. The umbilical cord and placenta are also oedematous and there is polyhydramnios. In the early stages of HF, the fluid accumulations are not present in all compartments. HF is caused by three main mechanisms: anemia, hypoproteinemia, and cardiac failure. Most cases fit within this classification, although some cases remain unsolved under the name of "idiopathic HF." Another classification divides HF into treatable (27%) and untreatable (73%) forms. The success of isoimmunization prevention programs demonstrated that most cases of HF are now non-immune and depend on cardiovascular diseases (22%), chromosomal abnormalities (13%), thoracic causes (10%), anemia (homozygous α -thalassemia), monochorionic twinning (6%), infections (5%), miscellaneous (16%), not determined (20%). Cardiovascular HF seems to be more frequently associated with structural and functional abnormalities that cause volume and/or pressure overload on the right atrium such as left heart syndrome, arrhythmias, myocarditis, cardiomyopathies, cardiac tumors, myocardial infarction, and arterial calcification.

Three unusual cases of congenital and isolated cardiac lymphangiectasia (ICL) manifested *in utero* with cardiac failure and hydrops will be presented.

Case 1: A male hydropic fetus with a gestational age of 14.2 weeks without dysmorphia. The mother was 32-years-old and had four pregnancies, one of them resulting in miscarriage due to unknown causes. Ultrasound of the fetus and placenta showed regular heart rate with biventricular hypocontractility and without congenital cardiac and extra-cardiac defects and polyhydramnios. Amniocentesis revealed a normal karyotype.

Case 2: A male hydropic fetus with a gestational age of 19.5 weeks without dysmorphia. The mother was 29-years-old and had a previous miscarriage due to a premature rupture of the placental membranes (acute chorioamnionitis) at the 25th week of gestation. Ultrasound of the fetus and placenta showed regular heart rate with biventricular hypocontractility, without congenital cardiac, and extra-cardiac defects, and polyhydramnios. Amniocentesis revealed a normal karyotype.

Case 3: A female non-hydropic fetus with a gestational age of 22 weeks without dysmorphia, except for the presence of a single head held plica. The mother, 27-years-old, was at first pregnancy. Ultrasound of the fetus and placenta showed light pericardial effusions, regular heart rate with biventricular hypocontractility, without congenital cardiac and extra-cardiac defects, and polyhydramnios. Amniocentesis revealed Trisomia 21.

In all cases, fetal autopsies showed ultrasound findings conducted during pregnancy. At histology, the organs were normally structured except for the heart that showed a “moth-eaten” aspect in the ventricular walls, due to severe, diffuse and transmural lymphangiectasia and interstitial lymphedema. The interposed myocardium resulted compressed, distorted, trabeculated, and with multifocal patchy coagulative myofibrillolysis (contraction band necrosis). The morphological examination in situ of apoptosis highlighted in all cases the presence of frequent apoptotic events in the endothelia of small arteries and veins.

Discussion: ICL is an extremely rare entity and up-to-date the literature reports describe only one case characterized by septal localization of this lesion causing septal hypertrophy and left ventricular outflow obstruction mimicking hypertrophic cardiomyopathy. These cases represent the first report of ICL involving diffusely the heart, causing cardiac failure and hydrops of various degrees. The findings of a marked apoptosis in the endothelial cells of blood vessels suggest that interstitial lymphoedema and lymphatic overload is due to increase vascular permeability of the cardiac blood microcirculation.

Hydrops Fetalis, Lymphangiectasia, Cardiomyopathy

G42 Prolonged Survival Time Following Duodenal Transection in a Child With Abdominal Trauma

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After attending this presentation, attendees will be able to recognize the symptomatology associated with abdominal trauma and will be able to understand the correlation between symptoms and pathologic injury correlating histologic examination of tissues with a timeline of events.

This presentation will impact the forensic community by providing valuable information about symptomatology associated with blunt abdominal trauma. Seemingly minor external injuries may harbor terminal internal pathology. Recognition of the potential severity of these injuries may prompt clinicians to conduct more thorough patient examinations and pursue imaging studies to identify unexpected internal injuries. In many cases of homicidal blunt force injury, forensic pathologists are asked to estimate the time of injury despite the uncertain circumstantial timeline of case investigation. In this case, a relatively accurate timeline was known. Hence, the correlation with microscopic sections of the injury can provide assistance in the evaluation of previously published timelines for the inflammatory response.

Upon completion of this presentation, attendees will have an appreciation for the clinical symptomatology associated with duodenal transection following blunt abdominal trauma and the importance of histologic evaluation of this type of injury to foster the sequencing of events. Subtle symptoms can dissimilate potentially emergent, life-threatening pathology. This particular case discussion exemplifies prolonged (approximately 24 hrs) survival in a child that sustained a duodenal transection injury after falling from a bicycle. A literature review of comparable cases will also be performed. Case correlation may aid in establishing a time range of survival, which would portend significant clinical value. Clinicians who are knowledgeable about the potential injuries caused by abdominal trauma are more likely to suspect injury despite the absence of suggestive symptoms. Such analysis will likely demonstrate that an official clinical diagnosis of intestinal laceration occurs when an individual's symptoms are more severe (postulating that there is a period of survival status-post injury).

A 9-year-old Hispanic female sustained head and abdominal injuries after falling from her bicycle on 6/27/08 at approximately 1-2

p.m. She was examined and released from a local hospital without having undergone imaging studies. According to the report, later that evening, the child began vomiting and subsequently went to sleep. The next morning, she continued to feel nauseous and vomited in the morning. She went to bed around noon and was found unresponsive at 12:50 pm on 6/28/08. The child was pronounced dead at 1:47 pm on the same day. Investigation revealed no evidence of anything other than unintentional injury. Autopsy revealed a laceration of the head with an underlying depressed skull fracture and focal epidural hemorrhage; focal minor contusions and abrasions of the torso; hemoperitoneum; duodenal transection distal to the pylorus; contusion of the liver; intra-abdominal soft tissue hemorrhage of the ligamentum teres, greater and lesser omentum, and mesentery; petechial hemorrhages of the lower lobe of the right lung; peri-pancreatic soft tissue hemorrhage with bile staining; and minor abrasions and contusions of the extremities. Histologic examination revealed an abundance of neutrophils, fibrinous debris, scattered monocytes, and an absence of hemosiderin laden macrophages, which confirmed the timeline of investigation. The cause of death in this 9-year-old female was head and abdominal injuries sustained after falling from a bicycle.

A common cause of accidental abdominal trauma in grade-school children is due to impact with bicycle handlebars. This injury can mimic homicidal blunt force injury. The importance of histologic examination of injuries in different tissues with a known timeline of events aids in predicting an unknown timeline in homicidal blunt force injury cases. Such trauma commonly causes lacerations of the duodenum, and in many instances, severe internal organ damage is accompanied by a dramatic paucity of significant external injury. Abdominal organ injury has a poor prognosis due to delay in therapy. An appreciation for the potential severity of blunt abdominal trauma, which can provoke more efficient diagnosis of the injury and hastened therapy, may save a precious life.

Duodenum, Trauma, Survival

G43 Role of Scene Reconstruction in the Medicolegal Investigation of Sudden Unexpected Infant Deaths

Richard C. Harruff, PhD, and Pamela S. Ulmer, DO, King County Medical Examiner's Office, 325 9th Avenue, HMC Box 359792, Seattle, WA 98104-2499*

After attending this presentation, attendees will recognize the value of scene reconstruction as a routine component of infant death scene investigation.

This presentation will impact the forensic community by showing how medicolegal death investigators can enhance the quality of their scene investigations and provide valuable information that may be used to prevent or reduce future infant deaths.

Complete investigation of sudden unexpected infant deaths requires scene investigation, full autopsy, and review of the case history. Careful scene investigation is crucial, not only for understanding why one particular infant died, but also for developing valid strategies to prevent future infant deaths. This presentation examines the techniques and value of doing scene reconstruction as part of a rigorous investigation of a sudden unexpected infant death.

The King County Medical Examiner's Office (KCMEO) investigates all sudden unexpected infant deaths using: (1) a standardized scene investigation protocol, (2) a complete autopsy including microscopic examinations, toxicology, metabolic screening, and microbiological cultures when indicated, and (3) review of the case history with police and child protective agencies. For this study, the computerized KCMEO database from 1995 to 2008 was searched for all deaths of children between the ages of one week and three years. These

were then analyzed to group the deaths by manner of death and further subclassify natural death. In addition, the photographic records of KCMEO were individually reviewed to find cases in which scene investigation included scene reconstruction. The cases in which scene reconstruction yielded information important for certifying cause and manner of death were then selected as examples to demonstrate the techniques of this investigative tool and its value for the overall death investigation.

Between 1995 and 2008, 505 deaths of infants and young children from one week to 3 years of age were recorded in the KCMEO database. Of these 505 deaths, 326 of these were classified natural, 107 accident, 2 complication of therapy, 47 homicide, and 23 undetermined. There were 232 deaths that were certified as SIDS. During this time period, 151 deaths were investigated using a doll or similar prop to reconstruct the scene in which the caregiver found the child dead. The scene reconstruction included instances of natural deaths, accidents, and deaths certified as undetermined.

Scene reconstruction is an essential part of the investigation into the death of an infant or young child. Invariably the death scene is disturbed and therefore requires a patient, well-trained, experienced, and compassionate investigator to uncover the details surrounding the death. Using a fabricated, stuffed doll or similar prop, and working patiently with the caregiver is the best means for establishing the location and position in which the child was last seen, the usual position for sleeping, and the position when found unresponsive. Furthermore, this method supports a photographic record that is fairly acceptable to the caregiver(s) and that can later be used to demonstrate the death scene in an emotionally neutral manner. Risk factors and hazards, including bed sharing, present in the child's environment can be readily documented and demonstrated with respect to the specific hazard and the way in which the hazard is responsible for the death. Witness reliability can also be assessed with this technique. As important as scene reconstruction proves to be, there are several obstacles in utilizing this method. Emergency medical personnel frequently disrupt the integrity of the scene by transporting babies that they know are dead to the hospital emergency department; this practice must be strongly discouraged. The death investigator, agency, or otherwise well-meaning individuals may feel that scene reconstruction is too invasive into the caregiver(s) grief and privacy. Training, experience, and compassion are needed to overcome this obstacle. There is the valid concern that a caregiver or witness may not be reliable in reconstructing the scene for the investigator(s). Again, experience has shown that patience and compassion are the most valuable qualities for gaining witness trust and revealing the truth. In conclusion, scene reconstruction provides invaluable information, and therefore, should be considered one of the standards for a quality infant death investigation.

Medicolegal Investigation, Sudden Infant Death Syndrome, Scene Reconstruction

G44 Death by INR: A Case of Vitamin K Deficiency Bleeding Masquerading as Shaken Baby Syndrome

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After attending this presentation, attendees will understand the need for a deconstruction oriented approach when evaluating Shaken Baby Syndrome cases; realize that differential diagnoses exist for most any medical finding and that superficial observations and failure to develop

the differential can lead to diagnostic errors and wrongful process.

This presentation will impact the forensic community by giving a better understanding of the value of integrated investigations and their ability to serve justice.

A 7-month-old child died at a pediatric hospital of "non-accidental trauma." The chart was given to the pathologist, and conversation from the treating physician indicated intracranial and retinal hemorrhaging. The pathologist recorded a cryptic entry: "INR=1.1." An extensive medical chart dating back to the decedent's third day of life was not disclosed.

The decedent was the twin B of twins born at 35 1/2 weeks, discordant from his twin sister by a birth weight 20% less. Severe reflux disease was present since birth. He required a fundoplication and a feeding tube through the abdomen. At birth he was in the 25th percentile, until his sixth month when it was in the 15th and terminally, had fallen to the 5th. Despite adequate nutritional intake, he no longer absorbed the nutrients and was diagnosed with failure to thrive. Shortly before death, he had the gastrostomy site cauterized for continual bleeding.

The medical examiner ruled Shaken Baby Syndrome. The father was arrested subsequent to his statement that after seeing his son on the floor with his aggressive 13-month-old daughter kneeling on the infant's stomach and her hands at his neck; he separated them and found the infant struggling to breathe. To revive the child, he "shook" it. He was charged with first degree murder. The defense desired a medical review.

Deconstruction revealed two different autopsy protocols, the absence of an adequate neck dissection, the missed presence of prior retinal hemorrhages, and the failure to observe a tongue tumor. The presence of the gastrostomy and fundoplication went unexplained, as did contusions the hospital reported, on the back. Significant hospital laboratory values included coagulation studies with a prolonged prothrombin time (PT) and a normal activated partial thromboplastin time (aPTT). The International Normalized Ratio (INR) was 1.1, within normal range. The timeline revealed an initial retinal examination with hemorrhage in the left eye, hours later both retinas were hemorrhagic. Iron stains of the eyes by the defense were positive, indicating remote hemorrhage. Records of the organ procurement organization indicated the use of vasopressors and anticoagulants, increasing the hemorrhages.

The differential diagnosis when the PT is long and the aPTT is normal is divided between liver disease or a deficiency of vitamin K an essential vitamin that enables the liver to produce coagulation factors. Vitamin K Deficiency Bleeding (VKDB) is a third world disease. The clinician relied upon the INR that no coagulopathy was present because the INR was normal. This is an inappropriate practice as the INR is intended *only* for those patients on coumadin therapy for periods greater than two weeks.

Studies from the University of Tennessee confirm clinicians rely upon the INR as an indicator of normal coagulation status. This practice obscures the initial stages of coagulopathies. Ironically, other studies ordered were not followed up, or were cancelled after death, thus preventing a definitive answer. The pediatricians remained adamant the child was murdered. The defense presented this finding to the prosecution, and settled via diversion.

Shaken Baby Syndrome, Deconstruction, Coagulopathy

G45 Malicious Use of Nonprescription Cough and Cold Medications in Children

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After attending this presentation, attendees will understand the process and outcomes of a systematic evaluation of pediatric deaths associated with nonprescription cough and cold drugs and will gain an awareness of the rare but apparent malicious use of these medications in children.

This presentation will impact the forensic community by increasing awareness of the malicious use of these drugs and encourage more detailed investigations into all pediatric deaths.

The safety of nonprescription cough and cold medication use in children less than 12 years of age has been questioned. To better understand the safety profile of these drugs, an independent expert panel reviewed available death reports of children less than 12 years of age with mention of a cough/cold ingredient that were obtained from three sources: English language medical literature (1949-2007), National Poison Data System (1983-2007) and Manufacturer Safety Records (1980-2007). The panel assessed the causal relationship between each reported drug and death using predetermined definitions for "Definitely Related", "Likely Related", "Possibly Related", "Unlikely Related", "Definitely Not Related", and "Unable to Determine". These definitions were based upon clinical course, drug exposure history, body fluid/tissue analytical evidence, and alternative cause of death. The panel also attempted to categorize the dose ingested (therapeutic/supratherapeutic), intent of administration (therapeutic/non-therapeutic) and potential contributing factors for all deaths determined to be at least possibly related to a cough and cold drug.

Of 227 fatality reports reviewed, 92 (41%) deaths were judged at least possibly related to one or more nonprescription cough and cold drugs. The panel determined that 79 of these involved a supratherapeutic dose of the suspect drug. The dose could not be assessed in the remaining 13 cases. There were no cases for which the panel suspected a therapeutic dose was involved. Of the 92 related deaths, 68 involved an overdose of the suspect drug administered by a caregiver. Ten such cases involved the administration of the drug in a daycare setting. Twenty-four reports (18 - age <2 years, 5 - age 2 to <6 years, 1 - age 6 to <12 years) indicated that the drug was given to the child without an appropriate therapeutic indication (i.e., not for cough or cold symptoms). The panel determined that malicious intent was a contributing factor in 20 cases. These were cases in which the drugs were used to either sedate or intentionally harm the child. Other signs of child abuse including hematomas and healed fractures were evident in some cases.

The incidence of non-accidental child injuries, specifically death, resulting from the misuse of nonprescription cough and cold medications or other drugs is unknown, in part because there is no standard laboratory testing during pediatric fatality investigations. Postmortem drug

concentration levels are rarely reported because appropriate specimens are not routinely collected during autopsy. These body fluid/tissue drug levels are often difficult to obtain due to limited specimen and analytical challenges. They are also difficult to interpret due to postmortem effects including redistribution as well as limited peer-reviewed reference ranges for the pediatric population. Interpretation of drug levels should be done with pharmacokinetic parameters and must not rely on published ranges which do not take into account the elapsed time since administration of the drug. Those performing investigations of pediatric deaths, especially in children less than 2 years of age, should consider overdose of cough and cold medications and other drugs, including instances of malicious use of these drugs by parents or caregivers.

Pediatric Deaths, Nonprescription Medications, Drug Toxicity

G46 Wrongful Convictions and Pediatric Forensic Pathology: The Canadian Experience

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After attending this presentation, attendees will understand of how inadequate training and supervision, difficulties in the communication of opinion evidence, and problematic areas in pediatric forensic pathology may result in wrongful convictions. Those in attendance will enhance their understanding of the ways to improve the interaction between forensic scientists and the criminal justice system.

This presentation will impact the forensic community by exploring the recommendations of the Inquiry into Pediatric Forensic Pathology conducted by appellate court Justice Stephen Goudge in Toronto, Ontario, Canada, which are likely to have a significant impact on the prevention of miscarriages of justice on an international level.

As a result of the identification of serious errors in the postmortem reports and testimony of Dr. Charles Smith, a pathologist called by the prosecution in several child homicide cases in Ontario, Canada, the provincial government convened a public inquiry to address systemic issues in order to prevent the recurrence of such tragedies. Between November 2007 and February 2008, the Commissioner heard from government officials, prosecution and defense counsel, police officers, judges, and law professors as well as the internationally recognized forensic pathologists who were involved in the review of the specific cases. Research papers on a variety of topics were received and policy roundtable discussions conducted. Dr. Smith himself also gave evidence regarding his efforts and explanations.

The investigation of suspicious deaths in children presents many complex challenges for all concerned, including the need for proper training and certification of the forensic pathologist, evolving and sometimes controversial issues in pediatric forensic pathology, the difficulty in choosing appropriate language to characterize the level of certainty of an opinion regarding cause of death and the dangers of "tunnel vision."

Evidence at the inquiry identified a variety of approaches to address these problems. The implementation of a comprehensive postmortem report format detailing all opinions and the basis for same ensures a standardized methodology for the timely communication of autopsy findings. A vigorous peer review process prior to the release of such reports contributes significantly in validating the conclusions. The principles of evidence-based medicine provide an important standard to implement and ensure the requisite degree of reliability for a court considering opinion evidence on issues involving pediatric forensic pathology. Appropriate measures of accountability are necessary to identify and deal with those circumstances in which the pathologist's practices may be deficient. Continuing education for counsel and

experts will assist in avoiding misunderstanding of their respective roles and participation in the trial process.

While the inquiry received considerable publicity in Canada, the lessons which may be learned from these unfortunate events should be shared with the international forensic community in order to achieve the objectives of fairness and justice for those charged with criminal offences.

Forensic, Pediatric, Pathology

G47 The Possibilities and Limitations of Neuropathology in Exhumation Autopsies

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After attending this presentation, attendees will understand important opportunities in difficult situations which commonly surround exhumation autopsies.

It is often assumed that exhumation autopsies will yield only marginal information, least of all to permit in-depth neuropathological examinations. This presentation will impact the forensic science community by demonstrating how five cases prove otherwise. This information should be valuable to pathologists and the general forensic community,

Five cases are presented that offer a range of forensic/medical issues in the context of exhumation autopsies. Four cases involved civil or criminal litigations and one case was done for personal reasons of a family of a suicide victim.

The durations of burial ranged from two to more than 18 years. All individuals had been interred in either wooden or metal caskets, usually within concrete burial vaults. All had been arterially embalmed. At issue were the nature of the injuries or processes leading to death that usually involved head trauma, but in one case involved possible Marchiafava-Bignami syndrome.

Three of the cases had not been autopsied before, but two had. In general, preservation of the head, brain, and other organs was good to excellent and permitted satisfactory case analysis both grossly and microscopically.

The opportunities and limitations of exhumation autopsy neuropathology will be presented.

Exhumation, Neuropathology, Autopsy

G48 Pathology/Odontology: The Team Approach to a Forensic Autopsy

John E. Filippi, DDS, 1325 North 127th Avenue, Omaha, NE 68154; and Mary H. Dudley, MD*, Jackson County Medical Examiner's Office, 660 East 24th Street, Kansas City, MO 64108*

After attending this presentation the attendees will understand the "dual role" the pathologist and odontologist have in determining the cause of death and the development of a positive identification.

The presentation will impact the forensic community by increasing the awareness of the medical legal system and law enforcement agencies regarding how the coordination of these two forensic sciences can support the investigation.

A forensic pathologist performs autopsies to determine the cause and manner of death in situations falling under the jurisdiction of the Medical Examiner/Coroner Office. After the forensic autopsy is completed, the forensic odontologist examines the dental structures, and through a comparison analysis between the antemortem dental and the postmortem dental records, can render a "rapid onset" positive identification. When working together, both forensic professionals, can

provide concordance, to the issuing of a prompt death certificate for the next of kin, and can also be called upon to be an expert witness in a court of law.

This presentation will increase the awareness of the forensic community and law enforcement agencies, in the attempt to show, how both fields can work together in the forensic autopsy. The focus of this case presentation will highlight the forensic investigation of a high profile dual homicide case illustrating the forensic team approach. The difficulty of the case stems from the young age of the two related victims, the cause and manner of death, the history behind that investigation, and the final court decision. The presentation will include how forensic anthropologists recovered the buried remains, how forensic pathologists determined the cause and manner of death, and how forensic odontologists determined the chronological dental age and the final rendering of a positive identification.

Skeletal remains were discovered in a shallow grave in a wooded area in Missouri. Forensic Investigators first surveyed and photographed the scene. A forensic anthropologist was then called to assist with the excavation. Two juvenile skeletal remains along with clothing fragments and projectiles were placed into evidence. The forensic pathologist determined that both children were shot in the back of the head, from an indeterminate range, which was the cause of death. The skeletal remains were further examined by the forensic anthropologist, who determined estimates of height, weight, and race. After procuring antemortem dental records, a positive identification was made by the forensic odontologist. In addition, bone samples were collected and stored for DNA analysis.

Discussion of the dental (oral) autopsy will reveal how the actual dental x-ray comparisons were made for a positive identification. Specific reference will be made to the use of special dental technology, such as digital dental radiographs and the WINID dental charting software program. These same dental protocols can also be developed in the SOP's and applied by a medical examiner/coroner's office, for future multiple deaths or a mass fatality incident.

Although this was a high profile homicide case, the routine utilization of a forensic odontologist can provide additional evidentiary value to many cases involving skeletal, decomposed, or fragmented remains. Forensic dentistry can provide support evidence for positive identification, when other modalities, such as fingerprints or time sensitive DNA analysis are not utilized.

In conclusion, the ability to blend the two forensic sciences, pathology and odontology, during a forensic autopsy, can be invaluable to a medical examiner/coroner office in the investigation process, criminal trial and for final closure for the victim's families.

Pathology, Odontology, Positive Identification

G49 Making the Best of Death

Chantal Ferraro, PhD, Long Island University, Sociology/Anthropology, CW Post, Brookville, NY 11548; and O. C. Smith, MD, Conscience and Science in Medicine, Atoka, TN 38004*

The goals of this presentation are to: (1) evaluate the existing notion of social autopsy, (2) modify and expand it both conceptually and methodologically, and (3) integrate findings of physical and social autopsies in order to establish a bridge between the forensics of the dead and the forensics of the living.

This presentation will impact the forensic community by providing a model that is applicable to any population in any community, the understanding of which will make the study of the dead a powerful tool of death prevention for the living.

The term autopsy most commonly refers to the postmortem examination of a deceased for medical or forensic reasons. In that context, autopsy is synonymous with necropsy. Etymologically, however, autopsy translates into "to see for oneself." Recently, the addition of modifiers, such as social or psychological, to the term reflects

the attempt to define new fields of inquiry based on the broader latter meaning. A psychological autopsy examines the mental state of a deceased at time of death, and may contribute to the determination of the manner of death, especially in cases of suicide. The concept of social autopsy is more confusing since its two applications belong to entirely different spheres. According to Rick Lavoie (2005) a social autopsy is a pedagogical strategy to help a learning disabled child to see for himself the cause/effect relationship between his social behavior and the reactions of others. But for sociologist Eric Klinenberg, who studied the 1995 lethal heat wave in Chicago, a social autopsy is a way to identify the social risks of a dependent population factors that led the isolated, the old and the poor to die by the hundreds. Although valid and useful in their own right, these definitions are not adequate for us.

The model of social autopsy being discussed originates in the longitudinal study of child death which was presented at the 2002 AAFS meeting. The original study was based on the autopsy reports of the Shelby County (TN) Medical Examiner's office where over 1,500 cases of child death were investigated, inclusive of all manners, over a period of ten years. The "Swiss Cheese" concept elicited by the Human Factors Analysis and Classification System (HFACS) was incorporated where defects in the layers of latent and active responsibilities, permit lethal latent and active failures within individuals, society and cultures to be identified. This presentation will focus on homicidal deaths from 0 to 4 years of age and accidental deaths from 0 to 18. Subsequent sociological and anthropological research of the community in which these deaths occurred allowed us to "see for oneself" the levels of failure and the failures within levels. From this evolves an understanding of what produces not just the death of each individual but identifies patterns that anticipate future trauma or death, with its human and societal costs. These patterns represent a framework of behaviors that must be altered or remedied by the community. It is the contention of the investigators that a social autopsy is defined by its ability to reveal such patterns and to highlight the line of failure. The necropsy exists to identify this "tip of this iceberg" the social autopsy defines its magnitude.

Social Autopsy, Necropsy, Prevention

G50 Building the Communication/Language for Collaboration Between the Forensic Pathologist and Funeral Director/Embalmer

Vincent E. Hill, MD*, Mortuary Medical Services, 3003 Van Ness Street, North West, Suite 106, Washington, DC 20008

After attending this presentation, attendees will be familiar with the language and techniques used in the funeral industry.

This presentation will impact the forensic community by arming the forensic pathologist with the words to scientifically describe a body that has been embalmed.

This presentation will expose the forensic pathologist to the language and embalming procedures used in preserving the dead body. The presentation will be useful to forensic pathologists who are members of FEMA's Disaster Mortuary Operational Response Team (DMORT) or work in jurisdictions where cemeteries are subject to flood waters.

Forensic pathologists are known for their skill in turning the visual into words. They are able to explain orally and in writing the most complex surgical procedures despite the fact that they are not trauma surgeons, orthopedic surgeons, neurosurgeons or gynecologists. But, when it comes to the postmortem surgical procedure known as embalming, the forensic pathologist lacks knowledge of the words and technical procedures used by the funeral director/embalmer. Michael M. Baden, MD mentions, in Chapter III, Part 4, "Exhumation" (Medicolegal Investigation of Death, 4th edition), "The entire exhumation and autopsy

process should be well documented by words and photographs ...". As stated above, forensic pathologists know the words of their fellow surgeons but are not trained in the words of the funeral director/embalmer despite the fact that autopsies are performed on embalmed bodies prior to interment and after disinterment. Since the conception of DMORT in the early 1980's, national forensic teams have been deployed to 24 mass disaster events. Three of these events exclusively involved cemetery floods, one involved a crematory, and three involved floods that secondarily caused local flooding of cemeteries. With disinterred remains the primary focus of the forensic team is not in determining the cause of death but in finding positive identification. With disinterred embalmed bodies, the presence of embalming artifacts may be one of the main physical findings the DMORT forensic pathologist will have for positive identification. If the forensic pathologist is unable to adequately describe the postmortem embalming changes that occur during arterial and cavity embalming he or she could exclude or misinterpret a useful identifier. If the forensic pathologist knows that the body was embalmed using a single-point injection through the right common carotid artery with right jugular vein drainage or was embalmed by use of the restricted cervical method, this level of knowledge would help expedite the identification process when the local funeral director/embalmer compares their embalming reports with the autopsy report. Since 29% of DMORT's mass fatality events involve disinterred remains, the affected community would be better served by having forensic pathologists who are able to speak and write the language of the local funeral director/embalmer.

Forensic, Pathologist, Embalming

G51 Sickle Cell Trait Associated Deaths: A Case Series With a Spectrum of Clinical Presentations

Christopher Wilson, MBBS, Jon R. Thogmartin, MD*, Noel A. Palma, MD, and Susan S. Ignacio, MD, Medical Examiner's Office, District 6, 10900 Uilmerton Road, Largo, FL 33778; Barbara C. Wolf, MD, and Wendy A. Lavezzi, MD, Office of the Medical Examiner, District 5, 809 Pine Street, Leesburg, FL 34748; and Mark J. Shuman, MD, Miami Dade County, Medical Examiner Department, Number One on Bob Hope Road, Miami, FL 33136

After attending this presentation, attendees will be educated with respect to the wide variety of clinical presentations persons with sickle cell trait manifest including clinical symptoms, laboratory abnormalities, and gross anatomic and microscopic findings. This study also seeks to show how simply the diagnosis can be made by the astute clinician or forensic pathologist if only he or she will consider it in the differential diagnosis.

This presentation will impact the forensic community by showing that sickle cell trait is a condition which is not restricted to conventional ethnic boundaries of Afro-Americans and that the diagnosis needs to be seriously considered in individuals living in geographic locations in which the natural environment plays a prominent role in the manifestation of the disease. Early recognition of the disease in such individuals can possibly result in a decline in mortality.

At the conclusion of this presentation, attendees will be educated with respect to the wide variety of clinical presentations persons with sickle cell trait manifest including clinical symptoms, laboratory abnormalities, gross anatomic and microscopic findings. This study also seeks to show how simply the diagnosis can be made by the astute clinician or forensic pathologist if only he or she will consider it.

This presentation will hopefully have a significant impact on not only the forensic community but also on humanity by showing that sickle cell trait is a condition which is not restricted to conventional ethnic boundaries of Afro-Americans and that the diagnosis needs to be

seriously considered in individuals living in geographic locations in which the natural environment plays a prominent role in the manifestation of the disease. Early recognition of the disease in such individuals can possibly result in a decline in mortality.

As many as one in three Africans living in areas where malaria is indigenous and approximately one in twelve Americans with African ancestry have sickle cell trait. The affected individuals are generally asymptomatic and many are not even aware that they carry the gene. The general consensus of the public is that sickle cell trait is a relatively benign condition and affected persons are at no increased risk of morbidity or mortality because of their condition. However, the forensic community is cognizant that under the proper set of circumstances, sickle cell trait can be potentially fatal.

This study presents a series of 11 individuals with sickle cell trait and one with hemoglobin SC disease who died during various circumstances. All of the victims were subject to the warm and humid climate of Florida. The onset and/or duration of symptoms varied from a few to several hours with many displaying a prolonged lucid interval with stable vital signs. Despite seeking medical treatment, sickle cell trait related micro-occlusive crisis was never considered in the differential diagnosis. Several cases were associated with sudden death. In those deaths which were delayed, high anion gap and uncompensated metabolic acidosis were typical. Also characteristic were large increases in creatine phosphokinase, alanine aminotransferase and aspartate aminotransferase along with myoglobinemia. Although the antemortem diagnosis of rhabdomyolysis was made, the underlying cause was never deduced by the clinicians. Of particular interest was a case of a fatal splenic crisis due to sickle cell trait in a Caucasian and a victim with hemoglobin SC who died from a combination of mild traumatic injuries and prolonged bodily inversion. In some cases, sickle cell trait was not even considered in the original death certification.

In conclusion, this study demonstrates the varying characteristics and presentations of 11 cases of sickle cell trait and one case of hemoglobin SC related deaths and shows that such deaths can be sudden or delayed. Conventional racial delineation of the sickle cell hemoglobinopathies should not deter one from considering it in the differential diagnosis especially if the patient is subjected to environmental and physical stressors which can potentiate the disease. Furthermore, failure to consider sickle cell trait related crises as a diagnosis can result in improper death certification. Greater efforts to educate the public especially athletes and coaches on the possible hazards of exercise induced sickle cell trait related micro-occlusive crisis hopefully will result in less morbidity and mortality.

Sickle Cell Trait, Exertion, Metabolic Acidosis

G52 Commotio Cordis: A Forensic Science Perspective

Ariel Goldschmidt, MD*, Steven T. Hensley, and Mary H. Dudley, MD, Jackson County Medical Examiner's Office, 660 East 24th Street, Kansas City, MO 64108

After attending this presentation, attendees will have an enhanced understanding of the prevalence, pathophysiology, and important forensic science issues related to commotio cordis and the ability to apply this knowledge to their practice should it become necessary.

This presentation will impact the forensic community by providing a broad and thorough review of the current literature and scientific knowledge about commotio cordis, with particular emphasis on key issues relevant to forensic scientists. Included in the discussion will be several published case examples of commotio cordis, as well as several case examples of commotio cordis investigated in the State of Missouri.

The presentation will begin with detailed criteria for what type of

deaths do and do not constitute commotio cordis. Mention will be made of the prevalence of commotio cordis and common involved activities, with specific published case examples involving sports activity and a low speed vehicle collision. Case reports resulting from a retrospective search of cases in Missouri will be presented.

Attention will next be focused on animal models used for the study of the pathophysiology of commotio cordis. The theory of "mechano-electric coupling" of myocyte stretching and the opening of potassium/ATP channels will be discussed. Lessons learned from various experiments using animal models will be presented, including the importance of hardness of sports objects and effectiveness of chest protectors.

The presentation will include several issues of particular interest to medicolegal investigators and forensic pathologists. Typical as well as atypical case histories of commotio cordis will be presented, stressing the importance of proper scene investigation and obtaining medical history. There will be a review of possible autopsy findings seen in cases of commotio cordis. Finally, controversies regarding manner of death in atypical cases of commotio cordis will be discussed.

Commotio Cordis, Precordium, Manner of Death

G53 Corpora Amylacea and Sudden Death: A Case of Adult Polyglucosan Body Disease Diagnosed at Forensic Autopsy

Timothy L. Williams, MD*, and R. Ross Reichard, MD, New Mexico Office of the Medical Investigator, MSC11 6030, 1 University of New Mexico, Albuquerque, NM 87131-0001

After attending this presentation, attendees will learn about a case of adult polyglucosan body disease diagnosed at forensic autopsy.

This presentation will impact the forensic community by educating them about the first reported case of adult polyglucosan body disease presenting as sudden death and diagnosed at forensic autopsy.

Adult polyglucosan body disease (APBD) is a rare neurodegenerative condition characterized by typical onset in middle age, progressive neurological impairment that is heterogeneous between those affected, and death within 1-14 years of diagnosis. The histopathological hallmark of the disease is massive deposition of corpora amylacea (designated polyglucosan bodies in this context) in the central nervous system, and variable deposition of similar material in other sites. While the cause of the disease is as yet unknown, recent research has identified mutations in proteins involved in glycogen metabolism in a subset of cases. Some of these mutations are similar to mutations identified in cases of glycogen storage disease type IV (GSD IV), a disease that classically is present in the first year of life, is of very heterogeneous manifestation, and is also characterized by massive deposition of corpora amylacea. The genetic and histopathological similarities between these two conditions have lead to speculations that APBD may represent an adult form of GSD IV.

In this presentation, a case of sudden death is presented wherein APBD was diagnosed at forensic autopsy. Scene details, relevant medical and social history, and autopsy and histopathological findings are presented and richly illustrated with supporting images.

The case provides an excellent example of a prolonged and enigmatic presentation involving a complex interplay of medical, social, and forensic issues. The histopathology is particularly illustrative of this rare disease, showing massive deposition of corpora amylacea in the central nervous system, and marked accumulation of similar material in the heart. The latter was determined to be the mechanism of death (cardiac arrhythmia) with APBD the underlying cause.

This presentation represents the first case of APBD reported in a forensic context. APBD is reviewed and its relationship with other

diseases characterized by massive deposition of corpora amylacea is outlined. The role of forensic autopsies in the diagnosis of rare conditions is discussed.

Neuropathology, Corpora Amylacea, Sudden Death

G54 Trends in Forensic Investigations Into the Missing: Observations From the ICRC

Morris Tidball-Binz, MD, Ute Hofmeister, MA, and Shuala M. Drawdy, MA, International Committee of the Red Cross, 19 Avenue de la Paix, Geneva, 1202, SWITZERLAND*

After attending this presentation, attendees will gain awareness of trends identified in the application of forensic medical sciences to investigations into the whereabouts and fate of persons missing as a result of armed conflict, internal violence, or catastrophes, as observed by the forensic unit of the International Committee of the Red Cross (ICRC). Attendees will also learn about the steps taken by the ICRC to meet challenges posed by these trends.

This presentation will impact the forensic community by outlining emerging challenges posed to the wider forensic community by investigations into persons gone missing as a result of armed conflict, internal violence or catastrophes, as observed by the ICRC. The trends and challenges identified in this paper will assist in the design of strategies for effective and efficient contribution to this emerging field by forensic practitioners, institutions, and service providers.

In February 2003, the ICRC organized an International Conference on The Missing in Geneva, Switzerland. Recommendations were adopted to prevent and resolve the tragedy of persons unaccounted for as a result of armed conflict and internal violence. These included recommendations on forensic best practices for the recovery, management and identification of the dead in challenging contexts, including: roles, duties, responsibilities and applicable ethical standards for forensic practitioners and teams; guidelines for the recovery and storage of human remains; criteria for forensic human identification; principles for ethical, effective and efficient information management; and advice on the relationship between forensic practitioners and bereaved families and communities.

Following the International Conference, the ICRC established a forensic unit to help implement the recommendations worldwide. Since its inception, the forensic unit has witnessed a sustained increase in the application of forensic medical sciences to the search for The Missing and has observed the following trends:

- Growing awareness and understanding of the tragedy of The Missing in armed conflicts and catastrophes;
- Growing recognition of the importance of proper management and identification of the dead in armed conflicts and catastrophes;
- Growing needs for experienced forensic practitioners for investigations into The Missing;
- Incorporation of recommendations from the 2003 International Conference on The Missing into international standards and national legal and institutional frameworks related to The Missing;
- Awareness of the need for sustainable local forensic capacity to investigate The Missing;
- A role-shift from medicolegal practitioners (i.e. coroner, medical examiner, forensic doctor) towards multidisciplinary forensic teams in the recovery and identification of The Missing;
- Growing reliance on forensic DNA analysis;
- Demands for professional standards of best practice and quality assurance and control from practitioners and institutions involved in investigations into The Missing;

- Increased incorporation of investigative practices regarding The Missing into scientific literature, research and training; and
- Growing expectations from bereaved families and the general public for swift and positive results from forensic investigations into The Missing.

These trends pose challenges and inherent opportunities for the forensic community, including:

- Helping to meet growing needs worldwide for forensic practitioners, institutions, and service providers for investigations into The Missing. These should conform to standards of professional best practice, quality assurance and control required for these investigations. Local capacity building and ownership should be prioritized;
- Empowering communication, coordination and cooperation, at regional and worldwide levels, between forensic practitioners, institutions and service providers involved in and available for investigations into The Missing;
- Supporting swift access to indispensable forensic know-how, technology and tools by practitioners and institutions operating in under-resourced contexts; and
- Sustained efforts in public awareness raising about the role, scope, value and limitations of forensic sciences applied to investigations into The Missing.

The clarification of the whereabouts and fate of The Missing in armed conflicts and catastrophes is a humanitarian priority that requires a global and concerted effort, including from the forensic community. Based on trends observed and lessons learned, the ICRC offers recommendations for addressing the challenges identified in this paper and also for building on the opportunities which these challenges offer to the forensic community.

Missing Persons, Humanitarian Identifications, International Committee of the Red Cross

G55 Evidence-Based, Medical-Legal Documentation of the Postmortem Anogenital Examination

Sharon R. Crowley, MN, FCNS, 122 Emeline Avenue, Santa Cruz, CA 95060*

After attending this presentation, attendees will understand how to incorporate an evidence-based methodology for the documentation of the postmortem genital examination. Attendees will also be able to facilitate incorporation of a previously proposed taxonomy, germane to the postmortem anogenital examination, in order to improve medical-legal documentation and able to incorporate a theoretical framework for sexual murders, as a basis for the methodological examination of the suspected sexual homicide victim.

This presentation will impact the forensic community by augmenting and enhancing the forensic examiner's diagnostic acumen in this arena. Helping to avoid ambiguity among examiners in the interpretation of clinical findings and improve documentation and ultimately contribute to a better understanding of the etiology and manifestations of fatal sexual violence against women.

The interpretation of genital findings in the deceased remains a vital and timely issue. Until recently, a paucity of information existed on the nature and appearance of the anogenital tissues during the postmortem interval. Because the traditional genital examination consists of gross visualization, subtle findings were not easily detected. These findings may constitute injury due to sexual assault, concomitant changes in the anatomy due to postmortem processes of decomposition, or a combination of both. The theoretical framework for this proposed methodological documentation format is founded on:

- Sexual activity by the offender that culminates in the death of the victim.
- Current, ongoing baseline clinical studies on the nature and appearance of the anogenital anatomy during the postmortem interval.
- Previously presented methodology for postmortem genital examinations (Crowley, JFS, 2004).
- Previously described taxonomy for the description and classification of the appearance of the tissues during the postmortem anogenital examination.

Currently, a wide variation exists in methodology for examination of both antemortem and postmortem sexual assault victims. Postmortem challenges vis-à-vis protocols and procedures may pose even greater significance, because there is no surviving victim to recount details of the assault, including sexual acts, threats, and other behaviors of the offender(s).

Currently, no standardized state, regional, or national form exists for the accurate and complete documentation of the postmortem anogenital examination. The clinical evaluation of the sexual homicide victim forms the basis for all related medical-legal reports.

- The question of exam authorization may be an area of concern. However, no separate authorization should be needed, as these examinations fall under the jurisdiction of the Coroner or Medical Examiner. In addition, they are medically non-invasive procedures.
- The postmortem genital examination record is not a complete medical record, as with other forms used to document the sexual examinations of *living* sexual assault victims, e.g., California Office of Emergency Services, forms 923 and 930. Therefore, supplemental medical and/or gynecological records may be of benefit for further review.

The meaning and performance of the acts committed during a sexual murder varies with the offender. Salient features of the crime may be evident, which may give information about the offender's sexual motivation. A systematic, evidence-based approach to documentation is part of a consistent, methodological approach to the evaluation of this population.

Scrupulous documentation should provide as much data as is known about a given case. This includes the following general categories: salient case and demographic data, disposition of the body, available history, general physical assessment, clothing, toxicology, evaluation of nongenital trauma, components of the sexual assault evidence kit, the genital and anal examination, and colposcopic examination. It is important to clarify where the primary responsibility for a portion of the examination and/or the documentation was *not* assumed, e.g., in the evaluation of nongenital trauma by a forensic nurse.

Select cases of fatal sexual violence provide actual examples of traumatic injuries, consistent with blunt force trauma to the anogenital tissues. Injuries can be categorized as to type, number, and anatomic site. In addition, normative studies of baseline controls were evaluated, using the sequential methodology for the postmortem genital examination with colposcopy, *SART-TO-GO* (Crowley, JFS, 2004). A previously presented taxonomy was developed to describe the nature and appearance of the postmortem genital anatomy (Crowley & Peterson, AAFS, 2004) and to develop a standardized classification system for these previously undescribed findings. This taxonomy is incorporated in the proposed protocol for the documentation of the medical-legal examination of sexual homicide victims.

The postmortem genital anatomy worksheet consists of the same anatomic sites that are routinely examined in the living sexual assault victim. These include the peri-urethra/peri-clitoral area, labia majora, labia minora, posterior fourchette, fossa navicularis, hymen, vagina, cervix, perineum, anus, and rectum. Supplemental documentation is included for both the adult male and the pre-pubescent child.

All examination techniques and any adjuncts should be recorded, such as use of balloon-covered swabs (Crowley, 1999), labial traction, or

labial separation, in addition to routine speculum examination and anoscopy.

Appropriate and complete chain-of-custody must be documented and is included within the tool. A copy of the tool should be placed within the sexual assault evidence kit for the criminalist.

A supplemental narrated summary or dictation is recommended, to complement the standardized form. It also places events in chronological order, incorporates more uniformly understood language, and clarifies roles and responsibilities. The emphasis on teamwork and evaluation is crucial in an event that requires multi-disciplinary cooperation.

The taxonomy for postmortem genital examinations has proved to be a useful classification system during clinical examination, case documentation, and database entry. This taxonomy has been incorporated into the proposed medical-legal form, in order to differentiate postmortem artifact from concomitant findings that might be suggestive of sexual trauma, i.e., blunt force injury, including lacerations, ecchymoses, and abrasions. This capacity is pivotal. Just as in living victims, it is essential to be able to distinguish benign gynecological conditions from traumatic findings.

Data to date from the analysis of ongoing, baseline controls has yielded useful information for the development of a template for documentation. It is important to carefully describe the nature and appearance of salient anatomic sites. Analysis of research data has reinforced the need for the examiner to avoid working in a vacuum. The examiner whose sole prior experience lies in the antemortem arena may confuse normal postmortem artifact with traumatic findings. Common benign gynecological findings, such as labial adhesions and punctate lesions, are often present. Other findings, such as postmortem mucosal shedding at various sites within the anogenital tissues, have occurred with sufficient frequency during the postmortem control study to warrant recognition as normal postmortem artifact.

The ultimate goal is to better visualize and improve the understanding of what is normal in anogenital anatomy during the postmortem interval. To this end, careful scrutiny and meticulous documentation will both add to individual case yield and enhance the overall body of knowledge within this area.

Postmortem Anogenital Examination, Sexual Homicide, Colposcopy

G56 Postmortem Recognition of Sickle Cell Trait

Kathryn H. Haden-Pinneri, MD, and Sara Nunez-Doyle, MD, Harris County Medical Examiner's Office, 1885 Old Spanish Trail, Houston, TX 77054*

After attending this presentation, attendees will gain a better understanding of the importance of recognizing the incidental autopsy findings related to sickle cell trait and the implications this diagnosis may have on surviving family members.

This presentation will impact the forensic community through knowledge gained about sickle cell trait and from insight regarding the importance of notification of surviving family members.

Sickle cell trait is defined as the heterozygous condition of having one gene for sickle cell hemoglobin and one for normal hemoglobin. Patients with sickle cell trait tend to lead normal lives, without serious complications; therefore it is not regarded as a disease state. In certain conditions; however, complications not only occur, but they may be fatal. Deaths due to exertional sickling involving young athletes have made headline news on multiple occasions. When an individual with sickle cell trait becomes hypoxic, acidotic, dehydrated, or hypothermic, the typically silent sickle cell trait transforms into a syndrome that resembles sickle cell disease with widespread sickling and subsequent vaso-occlusion.

The presence or absence of intravascular sickled red blood cells in tissue specimens depends on the degree of oxygenation of the sample

prior to fixation. Intravascular sickling may occur due to terminal hypoxemia in the setting of sickle cell trait. It is almost impossible to determine the role sickled cells may have played by the presence or absence of intravascular sickling in autopsy specimens.

The events surrounding a death due to exertional sickling will assist the pathologist in this diagnosis. Individuals with sickle cell trait who die without a history of intense exercise prior to death may pose a challenge to physicians in determining if the death is or is not related to their genetic condition. A third possibility exists in which an individual may not be known to carry the sickle cell trait until sickled cells are seen in biopsy or autopsy specimens.

Three decedents autopsied at the Harris County Medical Examiner's Office, ranging in age from 28 to 49 were found to have sickle cell trait. None of the individuals were known to have the trait and when family members were contacted, only one had any knowledge that this condition existed in their family. The sickle cell trait was found to be purely incidental in two of the three decedents and may or may not be related to the cause of death in the third individual.

Two of the decedents were black males who were found unresponsive at work, one outside and one at a desk. One was 39-years-old and the other was 49-years-old. Both had enlarged hearts with coronary artery atherosclerosis. Microscopic examination revealed sickled cells in the heart, liver, lungs, kidney, and brain of both men. Hemoglobin electrophoresis performed on postmortem blood revealed the presence of hemoglobins A, S, F, and A2 in levels suggestive of sickle cell trait with an underlying beta+ thalassemia.

The third case involved a 28-year-old morbidly obese black female (body mass index of 54.1) who became unresponsive shortly after complaining of shortness of breath and abdominal pain. Autopsy findings included bilateral pulmonary thromboemboli, deep venous thromboses, gallstones, and clear bile. Microscopic examination revealed sickled cells in the kidney liver and brain. Hemoglobin electrophoresis results are pending at this time. Family members were contacted and reported knowledge of sickle cell trait in a sibling, but not in the decedent.

All family members contacted were grateful for the information and most were planning a follow up visit with their physician to obtain testing for sickle cell trait. With the exception of possibly the pulmonary emboli, the finding of sickle cell trait was incidental to the determination of the cause and manner of death; however, the information was extremely important for the family members of the decedents. This finding underscores the responsibility of forensic pathologists to perform autopsies with the intent of complete and thorough documentation of all findings, not just determination of cause and manner of death.

Autopsy, Sickle Cell Trait, Incidental

G57 An Angel Dies on the Needle: Fatality After Injection Sclerotherapy for Prolapse Rectum in a Child

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After attending this presentation, attendees will be made aware of the toxicity of phenol, a product with multiple clinical applications that resulted in a fatality during a non-invasive surgical procedure.

This presentation will impact the forensic community by increasing its awareness about a previously unreported complication of use of phenol as a sclerotherapeutic agent for prolapse of rectum.

The goal of this presentation is to discuss the findings in a case of toxicity due to phenol toxicity that resulted in the death of child fatality after a surgical procedure for a non-life threatening condition.

Prolapse rectum (PR) or protrusion of the rectum beyond the anus occurs frequently in populations at both extremes of age. In the pediatric population, PR is usually diagnosed before the age of three years, and in adults, the peak incidence of PR is after the fifth decade of life. The etiology of PR in developing countries is usually related to diarrheal illnesses, parasitic infestations, and malnutrition. In the developed world, a common cause is cystic fibrosis. Surgeons have shown considerable ingenuity in the search for the ideal operation for PR. Over 200 different procedures have been employed, suggesting that the ideal surgical solution has remained elusive. Treatments include conservative management, resection and fixation, levator ani repair, presacral packing, Thiersch's wire suture and injection sclerotherapy. The last is considered an attractive treatment option because it is minimally invasive.

The case presented is of a 2-year-old female child, with PR, cystic fibrosis, and Ebstein malformation of the tricuspid valve. Due to refractory PR, the decision was made to treat her with injection sclerotherapy, using phenol as the sclerotherapeutic agent. In the operating room, and shortly after the injections, the baby had a sudden cardiac arrest, and received CPR for approximately 2 hours. She developed anoxic encephalopathy, rhabdomyolysis, non-hyperthermic elevated creatine kinase (CK) levels, and disseminated intravascular coagulopathy (DIC). She died approximately 4 days after the surgery. An antemortem urine specimen submitted on the day after the surgery had a total phenol concentration of 240mg/L. Phenol concentrations, done as part of workplace testing, in unexposed and chronically individuals should be below 10 and 30 mg/L.

At autopsy, the baby's external appearance and internal organs were appropriate for age. There was a reddish discoloration around the anus, and separate reddish brown discoloration to the buttocks. Internally there were multiple punctuate hemorrhages on the mesentery and capsule of internal organs. There was intraparenchymal hemorrhage within the lungs and spleen, and red blood cell casts within the renal pelvis. The anal canal was infarcted. The evaluation of the heart (48.2 grams) confirmed the Ebstein malformation. The muscle biopsy revealed nonspecific congenital myopathic changes with decreased myophosphorylase and glycogen. The section of liver showed PAS & PASD negative vacuolization of the hepatocytes. Examination of the brain revealed cerebral edema with acute hemorrhagic infarct of the left occipital cortex, and multifocal subarachnoid, cortical, and cerebellar hemorrhages.

A variety of sclerosing agents have been used with varying success rates. Phenol preparations have been used in dermatology and plastic surgery for the treatment of acne and during chemical face peels. During cutaneous application of phenol, absorption of the chemical has occurred with deleterious systemic effects, including cardiac arrhythmias have been reported. The publications about the value of the use of Phenol as sclerosing agent for PR have been mixed. One report indicated 90 to 100% cure rates after one or two injections and no complications. Another report indicated complications, including mucosal sloughing and perianal fistulae, in 27% of cases. No cases of fatality due to phenol toxicity after injection sclerotherapy have been reported in the medical literature.

This case report describes the steps taken to establish the diagnosis of phenol toxicity, and eliminate the other causes of sudden death suggested by the initial differential diagnosis. The forensic community should be aware of the toxicity of phenol as it has multiple clinical uses, and can result in fatality.

Prolapse Rectum, Injection Sclerotherapy, Phenol Toxicity

G58 MDMA Neurotoxicity

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After attending this presentation, attendees will gain knowledge on how to characterize MDMA neurotoxicity in rat brain.

This presentation will impact the forensic community by demonstrating how the results of even one single administration of MDMA can significantly alter the brains cellular antioxidant defense system and produce oxidative stress in both the striatum, and frontal cortex. Thus one possible mechanism of MDMA neurotoxicity appears to be a direct toxic effect of MDMA or its red-ox active metabolites

3, 4-Methylenedioxymethamphetamine (MDMA or "Ecstasy") is an increasingly popular psychoactive and hallucinogenic drug of abuse. It acts on the CNS by increasing the release of serotonin and other catecholamines in addition to preventing their reuptake. MDMA has been shown, in both man and animal, to damage serotonergic and dopaminergic nerve terminals and to cause neurodegeneration in multiple areas of the brain, including the cortex, hippocampus, striatum and thalamus. The closely related drug, methamphetamine (METH) and its derivates have been shown to produce long-lasting depletion in dopamine and its metabolites, as well as dopamine reuptake sites in the rat and primate striatum, but not in other dopamine rich areas such as the nucleus accumbens and the prefrontal cortex, in contrast to the neurotoxic effect of dopamine to striatal DA terminals. Two other important aspects of MDMA neurotoxicity have been identified: hyperthermia and neurodegeneration. The former appears to be a direct action of MDMA, while the later is due to the production of reactive oxygen (ROS). Mounting evidence suggests that MDMA-induced 5HT neurotoxicity is due to the increased production of free radical induced oxidative stress. Attempts were made to clarify the mechanisms of MDMA in rats' brain by administering a single dose of the drug and studying the effects using combined toxicological, biochemical and immunohistochemical analysis.

Fifty rats were used for the study, each weighing 200-250 grams. Twenty-five rats were used for the histopathological and toxicological examination. They were divided into three experimental groups of seven animals each and administered one 20mg/Kg dose of MDMA intraperitoneally. The four controls were injected with saline. The first group of animals was sacrificed six hours after injection, the second at 16 hours, and the third at 24 hours. Plasma samples obtained immediately after sacrificed, stored at -80°C and then analyzed for MDMA/MDA with gas chromatography/mass spectroscopy (GC-MS). Histological sections of the brains were also obtained and immunohistochemical stains were used to localized MDMA and its metabolites, MDA and MDEA, within the various areas of the brain. Other immunohistochemical stains were used to localized growth associated protein 43 (GAP43), tryptophan hydroxylase (TrypH), markers of synaptic plasticity of the serotonergic innervation and the vesicular monoamine transporter -2 (VMAT2) as a stable marker of striatal dopaminergic terminal integrity. Microglial activation and damage were measured using a different immunohistochemical stain for glial fibrillary acid protein (GFAP), Heat shock proteins (Hsp 27, Hsp 70 and Hsp 90) and beta-amyloid precursor protein (β APP). Apoptosis was measured using the tunnel assay, which identified apoptosis via DNA fragmentation. For the evaluation of oxidative stress, the others twenty-five rats, divided into three groups of seven male albino rats weighing 200-250 g were used to analyze the effect of MDMA administration (20 mg/Kg, i.p) on rats' brain. Hippocampus, striatum, and frontal cortex were removed 3 and 6 hours after treatment and analyzed for the activity

of antioxidant enzymes (super oxide dismutase, SOD; glutathione reductase, GR; glutathione peroxidase, GPx). Reduced and oxidized glutathione (GSH and GSSG) were measured using a spectrophotometric assay. Ascorbic acid (AA) levels were determined reverse-phase HPLC method. Finally, lipid peroxidation was measured by quantitating the release of malonaldehyde (MDA) using UV-HPLC.

The acute administration of MDMA produces a decrease of GSH/GSSG ratio and oxidative stress in all of the brain areas examined. SOD activity was significantly reduced after 3 hours in hippocampus (-60.7%) and after 6 hours in striatum, hippocampus, and frontal cortex (-43.3%, -86.1% and -23.4% respectively). GR and GPx activities were reduced after 3 hours (-22%) and after 6 hours (-33.3%) in frontal cortex. AA levels strongly increased in striatum, hippocampus and frontal cortex after 3 (+159%, +84% and 17.6%) and 6 (+162%, +154% and +23.4%) hours respectively. High levels of MDA respect to control were measured in striatum after 3 hours (+276%) and 6 hours (162%); in hippocampus (71.8%) and in frontal cortex (+18.22%) after 6 hours.

The results of even one single administration of MDMA can significantly alter the brains cellular antioxidant defence system and produce oxidative stress in both the striatum and frontal cortex. Thus one possible mechanism of MDMA neurotoxicity appears to be a direct toxic effect of MDMA or its redox active metabolites.

MDMA Neurotoxicity, Immunohistochemical, Oxidative Stress

G59 Levorphanol, Dextromethorphan, and a Case of (Probable) Mistaken Identity

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After attending this presentation, attendees will recognize that levorphanol and dextrorphan, a metabolite of dextromethorphan, are stereoisomers that cannot be distinguished from each other by routine toxicology testing, and that forensic pathologists and others in receipt of toxicology reports should be cognizant of this when interpreting toxicology results.

This presentation will impact the forensic community by raising awareness among both forensic pathologists and toxicologists of the laboratory's limitations regarding levorphanol and dextrorphan discrimination, thereby leading to improved communication between pathologists and the laboratory along with a reduction in instances of misinterpreted toxicology results involving these compounds.

Appropriate evaluation of toxicology results within the context of a forensic autopsy is vital, and relies, in part, on a laboratory's ability to detect, differentiate, and report individual compounds contained within specimens collected during a postmortem examination. The existence of pharmacologically active stereoisomers poses an additional challenge to both toxicologists and pathologists, as they cannot be differentiated in the laboratory by routine methods. This is the case with levorphanol, a relatively potent prescription narcotic, and dextrorphan, the active metabolite of the commonly used over-the-counter antitussive dextromethorphan.

A case involving a 70-year-old man with pneumonia and a history of chronic ethanol abuse is presented to illustrate the importance of recognizing the laboratory's general inability to differentiate levorphanol from dextrorphan. Laboratory testing in this case showed a relatively high level of levorphanol along with other medications commonly found in over-the-counter cold medications. The presence of levorphanol was unexpected within the context of the case, as the decedent was taking no prescription medications and had not seen a physician for years. The

levorphanol was initially considered a significant contributing factor in the man's death.

Re-evaluation of the toxicology findings, spurred by a second case with similar toxicology results under equally incongruous circumstances, uncovered the difficulty posed to toxicology testing by the structural similarity between levorphanol and dextrophan. Given this insight, the circumstances of both of these cases suggested that the compound originally reported to be levorphanol was considered more likely to be the metabolite of dextromethorphan. Subsequently, "levorphanol intoxication" was discounted as a factor contributing to death in the first case. The original toxicology reports were amended to reflect the inability to distinguish between levorphanol and dextrophan.

Subsequent review of in-house case files since 1999 revealed 13 more cases in which levorphanol was reported to be in blood and/or urine along with other compounds often admixed with dextromethorphan in over-the-counter cold medications. These findings suggest that some, if not all, of these earlier cases were more likely to represent the detection of dextrophan and not levorphanol.

Toxicologists and pathologists should be aware that levorphanol and dextromethorphan's metabolite dextrophan are stereoisomers, and that their structural similarity renders them indistinguishable by routine laboratory testing. An understanding of these limitations is critical to the interpretation of toxicology results that may indicate the presence of one or both of these compounds.

Levorphanol, Dextromethorphan, Isomers

G60 Fentanyl-Related Drug Deaths in Virginia (2000-2006)

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After attending this presentation, attendees will recognize the growing contribution of fentanyl to drug deaths, especially in combination with other drugs and alcohol.

This presentation will impact forensic scientists, primary care physicians, pharmacists, and patients by demonstrating the danger of combining fentanyl with other medications, street drugs, or alcohols.

Fentanyl is an opiate analgesic with about 81 times the therapeutic effect of morphine. Initially used mostly in hospital settings, fentanyl is increasingly used for outpatient management of chronic pain, especially delivered transdermally or through mucous membranes. Over the past years fentanyl has appeared more frequently in toxicology screens associated with drug deaths.

All deaths investigated by the Virginia Office of the Chief Medical Examiner between January 1, 2000 and December 31, 2006 in which fentanyl was detected on toxicological examination were received. Cases where fentanyl was used therapeutically in natural deaths were excluded from this analysis. Cases where fentanyl was present but the cause of death was a traumatic injury were excluded.

Analysis demonstrated a progressive increase in number of cases from three in 2000 to 51 in 2006. Deaths involving fentanyl typically occurred in the 3rd and 4th decade of life (average 40 years). There was a slight male predominance (about 60%), and 97% of the victims were white. There was significant geographic disparity in the data. There are four District Offices in Virginia, each office serving approximately 25% of the population. The relatively rural Western District had 51% of the fentanyl-associated death cases. The more urban Central, Eastern, and Northern Districts had 15%, 19%, and 15% of the cases respectively. Most of the deaths were classified as accidental (88%) with 10% suicidal and 2% undetermined.

Only 12% of the deaths in this study were caused by fentanyl alone. In the remaining cases other drugs were present and contributed to the death. The other drugs included prescription medications, street drugs, over the counter medications, and alcohol. Prescription medications were involved in 85% of the cases and included analgesics, muscle relaxants, and mental maintenance drugs. Prescription drugs were overestimated in this study since medications which may have been obtained illegally (i.e., oxycodone and methadone) were classified as prescription drugs. Morphine was classified as prescription unless 6-acetylmorphine was also present. Street drugs were involved in 14% of cases, over-the-counter drugs (acetaminophen, antihistamines, and dextromethorphan) in 8% and alcohol in 13%.

This analysis documents the marked increase (17-fold) increase in fentanyl-related deaths over the last six years. The observation that most of the deaths are associated with other drugs suggests a role for increased caution by physicians in prescribing fentanyl, especially in combination with other medications. Increased education of patients is essential with emphasis on the critical importance of using the medication as directed. Patients should also understand the danger of mixing fentanyl with non-prescribed substances such as street drugs, alcohol, and sedating over-the counter drugs.

Fentanyl, Drug Death, Epidemiology

G61 Deaths Involving Stress

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After attending this presentation, attendees will learn characteristics of traumatic and natural lesions identified in a series of cases presenting for medicolegal autopsy in which the medical examiner determined that stress played a role in death; will be able to evaluate the role of toxicology, history, and time course in determining the cause and manner of death in such cases; and will be able to evaluate impact of such characterization of cause and manner of death on courtroom testimony.

This presentation will impact the forensic community by demonstrating how to utilize a case format series to evaluate the common factors which should be present in order to assign stress a role in certification of medicolegal death. Discuss the appropriate manner in each of several cases of stress-related death.

Although most deaths presenting for medicolegal autopsy fall readily into the categories of natural, accident, suicide, and homicide, some deaths from natural disease appear to be influenced by stress, which raises the question of whether a manner of accident or homicide should be assigned to a death that is primarily from natural causes.

Stress as defined in these cases may include participating in an altercation, whether verbal or physical; suffering trivial injury, or nontrivial injury which is nevertheless not fatal; being afraid for one's life; fearing catastrophic outcomes to oneself or another; losing valued personal property during an assault; or undergoing poisoning with varying substances to a degree which should not be fatal, while under emotional stress from other causes.

Stress is a vaguely defined word which has been used in the media, in lay discussions, in psychology, in research, and in forensics. It has multiple overlapping meanings more than one of which may be utilized in a discussion, resulting in decreased communication clarity. Nevertheless the death of an individual during an emotionally violent incident from what appears to be natural disease, without sufficient trauma to explain death, may be difficult to describe without using the word stress.

Medical examiner opinion on the role of stress in such deaths varies. Some take the position that an influence as difficult to measure

as stress should not play a role in death certification. This series of cases from a five-year period in the Tidewater district of the Commonwealth of Virginia illustrates examples of deaths which the medical examiner felt were best certified with some reference to stress. The manner of death in these cases, as well as the relevant history, toxicology, autopsy findings, and scene investigation, is reviewed with an eye to developing some common factors which belong in the evaluation of a death that is at least partly attributed to stress.

Stress, Altercation, Death

G62 Investigation of Acute Oxymorphone (Opana® ER) and Ethyl Alcohol Intoxication

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After attending this presentation, the attendees would appreciate the significant impact of coordinated interdisciplinary approach in determining an acute oxymorphone (Opana) and ethyl alcohol intoxication.

The presentation will impact the forensic science community by reporting the limitations of ELISA methodology for screening detection of oxymorphone (Opana®).

Scene investigation, circumstantial information together with thorough autopsy/toxicology and ancillary studies constitute the triad of a competent medicolegal death investigation. Herein is described the death investigation of a 28-year-old Caucasian male, whose cause of death would be classified undetermined, had the systematic aforementioned principles not been applied. The case is characterized by astute police investigative efforts, competent scene recovery and awareness of synergistic drug effects between Opana®ER (oxymorphone) and ethanol. The decedent, accompanied by friends, participated in a celebration at a local bar prior to a major social event. Following a period of marked ethanol consumption, the decedent returned to a friend's house and retired. Approximately 6.5 hours later, attempts to awake the decedent were unsuccessful; he was found to be apneic and in asystole. Resuscitative efforts were initiated and ACLS protocols followed as the decedent was transported to a nearby emergency room. The decedent was pronounced shortly after arrival.

Autopsy findings revealed a well nourished, well developed 28-year-old Caucasian male, measuring 71 inches long and weighing 160 pounds. No external or internal evidence of trauma was detected. All body organs revealed weights within normal limits, with the exception of heavy lungs indicating severe pulmonary edema. Initial postmortem toxicology indicated non-fatal concentrations of ethanol at 0.11%, 0.14%, and 0.25% respectively in blood, vitreous humor, and urine. The scene investigation did not indicate an unsafe sleeping environment. Gross and microscopic examinations were negative for gastric contents or foreign body aspiration.

The cause of death remained undetermined until a second review and reassessment of the police investigation, including witness testimonies, raised suspicion for a drug-related event. In the area where the decedent had been sleeping, a broken 40 mg tablet of Opana®ER was found in a prescription vial on a shelf. The decedent's friend stated to police he never crushed or broke the prescription tablets. Further, the friend stated that on past occasion the decedent requested his medication for experimental use. The friend denied compliance with previous requests and no inquiry was made by the decedent the night of the party.

Additional toxicological studies included directed analysis for synthetic opioids by GCMS/SIM in blood and urine. The analysis revealed oxymorphone concentrations of 95 ng/mL and 214 ng/mL in blood and urine, respectively. The UMass Forensic Toxicology Laboratory employs ELISA technology, which includes a specific assay for oxycodone, in front line presumptive screening of postmortem blood.

Oxymorphone, a metabolite of oxycodone, exhibits limited cross reactivity in this assay (at a 50 ng/mL positive cut-off concentration for oxycodone approximately two and one-half times that concentration, or 130 ng/mL oxymorphone, is needed to elicit a positive response). The ELISA result for oxycodone was therefore negative.

The cause of death was certified as acute oxymorphone and ethyl alcohol intoxication. Most notably, the drug's manufacturer cautions contemporaneous use of alcohol since oxymorphone plasma concentrations may increase as much as 270% and causes fatal overdose. Similar to OxyContin®, crushing or breaking Opana®ER tablets defeats the extended release formulation and precipitates delivery of the drug's full dose into the blood.

This case underscores the significance of a coordinated, interdisciplinary approach to competent death investigations. Absent or superficial scene investigations, cursory or incomplete autopsy examinations, and inadequate toxicological studies can undermine accurate cause of death certifications.

Toxicology, Synthetic Opioids (Opana), ELISA

G63 Deaths During Police Chases

Jeffery J. Gofton, MD*, 901 North Stonewall, Oklahoma City, OK 73117-1218; and Wendy M. Gunther, MD*, Office of the Chief Medical Examiner, Tidewater District, 830 Southampton Avenue, Suite 100, Norfolk, VA 23510-1046

After attending this presentation, attendees will: (1) learn characteristics of traumatic and natural lesions identified in decedents presenting for forensic evaluation after dying during police pursuit, (2) will be able to evaluate the role of toxicology, behavioral history, and time course in determining the cause and manner of death, (3) and, will be able to distinguish injuries inflicted by police from accidental or suicidal injuries incurred during the course of police pursuit and evaluate impact of such recognition on courtroom testimony.

This presentation will impact the forensic community by assisting participants in recognizing significant characteristics of trauma and other features of deaths during police pursuit by analysis of a case format presentation.

Deaths occurring during police chases require special attention at forensic autopsy. A number of issues may be raised by death during police pursuits which are relevant to the cause and manner of death. Even issues which are not directly relevant to cause and manner may influence subsequent court decisions on police actions.

The primary issue in many cases is whether police actions directly caused death. In cases of police shootings, this is obvious; in car crashes, it may be far from obvious, so much so that the question has gone as far as the United States Supreme Court. In addition, the medical examiner may be presented with a decedent who was not the person police were chasing; passengers, innocent bystanders, and pedestrians have all been killed during police pursuit.

Death during pursuit is by no means only due to motor vehicle related trauma or police shootings. A decedent whose cause of death is clearly a gunshot wound may not have sustained it at police hands. Sometimes more than one officer has shot a decedent and the question arises of which bullet is most responsible for death. In cases where gunshot wounds are not responsible, the cause and manner of death may vary widely. Blunt force trauma or sharp force trauma such as canine bites may be identified. These injuries may have been inflicted by police, by accident, or by another. Such blunt trauma may be primary in death, contributing, or irrelevant. Other accidental means of death may supervene over police-inflicted injuries when suspects flee. The time course from initiation of police chase to death is also significant and may not always be what is expected. Deaths have occurred after police chase was called off that may nonetheless be related to the history of police pursuit.

In examination of all deaths during police pursuit, careful photographic documentation is essential along with a number of other methods of documentation only some of which are routine. Collection of trace evidence may require a higher level of care than is applied in routine cases. The medical examiner's experience and judgment as well as observations are essential to separate trauma significant in death from trauma not relevant to death, and to determine the likely origin of both kinds of trauma. For example, the medical examiner is called on to identify injuries inflicted directly by police from injuries sustained by accident or at other hands. Natural disease, intoxication with drugs and alcohol, and history of behavior such as previous flight from police or suicidal ideation prior to the incident, may all be relevant; each is likely to require careful assessment during the course of forensic evaluation. Familiarity with a variety of traumatic lesions that have occurred during police pursuits ending in death assists the medical examiner with resolving questions of police responsibility and authority, and with cause and manner of death.

This series of deaths during police pursuit provides a review of accidental, suicidal, natural, and directly police-inflicted deaths occurring over a five-year period in the Tidewater district of the Commonwealth of Virginia. The causes of death include single gunshot wound, multiple gunshot wounds, motor vehicle collision-related trauma, and drowning. The documentation of injuries and disease and the process of medical examiner reasoning which resulted in the determination of cause and manner of death are presented for each case.

Police Chase, Death, Forensics

G64 Variations on a Theme: Inhalant Abuse Related Fatalities in Central New York — An 11 Year Review

Abraham T. Philip, MD, Onondaga County Medical Examiner's Office, 100 Elizabeth Blackwell Street, Syracuse, NY 13210*

After attending this presentation, the attendees will be made aware of the epidemiology of the inhalant abuse related fatalities evaluated by the Onondaga County Medical Examiner's Office from 1998 to 2008.

This presentation will impact the forensic community by examining the variations in inhalant abuse related fatalities, and dispute the notion that it is usually a juvenile behavioral problem.

Inhalant abuse is the intentional or deliberate inhalation of chemical vapors, often a household product, to achieve intoxication. The commonly used chemicals are volatile solvents, aerosols, glues, paints, and lighter fluids. In inhalant abuse there is a progression from "Sniffing" - inhalation of vapors from an open container, to "Huffing" - inhalation of vapors holding a piece of cloth that has been soaked in volatile substance against the nose and mouth, to "Bagging" - inhalation from a plastic bag containing the desired substance. The prototypical inhalant abuser is a young male, between 10 and 15 years of age, indulging in inhalant abuse during school vacation times.

A study was conducted examining the inhalant related fatalities evaluated by the Onondaga County Medical Examiner's Office from 1998 to 2008, to obtain data about demographic characteristics; circumstances of the deaths; major autopsy findings; toxicology test results; and cause and manner of death (COD & MOD) formulations of these cases.

There were nine possible cases identified by the initial searches, of which two cases were deleted as not suitable for this study. Of the remaining seven cases (three female; four male) the mean age was 32.0 years and the median age was 21. There were three cases in 2002, two in 2007, and one each in 2005 and 2008. There was one case each in the months of January, February, April, June, and August and two cases in July.

Of the seven cases only one was the so-called prototypical inhalant abuser a 13-year-old male found with evidence of direct inhalation. The three female victims were aged between 18 & 21, while the remaining male victims were in the 4th and 5th decade of life. Besides the one case of direct inhalation, three cases had spray paint residue on the face, two cases had strong circumstantial evidence of inhalant abuse and in one case there was a past history of inhalant abuse. All cases below the median age had issues with scholastic performance and or depression. The cases above the median age had histories of illicit drug and alcohol abuse or psychiatric issues.

Toxicology was confirmatory in five (71%) of the seven cases. In one case the testing was limited by decomposition of the victim and in another case specimens were not submitted for an inhalant abuse test panel. The inhalant panel tests revealed 1-2 aromatic or halogenated hydrocarbons and or ketones including the following compounds with the following frequency noted in parenthesis: benzene (1), toluene (3), difluoroethane (1), and methyl ethyl ketone (2). Illicit drugs of abuse were identified in one case, lead was identified in the gasoline direct inhalation case and multiple medications (predominantly psychiatric) were identified in four (57%) of the seven cases.

In one case each the listed COD was: complications of solvent abuse; inhalation of toxic products of combustion and thermal injury; multiple drug intoxication; and laceration like incised wounds to the neck due to circular saw. In three cases the COD was: asphyxia due to (1) inhalant abuse, (2) spray paint, and (3) drowning as the cause of death. Inhalant abuse was listed in the contributory conditions of the drowning and neck trauma victims. The MOD in six cases (85.7%) was accident and one was suicide. A further review of the autopsy report determined that inhalant abuse (or variant terms) was mentioned in the summary of diagnostic finding. The cases in which the inhalant abuse was not mentioned included the victims of fire, drowning, and multiple drug intoxication.

Education and preventive efforts focused not just on teenagers, but targeted to older at risk adults, are required if inhalant abuse related fatalities are to be eliminated. Furthermore, clinical services should consider these findings to identify the at risk individuals.

Inhalant Abuse, Huffing, Bagging

G65 A New Framework for Guiding Research in Forensic Entomology: Improving the Science Relevant to PMI Estimates

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After attending this presentation, attendees will increase awareness of specific basic research needs essential for refining estimates of the period of insect activity (PIA) on human remains. Furthermore, attendees will be introduced to a needed differentiation of semantics intended to improve communication among forensic entomologists, other professionals of the forensic science community, members of the judicial process, and the general public.

This presentation will impact the forensic science community by presenting a new framework for describing the aspects of entomological activity associated with human remains. After attending this presentation, the attendees will understand the need for additional research examining neglected study foci related to the PIA, specifically the interval of activity prior to physical colonization. This presentation will raise attendee awareness to specific basic research needs essential for refining estimates of the PIA on human remains.

A major component of the nature and practice of forensic entomology is assisting investigators in determining the postmortem interval (PMI). To date, the initial time of colonization that begins the defined post-colonization interval (post-CI), and includes arthropod occupation and use of the remains, has been the most relevant information for entomologically-based PMI estimates, which is concisely defined as the PIA; however, the time between death but before initial insect colonization is also a portion of the PIA and is important for cases that require accurate estimates within hours after death. For this presentation, this portion of the PIA is defined as the pre-colonization interval (pre-CI).

The pre-CI encompasses the portion of the PIA from time of death until initial physical colonization and use by insects for consumption or oviposition. Most studies that address the pre-CI have focused on nocturnal oviposition, but few have addressed other processes that influence initial insect contact and early colonizer oviposition; most notably measurable behavioral characteristics that are influenced by both biotic and abiotic factors in the environment. In addition, there is tremendous variation in the length of time and faunal succession characteristics of insect activity on a body. The interface of the pre-CI and the post-CI is defined by the time when arthropods physically colonize and begin using the human remains as a resource; as an oviposition site, habitat for finding prey or primary consumption of tissues. This interface is preceded by an acceptance phase defined by behavioral patterns of body detection and evaluation for full colonization. The acceptance phase of the pre-CI has been all but unstudied to date, but can affect estimates of the PIA. In the current state of knowledge regarding the PIA, limited scientific information can lead to interpretative differences among forensic entomologists.

The pre-CI in general, and the acceptance phase in particular, are broad areas of forensic entomology research that have been neglected, and require more rigorous and repeatable experimental design necessary to improve the entomological information relevant to total PIA, and consequently further refinement of PMI estimates. However, a common language and framework among forensic entomologists is necessary to facilitate and guide this research. To this end, a new conceptual framework is introduced to identify areas of needed forensic entomological research and propose standard terms when discussing entomological data used in investigations involving PMI estimates. This framework divides the PMI into logical components from death to body discovery including but not limited to the following: death to initial insect detection of the decomposing body (pre-CI exposure phase); the time from detection to location of the body (pre-CI detection phase); the time from body location to first oviposition (pre-CI acceptance phase); and, the time from insect colonization of the body to discovery of the remains (post-CI).

This framework identifies specific areas of research within each of these entomological phases that involve the behavioral and physical stages of insect activity on a body, and suggests which abiotic and biotic factors influence these entomological processes that can be of focused and applied studies. It is the intention of the authors to facilitate a common language and conceptual structure to improve the science of forensic entomology, an important consideration for aiding criminal investigations involving estimates of the PMI. Accordingly, this platform is used as a method for developing a common path leading from basic to applied research in the field of forensic entomology.

Forensic Entomology, Arthropod, Insects

G66 The Activity of *Calliphora vicina* (Diptera: Calliphoridae) Can Alter the Morphology and Presumptive Chemistry of High Impact Bloodstains

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After attending this presentation, attendees will have a better understanding of fly artifacts, their importance when interpreting and reconstructing a crime scene, and practical applications in locating and identifying fly artifacts.

This presentation will impact the forensic community by increasing knowledge of outside influences, specifically *Calliphora vicina*, on crime scenes and the means of using this knowledge to make more accurate scene reconstructions.

The study being presented examined the effect of *Calliphora vicina* on high impact bloodstain patterns and to test presumptive blood tests that could be used to differentiate between blood spatter and fly artifacts.

The experiments were conducted in microscenes (.46 m³ wooden boxes) that had two walls of glass and a ceiling of plexiglass to facilitate observation and photography. Interchangeable inserts were made to allow for surface changes in the microscenes. Surfaces used in this study were combinations of indoor materials commonly found at crimes scenes. Combinations of white linoleum with white textured and painted walls (Combination 1), wood floor laminate with a wallpapered wall (Combination 2), and mid-grade carpet with light hued paneling (Combination 3) were used to demonstrate surface texture and its effect on the flies' ability to feed and deposit artifacts. High impact bloodstains were made from fresh (within 5 minutes of drawing) human blood on two walls and a pool was formed on the floor. The flies were placed in holding cages that attached to the microscene. This design provided an opportunity for the flies to choose to enter the microscene. Flies entered the microscene within 30 minutes with combinations 1 and 2. They entered the microscene within 60 minutes with combination 3. The flies remained in the microscenes for 48 hours. After they were removed, measurements, photo documentation, and presumptive chemical tests were performed. Four commonly used presumptive blood tests were used: phenolphthalein, Hemastix®, leucocrystal violet, and fluorescein.

The deposition of artifacts was evenly distributed between floor and wall surfaces within a microscene. Both male and female flies fed on the blood and deposited artifacts. Artifacts could range from completely clear, consisting mainly of water, to completely opaque, consisting mainly of blood. Regurgitation was the most common method of deposition, but defecation did occur. Regurgitated artifacts were generally small, 1-2 millimeters, with little or no tail. Defecated artifacts were of similar size to the regurgitated but generally had a tail from a few to over 20 mm in length.

There was no difference in reaction time between blood spatter and artifacts when using phenolphthalein, Hemastix®, and fluorescein. The reactions times with leucocrystal violet were generally similar although increased reaction time was seen in some instances. Artifacts that consisted of less blood fluoresced under a blue/green light when viewed through an orange filter without chemical enhancement.

Forensic Entomology, Insect Artifacts, Blow Fly

G67 Rehydrating Dried Blow Fly Larvae to Reclaim Their Usefulness in Forensic Investigations

Michelle R. Sanford, MS*, Jennifer L. Pechal, MS, and Jeffery K. Tomberlin, PhD, 2475 TAMU, Department of Entomology, Texas A&M University, College Station, TX 77843

After attending this presentation, attendees will learn methods for rehydrating dried larval insect specimens. The impact that initial preservation coupled with drying and rehydrating of larval specimens on their length and weight as it relates to estimating period of insect activity also will be discussed.

This presentation will impact the forensic community by demonstrating how studies on methods development in forensic entomology can benefit the forensics community by being used to define protocols and standard operating procedures that can be cited and used in legal proceedings.

Ethanol is commonly recommended for preserving larval blow fly specimens in forensic investigations. Alcohol is a volatile preservative that can evaporate over time resulting in the dehydration of larval specimens or the creation of *crispy maggots* which are difficult to identify and unreliable for measurements for age estimation. In this study methods recommended for rehydrating dried museum specimens were adapted and applied to *crispy maggots* of three common North American blow fly species (*Phormia regina* (Meigen), *Cochliomyia macellaria* (Fabricius), and *Chrysomya rufifacies* (Macquart)). Length and weight of the specimens were documented throughout the process. The effect of initial preservation method was also observed by collecting replicate samples and preserving in 80% ethanol, 70% isopropyl alcohol, or with fixation by hot water killing followed by preservation in 80% ethanol. Third instar larvae were collected over the course of nine months from different animal carcasses used for teaching the Texas A&M University forensic entomology course. Individual third instar larvae from each species (n = 90/species) were measured and weighed before the preservative was allowed to evaporate. Rehydration was attempted by soaking overnight in 80% ethanol, a commercial trisodium phosphate substitute solution, or 0.5% trisodium phosphate solution after which specimens were again measured and weighed. Analysis of length and weight data with analysis of variance showed that for each species the impact of rehydration and the impact of the interaction between initial preservation and rehydration treatment significantly affected final rehydrated length and weight among the different species.

For all specimens, soaking in any of the rehydration treatment solutions restored a portion of the original larval length (mean percent difference initial–final across all species and preservatives: 80% ethanol: -10.6%; trisodium phosphate: -2.9%; trisodium phosphate substitute: 1.1%) but none of the solutions were able to restore original larval weight. The original larval length and the final rehydrated larval length were used to estimate larval age using published data sets. These estimates agreed within a few hours in many cases with individual preservation by rehydration treatment combinations more closely agreeing for some species than others. A comparison between the length-based larval age estimate and the known duration of the exposure of the animal carcasses revealed that there were large differences (percent difference between estimated and actual exposure: *P. regina*: 74% lower than actual; *C. macellaria*: 51% lower than actual; *C. rufifacies*: 150% higher than actual) which probably reflect delays in, and barriers to, colonization coupled with differences in tissue types used in published studies and this experiment.

Overall the data show that *crispy maggots* can be rehydrated and suggest that their length can be measured to obtain a length-based age estimate for period of insect activity estimates. Knowledge of the initial preservation method might also aid in selecting the most appropriate rehydration method.

Studies on methods development in forensic entomology can benefit the forensic sciences community by being used to define protocols and standard operating procedures that can be cited and used in legal proceedings.

Diptera, Method, Length

G68 Patterns of Adult Blow Fly Attraction to Carrion Over Time

Rachel M. Mohr, MS*, and Jeffery K. Tomberlin, PhD, Department of Entomology, Texas A&M University, 2475 TAMU, College Station, TX 77843-2475

After attending this presentation, attendees will better understand about the length of time between the exposure of carrion to adult blow flies and the onset of fly attraction to that carrion. Attendees will also learn about the physiological age profile of adult flies attracted to carrion over time.

This presentation will impact the forensic community because it helps better quantify the length of time between exposure of a cadaver and the onset of insect colonization.

This presentation is intended to educate attendees about the length of time between the exposure of carrion to adult blow flies and the onset of fly attraction to that carrion. Attendees will also learn about the physiological age profile of adult flies attracted to carrion over time.

This information is significant for the forensic sciences community because it helps better quantify the length of time between exposure of a cadaver and the onset of insect colonization.

Forensic entomology's most common application is to calculate the length of time that a cadaver has been deceased, the total postmortem interval (PMI). Most commonly, what is actually calculated is the duration of immature insect inhabitation of the cadaver, based on the known growth rate of particular insect species - what the authors are terming the post-colonization interval (post-CI). Little attention has been paid to the time between exposure of a body to insect activity and the onset of oviposition, and in this research, termed as the pre-colonization interval (pre-CI). However, under appropriate conditions such as a very fresh cadaver, or when high temperatures lead to rapid decay, the pre-CI may represent a substantial portion of the total PMI. Adequately characterizing the behavior of the adult fly, particularly as a function of cadaver age and ambient temperature, could greatly assist entomologists in calculating the total period of all insect activity on a cadaver.

Insects arrive at a cadaver in relatively predictable succession patterns. Blow flies tend to arrive very early in the succession pattern, often within 24 hours postmortem. Adult flies found around a very fresh cadaver are usually presumed to oviposit shortly after locating it. However, since most blow flies require a protein meal in order to produce eggs, young flies may visit a cadaver long before they are capable of ovipositing. The process of producing eggs by depositing vitellin (yolk protein) into the immature ovarioles allows the physiological age of flies to be determined. By determining the ovarian status of flies, and the patterns of the groups' relative carrion usage, it can be accurately assessed how long postmortem oviposition-ready flies are found at a cadaver. The rate of ovarian development is largely dependent on fly metabolism, which in turn is significantly influenced by temperature. The higher the temperature, the faster ovaries develop, so long as the fly has obtained adequate dietary protein. Therefore, temperature is an important factor to track when estimating either the rate of ovarian development or simply the overall physiological age.

Experiments were performed evaluating the attractiveness of carrion to the common early-arriving blow flies, *Cochliomyia macellaria* (Fabricius) and *Chrysomya rufifacies* (Macquart). Pigs were killed by cranial stunning, and placed in an open field within one hour of death. At hourly intervals between dawn and dusk of the next 72 hours, ambient

temperature observations were made, and adult flies were collected from the carcasses. Flies were identified to species and sexed. All flies were weighed and placed in different weight classes. Female flies were dissected, and their ovarian developmental status determined in order to place them into five separate age groups. The post-CI and behavior pattern was evaluated for each group. The post-CI of each age group will be discussed in relationship to temperature. Complicating or retarding environmental factors will also be discussed, as well as the limitations of the findings. However, the results of this study are expected to be useful in improving the accuracy of entomologically derived postmortem intervals. Furthermore, this research shows the importance of collecting adult insects as well as immatures at a body recovery site.

Forensic Entomology, Blow Flies, Postmortem Interval

G69 The Effect of Soil Compaction on Pupation Depth of *Lucilia sericata* in Soil

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After attending this presentation, attendees will understand the effect that soil compaction has on the burrowing ability of post-feeding third instar larvae of *Lucilia sericata* (Meigen) (Diptera: Calliphoridae) searching for a pupation site.

When paired with information from post-feeding larval dispersal studies, this information will impact the forensic sciences community by aiding investigators in locating entomological evidence at a body-recovery scene.

After attending this presentation, attendees will understand the effect that soil compaction has on the burrowing ability of post-feeding third instar larvae of *Lucilia sericata* (Meigen) (Diptera: Calliphoridae) searching for a pupation site. When paired with information from post-feeding larval dispersal studies, this information will impact the forensic science community and humanity by aiding investigators in locating entomological evidence at a body-recovery scene. Information from this study also can be used to decipher the relationship between ambient temperature and soil temperature to better determine development of insects that have dispersed from human remains and burrowed into the soil to pupate. This information will allow for a more precise estimate of the period of insect activity (PIA) as it relates to the time since initial insect colonization, or post-colonization interval (post-CI).

Locating the oldest insects that develop on human remains is crucial for accurate analysis of entomological evidence. If the remains are in a late stage of decomposition, fly larvae from the first sere of succession might have left the remains and pupated in the surrounding soil. If this has happened, a PIA estimate based on fly larvae collected from the remains will not accurately represent the post-CI. Therefore, investigators must be able to locate flies that have pupated in the soil to obtain an accurate post-CI.

In this study, post-feeding third instar larvae of *L. sericata* were allowed to burrow into soil of different compactions. After adult emergence, the depth in the soil of empty puparia was recorded. Time from egg to adult emergence also was recorded. Results from this research will generate a standard operating procedure for collecting fly puparia in soil at a body recovery scene, as well as evaluate development

times of these insects in soil when using development data from previous laboratory studies.

The utility of *L. sericata* in forensic entomology has long been recognized. It is an early colonizer of decomposing remains, occurring in the first sere of succession. Due to its nearly cosmopolitan distribution, it has been widely studied in many locations worldwide, and can be considered a laboratory model for forensic entomology research. *Lucilia sericata* has been studied for its forensic implications in the context of temperature-related development, entomotoxicology, molecular identification, and now pupation behavior.

Entomology, Pupation, Soil

G70 Feeding Patterns of American (*Periplaneta americana*) and German (*Blattella germanica*) Cockroaches on Pig Skin

Lindsay A. Bright*, 1500 Olympia Way #12, College Station, TX 77840; and Jeffery K. Tomberlin, PhD, and Roger Gold, PhD, Department of Entomology, TAMU 2475, College Station, TX 77843-2475

After attending this presentation, the attendees will understand the characteristics of *Periplaneta americana* (Linnaeus) (Blattodea: Blattidae) and *Blattella germanica* (Linnaeus) (Blattodea: Blattellidae) feeding sites on epidermal tissue.

This presentation will impact the forensic sciences community by educating attendees about cockroach feeding on human remains and variables that can affect their associated feeding behavior.

Cockroaches are voracious consumers of a wide variety of organic material and debris. They are also commonly found in and around human dwellings. Consequently, it is not uncommon to discover human remains exhibiting signs of cockroach feeding. Because cockroaches tend to feed on just the top layers of epidermis, their bites and feeding sites closely resemble second degree burns or abrasions. Postmortem injuries caused by cockroach feeding are often misinterpreted as antemortem injuries which can lead to the suspicion of foul play even when none exists.

The American and German cockroaches are two of the most common species of cockroach found in residential areas. The differences in feeding behavior between these two species of cockroach have not been characterized. Consequently, it is currently not possible to determine which species fed on a given set of remains. Furthermore, no information is available about the effects of temperature or population size on the feeding habits of either species.

Studies were conducted to observe the effects of temperature and population size on the feeding behavior of both American and German cockroaches. Pig epidermal tissue was used as a substitute for human epidermis. All cockroaches were starved for 24 h prior to the study and cockroaches not used in previous trials were obtained for each replicate. In order to understand the effects of population size on feeding behavior, 100, 150, or 200 American and German cockroaches were exposed to a 124.63 cm² area of pig epidermis for 48 h. The experiment was conducted at 27°C RH 80±10% and a photoperiod of 12:12 [L:D] h. Pig epidermal tissue exposed to each species was examined individually and not in mixed cultures. The effects of temperature on feeding behavior were tested using groups of 150 American or German cockroaches. One hundred and fifty individuals of each species were kept in growth chambers maintained at 15°C, 21°C, or 27°C. All growth chambers had RH 80±10% and a photoperiod of 12:12 [L:D] h. Pictures of the pig skin from both studies were taken with a digital camera every 6 h for 48 h. Feeding sites were identified and measured using SigmaScan Pro 5, and percent area damaged due to cockroach feeding was determined.

According to these studies, the amount of epidermis damaged due to cockroach feeding was positively correlated to both density and temperature. Epidermis that was exposed to 200 of either species of cockroach was damaged far more than skin exposed to lesser densities. Both American and German cockroaches showed very little feeding activity at 15°C, suggesting a minimum temperature for feeding. At 27°C, both species of cockroach consumed the most area. It is anticipated that the outcome of these studies will be useful in better identifying and understanding the interactions between anthropophagous roaches and humans in forensic investigations.

Cockroach, Insect Feeding, Epidermis

G71 Attraction of Two Forensically Important Fly Species: *Chrysomya rufifacies* (Macquart) and *Cochliomyia macellaria* (Fabricius) to Inter- and Intraspecific Eggs

Adrienne L. Brundage, MS*, Texas A&M University, 2001 Cobblestone Lane, Bryan, TX 77807; and Jeffery K. Tomberlin, PhD, Texas A&M University, Department of Entomology, TAMU 2475, College Station, TX 77843-2475

The goal of this presentation is to elucidate the attractive mechanism of inter- and intra-specific eggs to two forensically important fly species: *Chrysomya rufifacies* (Macquart) and *Cochliomyia macellaria* (Fabricius). The evolutionary relationship between the two species will also be discussed, as well as the potential for this information to elucidate mechanisms used to initiate colonization of a resource by blow flies at the conclusion of the pre-colonization interval (pre-CI) which is described below.

This presentation will impact the forensic sciences community by: (1) explaining the importance of the pre-CI when attempting to estimate time of colonization, (2) examining the biology of, and interactions between, two forensically important fly species, *Chrysomya rufifacies* and *Cochliomyia macellaria*, and (3) investigating one possible mechanism triggering and/or inhibiting their oviposition on a resource.

Carrión represents a temporary and ever-changing habitat and food source for a wide variety of organisms. Previous studies indicate the first macrobiotic decomposers to discover ephemeral resources include blow flies (Diptera: Calliphoridae). However, their arrival does not necessarily translate into immediate colonization of the remains. Therefore, the period of insect activity (PIA) is broken into two portions. The pre-CI is from the time of death until arrival of arthropods on the corpse. The post-colonization interval is from colonization of the remains until discovery. Colonization can be defined as utilizing a resource as a habitat or for offspring development.

Blow flies arrive in predictable patterns and are present for a predictable time interval depending on abiotic and biotic factors. These primary colonizers may colonize carrión within hours of death. The act of colonization starts a “biological clock” and given the collective knowledge of blow fly biology, it is possible to determine the post-CI of the PIA. Since the majority of blow fly species do not colonize living tissue, exposure interval of the remains may be synonymous with the post-CI or minimum postmortem interval (PMI). In some instances estimates of the post-CI are analogous to the PMI.

The accuracy of estimating the pre-CI along with the full PIA may provide greater understanding of the period of exposure of the remains and more accurate estimates of the PMI. While a great deal is known about a few species of forensically important arthropods, much more research is needed. The community of necrophagous insects differs between habitats and between geographical areas. These differences mean that general successional and life history studies may be of some use to all forensic entomologists, but accurate PIA is dependent upon

intimate knowledge of the community makeup, specific successional patterns, and life histories of forensically important flies common in the area of the crime.

Ten forensically important species have been collected in Brazos County, Texas, USA and deserve further investigation: *Calliphora livida*, *C. vicina*, *Cynomyopsis cadaverina*, *Lucilia cuprina*, *L. eximia*, *L. coeruleiviridis*, *Cochliomyia macellaria*, *Chrysomya rufifacies*, *C. megacephala*, and *Phormia regina*. Of these, *Cochliomyia macellaria* and *Chrysomya rufifacies* dominate the maggot mass during the warmer months, and are therefore important in time of colonization estimates.

Recent studies have characterized an ovipositional phenomenon in a family closely related to blow flies. Female *Musca domestica* (Linnaeus) (Diptera: Muscidae) utilize bacterial volatiles present on conspecific eggs to mediate oviposition preference. Due to the ubiquity of bacterial symbionts in the insect realm and the related life histories of Muscidae and Calliphoridae, this same oviposition mechanism may be present in forensically important blow flies, and may therefore be important to the post-CI. The current study was designed to test volatiles emitted from Calliphoridae eggs.

In this study, the attractiveness of inter- and intraspecific eggs to adult flies was investigated. A y-tube was used to present individual males and females of each species with a choice between egg clusters of each species and blank controls, and the preference recorded. The results help elucidate the mechanism for oviposition choice and timing, and help characterize the pre-colonization interval.

Entomology, Diptera, Calliphoridae

G72 Effects of Resource Age and Sterilization on the Attraction of *Cochliomyia macellaria* (Fabricius) and *Chrysomya rufifacies* (Macquart)

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After attending this presentation, attendees will understand the attraction of two forensically important blow flies, *Cochliomyia macellaria* (Fabricius) and *Chrysomya rufifacies* (Macquart) (Diptera: Calliphoridae), to different resources. This presentation will also serve to educate attendees about the roles bacteria on dead tissue serve to attract flies.

This presentation will impact the forensic community by demonstrating the need to exercise caution in estimating the period of insect activity (PIA) because of the different rates of colonization by different species. By understanding differences in colonization between species, more accurate period of insect activity (PIA) estimates may be developed.

C. macellaria and *C. rufifacies* are two species of forensically important blow flies whose interaction is important to understanding both their behavior and their impact as evidence in forensic investigations. When both species are present on decomposing animals or bodies, *C. rufifacies* larvae commonly prey on *C. macellaria* larvae. Furthermore, studies on carrión succession suggest that *C. macellaria* is a primary colonizer of carrión, while *C. rufifacies* is a secondary colonizer. However, these studies have all provided only anecdotal conclusions about their colonization behavior.

Blow flies locate carrión primarily through odor signals given off by the decomposing tissue which combine with visual cues to attract flies to a resource. Female flies use these signals to locate the most suitable oviposition location. The aim of this study was to examine the preference of *C. macellaria* and *C. rufifacies* for resources at different

ages of decomposition; to determine if fly preference is due to the microbial content of the resource; and to determine if bacteria isolated from the resource is attractive to blow flies.

A Y-tube olfactometer was used in these experiments. In the first experiment, males and females of both species were allowed to choose between fresh and 3-day old beef liver. The second experiment consisted of testing the preference between sterile and non-sterile beef liver of different ages. In the final experiment, both species were given the choice between sterile nutrient agar and agar colonized with bacteria from the liver. Initial choice, choice after 5 minutes, and residence time at each resource was recorded in each experiment.

Chi-square analyses of the data indicate no significant preference in either species to a resource based initial response. Therefore, final response (i.e. after 5 minutes) was tabulated. *C. macellaria* and *C. rufifacies* exhibited significant preference for fresh liver and 3-day old liver, respectively. Closer analyses of the data indicate males of both species demonstrated a significant preference, but females did not. For experiment two, neither initial nor final choice showed a significant difference between species. Finally, neither species exhibited a significant preference between sterile agar and agar treated with bacteria.

T-test analysis of residence time provided similar results to those determined with the Chi-square tests. Both species spent a significant amount of time at a particular resource. *C. macellaria* resided a significant amount of time on fresh liver while *C. rufifacies* had a greater residence time on 3-day old liver. Additionally, both species spent a significantly greater amount of time on the bacteria and agar than on the sterile agar.

The results from the first experiment support the assumptions that *C. rufifacies* is a secondary colonizer and *C. macellaria* is a primary colonizer. While only anecdotal information was previously available, the data collected in these studies provide a better understanding of the behavior of these blow flies. In some cases, succession data are used to estimate the PIA. For instance, these data are useful in the case of predicting sequence of colonization by *C. macellaria* and *C. rufifacies*. Data from the studies indicate that odors from decomposing remains as well as associated bacteria might be regulating attraction and colonization by these species.

Forensic Entomology, Blow Flies, Period of Insect Activity

G73 Factors Affecting the Rate of Decomposition of Pig (*Sus scrofa*) Carcasses During a Period of Drought in Southern-Western Australia

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After attending this presentation, attendees will have an understanding of the factors which affect the rate of decomposition of pigs in southwestern Australia. These decompositional data can be used to better understand the factors which affect decomposition of a human body.

This presentation will impact the forensic sciences community by illustrating the factors which will affect the time since death estimations used by law enforcement agencies. These factors will significantly affect a body exposed to environmental variables for any amount of time in Western Australia. The experimental methodology can be utilized in other parts of the world to determine the impact of local environmental factors on the rate of decomposition.

Estimation of time since death is an important factor in forensic investigations and the state of decomposition of a body is a prime basis for such estimations. Environmental factors have been shown to have a significant influence on the rates of decomposition; these factors can include temperature, solar radiation, rainfall, humidity, physical placement, coverings, and scavenging activity. Many studies have documented and quantified the influence of such factors on the decomposition stages of human bodies and pig carcasses which serve as models of human bodies in North America. However the application of these types of investigations to an Australian environment is still rare. This study provides a quantitative analysis of the impact of environmental factors on the rate of decomposition of exposed pig carcasses in the southern region of Western Australia surrounding the capital city, Perth. Pig (*Sus scrofa*) carcasses of approximately 45 kg were placed in four different environments including native bushland and suburban agricultural land. The carcasses were not protected and had trauma from the headbolt or rifle shot to the skull. The decompositional process was monitored using time-lapse image capture from an infrared camera. Monitoring was conducted for 24 hr cycles until the carcasses reached the skeletonization stage of decomposition. The images were viewed to determine the stage of decomposition and to identify any animal necrophagric activity. Weather data were collected for each location which included temperature and rainfall. This research found that temperature was the most influential factor in determining rates of decomposition with summer having significantly faster rates than any other season. While winter had the slowest rates of decomposition it was also the season with significantly higher levels of rainfall. Scavenging by native and introduced animals significantly affected the rate of decomposition in the cooler months of the year but had no significant impact in the warmer months. The lack of rainfall in all seasons except winter made statistical analysis inconclusive as to the significance of rain on the rate of decomposition. During these experiments, southwestern Australia was experiencing one of the greatest periods of drought in recorded history. Therefore the research examines both the decompositional rates in Western Australia and these rates in periods of drought.

This presentation will include methodology which can be used in other locations throughout the world to replicate the experimentation as well as the results of the study illustrating the importance of such research.

Decomposition, Taphonomy, Western Australia

G74 Associative Learning of *Cochliomyia macellaria* in Response to Larval Resource: Inter- and Intraspecific Resource Interaction, and Presence of Inter- and Intraspecific Larvae on a Resource

Stacy A. Boatright, BS*, 2304 Cornell, College Station, TX 77840; and Jeffery K. Tomberlin, PhD, Department of Entomology, TAMU 2475, College Station, TX 77843-2475

After attending this presentation, attendees will understand the concept of associative learning as it pertains to the blow fly, *Cochliomyia macellaria*. Experiments assessing adult blow fly response to its larval food resource, exposure of both intra- and interspecies to a food resource, and the presence of both intra- and interspecies larvae on a food resource were examined.

This presentation will impact the forensic science community by being the first to assess the importance of blow fly biology as it pertains to the pre-colonization interval (pre-CI) in a forensic investigation.

The pre-CI is the portion of the period of insect activity (PIA) prior to colonization of a food resource. The location phase begins when the insect detects a body and is more than likely governed by volatile odors

not only from the corpse itself, but also from other adult blow flies and their larvae present on the corpse. The acceptance phase begins when the insect first makes physical contact with the food resource. Understanding blow fly behavior under various conditions might allow for more concise estimates of the pre-CI of a body; the current study assesses *C. macellaria*'s behavioral response to three such conditions.

The first experiment addressed whether *C. macellaria* adult flies will be more attracted to food resources on which they were raised. An abundance of *C. macellaria* eggs was gathered from pre-existing colonies and randomly distributed between bull testicles and beef liver and kept under the same conditions. Once the flies reached the adult stage, they were only provided with water and a powdered milk and sugar mixture *ad libitum*. Beginning on the seventh day post-emergence, seven testicle-fed males and seven testicle-fed females were placed individually in a Teflon dual-choice olfactometer and their response to the resources provided recorded; likewise, seven liver-fed males and seven liver-fed females were examined under the same circumstances. Testicles were placed in containers connected to the dual-choice olfactometer, while liver was placed in the other. Resources were rotated between arms with each replicate. The olfactometer was also cleaned between sessions. This regime lasted for five consecutive days. The goal was to determine whether or not adult flies would associate with the odors of the source on which they were raised, thus "choosing" that particular resource.

The second experiment determined whether *C. macellaria* flies are equally attracted to a food resource that has been exposed to adults of the predatory species, *Chrysomya rufifacies*. An equal number of male and female *C. macellaria* were kept in one cage, while an equal number of male and female *C. rufifacies* were kept in a second cage, under the same conditions. Containers of beef liver were introduced to each cage, and one from each of the cages was removed every 24 hours for five consecutive days. Once one 24-hour exposed container was removed from each cage, they were connected to separate arms of the dual-choice olfactometer. Five female and male *C. macellaria* adults were tested to see whether they were deterred from the liver that had been exposed to *C. rufifacies*. Other containers of liver were exposed to each of the fly species colonies for 72-hour time intervals, at which point they were also used in the olfactometer. All *C. macellaria* adults used in this experiment were reared on beef liver.

The third experiment assessed whether the presence of intra- and interspecies larvae affected *C. macellaria*'s attractiveness to a food resource. This study is applicable to forensics because it addresses whether or not *C. macellaria* adults are less likely to lay their eggs on a cadaver that has already been infested with the predatory species, *C. rufifacies*. A similar experimental design with the olfactometer as described previously was used in this study. One container of beef liver containing third instar *C. macellaria* maggots and one container of beef liver colonized by *C. rufifacies* maggots were placed at the arms of the olfactometer. Five *C. macellaria* adults from each sex were tested for five consecutive days.

These experiments are the first to assess the importance of blow fly biology as it pertains to the pre-CI in a forensic investigation. In other words, the current experiments take into consideration a variety factors which may influence the colonization of a food resource by the blow fly, *C. macellaria*.

Forensic Entomology, Period of Insect Activity, Associative Learning

G75 Attraction and Repellance of Blow Flies to Intra- and Interspecific Fecal Bacteria

*Melinda K. Dooley**, and *Jeffery K. Tomberlin, PhD, Department of Entomology, TAMU 2475, College Station, TX 77843-2475; and Adrienne L. Brundage, MS, 2001 Cobblestone Lane, Bryan, TX 77807*

After attending this presentation, attendees will have a greater understanding of the conspecific and interspecific interactions of blow flies: specifically, the role of fly feces and related bacteria on the attraction and repellence of forensically significant blow flies (Diptera: Calliphoridae).

This presentation will impact the forensic community by improving understanding of factors that can affect attraction and oviposition of two of the most common blow flies in the summer in the southern United States, *Cochliomyia macellaria* (Fabricius) and *Chrysomya rufifacies* (Macquart).

The most important duty of the forensic entomologist in a death investigation is to provide an estimate of the time of colonization, or period of insect activity (PIA) which translates into a minimum postmortem interval (mPMI). Blow flies are the most significant insects in death investigations because known patterns of larval development allow entomologists to determine how long a corpse has been colonized. As blow flies generally only oviposit on a body after death occurs, the amount of time that has passed since eggs were laid is the minimum length of time for which the victim has been dead. However, flies may not oviposit immediately at the instant of death. Rather, there are elements that delay oviposition, especially in *C. rufifacies*, which has been observed to arrive at the scene of death first, but only oviposit after other species such as *C. macellaria*. These elements may include quality or decomposition of the resource, the presence or lack of certain bacteria, or conspecific and interspecific signals left in the secretions of flies.

In this study, fly specks were gathered from recently emerged *C. macellaria* adults. A saline solution of the fecal matter was grown on nutrient agar, and the resulting bacteria were cultured and used in preference testing via Y-tube olfactometry. Based on odor alone, fecal bacteria do not produce volatiles strong enough to attract or repel adult flies of either species. However, certain signals must be present to trigger the beginning of oviposition of these two species on their respective timetables.

C. macellaria are typically one of the first species to colonize a resource in the southern United States. However, a few days after death, the majority of maggots on a body may be *C. rufifacies*. Although this species is often one of the first to arrive at a scene of death, adult females will wait to oviposit until after other fly species have begun to colonize the resource. It is possible that the presence of maggots of primary colonizers such as *C. macellaria* somehow prepares or alters the resource, improving the viability of the later-colonizing *C. rufifacies*. The adult *C. rufifacies* may be waiting for some signal that the resource has been colonized by other species before beginning oviposition, and this study investigates the role that *C. macellaria* feces and related bacteria may play in that signaling process.

By increasing understanding of what delays and triggers oviposition on a body, improved estimates of pre-colonization intervals will lead to more accurate estimates of the PMI.

Blow Fly, Postmortem Interval, Oviposition

G76 Three Dimensional Polygonal Model Visualization of *Lucila sericata* From SEM and Stereomicroscopic Data

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After attending this presentation, participants will be able to understand how a true color, three dimensional polygonal model visualization of *Lucila sericata* can be produced from SEM and stereoscopic photomicrograph data.

This presentation will impact the forensic sciences community by providing a tool for better anatomical training methods of forensically important insect species.

Blow flies (Diptera: Calliphoridae) are a cosmopolitan group of insects and often the first to colonize human remains. Therefore, they are often collected as evidence. Analysis and prediction of their age often is interpreted as the period of insect activity (PIA). However, in order to utilize any insect collected from human remains as evidence, they must first be identified. Skills necessary for identifying these insects are gained primarily through courses taken while in college, graduate school, or workshops. Primary information utilized for identifying these insects is found in texts or research publications. These sources contain detailed taxonomic information about each of these species which enables their identification. However, few resources are available that provide three-dimensional imagery for teaching or identification purposes. For this reason, a highlydetailed three-dimensional polygonal model of the species has been created. The creation of an anatomical training tool that can be utilized by any age group would significantly increase the awareness of discipline-specific species. While utilizing two different diagnostic microscopes (i.e. scanning electron microscope (SEM) and dissecting microscope), a better understanding of the anatomical characteristics and landmarks can be understood. The issue becomes, who else can benefit from the data acquired? Usually the investigator is the only individual to benefit. From this stereoscopic data, an accurate three dimensional polygonal model was created using computer software forming the basis of the three dimensional investigational/visualization tool. By combinatorial investigation, a tool can now be utilized by everyone in the form of three-dimensions, true color, high-definition imagery and movies. This proposed model is the first investigational process utilizing both stereoscopic photomicrographs and SEM data to generate a specie-specific three-dimensional polygonal model. *Lucila sericata* is a green bottle fly that is common throughout the United States during the warmer months of the year and has been used in many studies to understand the biology and ecology of blow flies in general. Therefore, this species was selected for the study.

This study is also important because it allows forensic entomologists to better communicate blow fly anatomy to a wide array of sciences including but not limited to pathology. The end result, a three dimensional visualization of the blow fly, offers a compelling tool for teachers at all levels to introduce entomology in the classroom. This concept will continued to be investigated for a further detailed polygonal model, and to include other forensically significant species.

***Lucila sericata*, Visualization, SEM**

G77 An Unusual Case of Homicidal Chest Trauma Using a Golf Club as a Weapon

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The goal of this presentation is to describe and discuss an unusual case of homicidal chest trauma caused by a single blow to the chest with a golf club that was used as a weapon.

This presentation will impact the forensic sciences community by demonstrating an unusual mechanism of chest trauma and death produced by a golf club head without penetration of the thoracic cavity by the weapon.

Different accidental injuries from golf equipment have been reported for adults and children. The vast majority of these reported cases were accidental blows to the head from clubs and balls. To this date there are no reported cases in the literature of homicidal chest trauma using a golf club as a weapon. Golf clubs are potentially lethal weapons when used inappropriately. A golf club is particularly designed to hit a golf ball. The club head is capable to accelerate to a great speed. This speed is produced by body motion swinging the club in vertical, circular, and horizontal directions.

This witnessed case involved an 18-year-old, black Hispanic healthy man who received a single blow to the chest in the presternal region with a club head during a fight. Immediately after he was hit he collapsed at the scene. Minutes later he was pronounced dead on arrival at the emergency room.

At autopsy the body corresponded to a well-developed and well-nourished lean male. He was 67 inches tall and weighed 118 pounds. External examination of the anterior torso, disclosed the presence of two well-defined brown-tan abrasions in the medial aspect of the left pectoral region separated by a 1" by 1" inch contused area. One of the abrasions was lateral and higher compared to the other. It measured 3/4" by 1/2" and had a rectangular shape. The other abrasion measured 5/8" by 5/8" and had a triangular configuration. The contused area had a triangular shape with a vertex pointing to the medial aspect of the thorax. The body had no other external signs of trauma. Upon reflection of the skin of the anterior thorax, a localized 1 1/4" by 1" hemorrhagic area was involving the presternal soft tissue and was associated to linear non-displaced fractures of the anterior aspects of the left 5th and 6th ribs at the costosternal junction. The right pleural and pericardial spaces had 1000 ml and 30 ml of liquid blood respectively. The pericardium had an extensive laceration associated with two parallel transmural lacerations of the anterior right ventricular wall, slightly parallel to the heart axis. There was no other cardiac involvement by trauma. The rest of the thoracic and abdominal organs had no lesions. Additional autopsy findings were remarkable for right lung collapse and brain edema. Toxicological evaluation was negative for alcohol, cocaine, opioids, and cannabinoids.

Chest trauma is traditionally described as blunt or penetrating. The trauma is classed as blunt when the chest wall remains intact and as penetrating when the integrity of the chest wall is breached. Blunt trauma is more common than penetrating chest injury, accounting for more than 90% of thoracic injuries. Two mechanisms occur in blunt trauma: by direct transfer of energy to the chest wall and thoracic organs and by differential deceleration, experienced by thoracic organs at the time of the impact. A direct blow to the thoracic wall produces crush and shear injury associated with fractures of bones and soft tissue damage. Ribs may be fractured at the point of impact and damage the underlying

thoracic organs by producing contusions or punctures. This case represent blunt chest trauma in which a great amount of energy was applied over a small body surface causing a penetrating injury of the heart by fractured ribs. An important feature of this injury is that the fractured ribs were not found displaced at autopsy examination. A temporal displacement of these ribs could explain the nature of the heart injury.

Factors such as golf club design and physics of chest trauma are keys for understanding the mechanisms of trauma involved in this unusual homicide case.

Golf Club, Chest Trauma, Homicide

G78 Non-Chemical Suffocation Deaths in Forensic Setting: A Six Year Retrospective Study of Environmental Suffocation, Smothering, Choking, Traumatic, and Positional Asphyxia

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After attending this presentation, attendees will be afforded a six-year review of forensic autopsies of non-chemical suffocation deaths in the province of Quebec, Canada.

This presentation will impact the forensic community by providing evidence-based data to support common knowledge on non-chemical suffocation deaths.

Suffocation has been the object of several papers but mainly case reports or cases series. Studies of subsets of suffocation deaths, limited to a specific scenery or category, have also been reported, such as suffocation in motor vehicle crashes, lethal crush/traumatic asphyxia, fatal entrapments in on-farm grain storage bins, suffocation by plastic bags, coffee thrombosis deaths, or overlaying and wedging deaths in children. However, no systematic study has ever portrayed non-chemical suffocation deaths in forensic setting. A six year retrospective study of all non-chemical suffocation cases in the laboratory in the forensic victim population aged of more than one year will be presented.

In the province of Quebec (Canada), a single centralized forensic laboratory covers the entire 7.5 million province population. Over a six year period (2000-2005) all autopsy cases performed at this laboratory were retrospectively reviewed for non-chemical suffocation deaths in the forensic victim population aged of more than one year. For each case, the type of suffocation, manner of death, gender, and age were compiled. In the case selection, cases of suffocation occurring in association with another type of trauma, such as sharp or blunt weapon, were excluded. Cases of suffocation in association with another category of asphyxia, such as hanging combined with suffocation by a plastic bag overhead were also excluded.

During the six year study period (2000-2005), a total of 96 non-chemical suffocation cases were autopsied in the forensic laboratory of the two Lab Sciences Judiciaies. This represents 2.3% of all forensic autopsies for the same period. Overall, cases were aged from two to 90-years-old (mean \pm standard deviation, 46 \pm 19), with similar averages for men (46 \pm 19) and women (48 \pm 24).

Type of suffocation: Traumatic /positional asphyxia ranked as the leading type of non-chemical suffocation, with over half cases (54%). Smothering and choking followed, in 30% and 14% of cases respectively. Entrapment/ environmental suffocation, on the other hand, was found in only 2% of cases.

Gender and Age: Overall, a strong male predominance was observed, with two-thirds of male victims. Traumatic

/positional asphyxia remained the leading type of non-chemical suffocation in male victims. However, the type distribution of non-chemical asphyxia differed in female victims, smothering being the most common type (64%), relegating mechanical/positional asphyxia to second position (32%). Choking occupied third position in both gender, with 16% and 5% in males and females respectively. As for age, the average in each type of suffocation did not seem to differ significantly.

Manner of death: Taken as a whole, manner of death in non-chemical suffocation is generally ruled as accidental (73%). In fact, all entrapment/ environmental suffocations and traumatic/ positional asphyxia deaths were accidental, as well as the vast majority of choking (85%). Smothering, in contrast, is associated with a higher variability of manner of death between cases: though suicide makes up the main core (17 cases), manner of death was ruled differently in 12 cases, including six homicides and five accidents. The most common form of smothering was from a plastic bag overhead (69%), with all suicidal smothering cases being related to this method.

In the last 15 years, evidence-based medicine has been advocated as a new paradigm, proclaiming that evidence from research is the best basis of clinical decisions and practice. In this global context, forensic pathology is no exception and is increasingly becoming a science and decreasingly an art. Nevertheless, there are still several areas of forensic pathology mainly based on tradition, with textbooks describing common knowledge that is not supported by modern research data. The present study is intended to contribute to evidence-based data on non-chemical suffocation deaths. Despite several case reports, case series and a few studies on suffocation subsets, this is the first time non-chemical suffocation deaths are systematically studied. Taken as a whole, the outcomes of this study corroborate the literature data, thus supporting the common knowledge with evidence-based data.

Asphyxia, Suffocation, Manner of Death

G79 Death by Electrocution: Unusual Findings in a “Love Nest”

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After attending this presentation, attendees will realize the significance of a complete forensic examination of each case in order to understand the real cause of death. Sometimes the evidence found at the crime scene could lead examiners to misunderstand the cause of death, but only by collecting pathological, toxicological, immunological, and histological findings, you can be sure to correctly solve a case.

This presentation will impact the forensic science community by showing some unusual findings observed in an apartment that seemed to be a quiet love nest. Some of these findings seemed to suggest a different cause of death from the real one that was obtained through histological examinations.

A 63-year-old married man with two children was found dead in an apartment in a suburb of Bari, Italy. The apartment turned out to be a “love nest” of sorts, complete with nude pictures on the walls, erotic books, and pornographic videos and magazines. A large quantity of condoms and various types of sex toys were discovered in the drawers

throughout the premises. None of the family members of this man were aware of this apartment.

The body was found completely nude, lying prone on the floor of the kitchenette with the knees and pelvis in a flexed position. On the wall were exposed electrical wires from the thermostat of the boiler, a tool drawer on a shelf, and screwdrivers and pliers scattered on the floor around the cadaver. External inspection of the body showed no presence of any significant traumatic lesions except for some oval, slightly depressed, yellowish, grazed areas on the back of the right hand and on the external malleolus of the right ankle which resembled parchment.

An autopsy revealed a diastasis between the IV and V cervical vertebrae with light hemorrhage of the soft tissue which probably happened just before the moment of death (*limine vitae*) due to the anomalous position assumed by the cervical roots after the victim fell to the floor into a very confined space. It was later discovered that the victim suffered from pre-existing cervical arthrosis. Immunological investigation was carried out on the suspicion that the death may have been the result of anaphylactic shock, but the findings were negative. Toxicological investigation showed the presence of nontoxic levels of Sildenafil (the principal active ingredient in Viagra®), along with high levels of some components of a cutaneous disinfectant used in the sterilization of medical surgical instruments.

These findings, which seemed quite curious, were attributed to the possible transrectal absorption of the substance, most likely used in the disinfection of some of the autoerotic instruments discovered in the apartment. In the end, the definitive diagnosis of the cause of death was arrived at by means of histological verification carried out on fragments of skin taken from the grazed areas of the right hand and ankle which showed signs of the passage of electrical current. In particular, it was the coagulative changes of the epidermis (i.e., cytoplasmic hyperesinophilia, lengthening of the nuclei) and congestion of the small blood vessels which suggested that the subject died of electrocution.

Electrocution, Sex Toys, Transrectal Absorption

G80 A Fatal Case Due to a Pitchfork Penetrating Head Injury

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After attending this presentation, attendees will have a better understanding of an unusual fatal case of penetrating cranial stab injury due to pitchfork.

This presentation will impact the forensic community due to the rarity of the deaths by pitchfork, the particular features of eye and intracranial lesions caused by the tool, and for the importance of a careful autopsy examination in order to clarify the exact mechanism of the death.

Penetrating head injuries can be the result of numerous intentional or unintentional events, including missile wounds, stab wounds, and motor vehicle or occupational accidents (nails, screwdrivers). The most common wound is a knife injury, although bizarre craniocerebral-perforating injuries have been reported that were caused by nails, metal poles, ice picks, keys, pencils, chopsticks, and power drills. Here is presented a case where a farmer was wounded with a pitchfork.

In the rural area in southern Italy, a 56-year-old Caucasian farmer was found unresponsive by his father-in-law a few meters from their farmland, with a tine of the pitchfork penetrating the right eye. He was quickly taken by helicopter to the nearest hospital in serious clinical condition and immediately accepted in the Intensive Care Unit. Glasgow Coma Scale score was three. A penetrating circular wound in the right eye was detected. The cranium CT showed a large hemorrhagic area in the right frontal-temporal-parietal lobe, hemoventricle and right to left brain shift. Subarachnoid hemorrhage and fractures of the lateral wall of

the orbital bone in the right occipital region was present. Neurosurgical treatment was performed for subarachnoid hemorrhage, but the man was pronounced dead four days after the penetrating stab trauma.

Prosecutor arranged the autopsy on the body because the circumstances of the wounding suggested that the death could have been a murder in connection with the father-in-law.

A complete autopsy was performed 24 hours after death. The external examination revealed a laceration in the external part of the upper eyelid measuring approximately 0.5 cm x 0.4 cm and surrounded by traces of reddish color, a wide subconjunctival hemorrhage and in the upper lateral quadrant of cornea a 0.5 cm in diameter circular tear. This corneal lesion penetrated in the eyeball that was removed and revealed on the lateral wall of the orbital bone a round bone defect measuring 0.5 cm in diameter that went through the orbit in the cranial cavity and exited in the anterior cranial fossa with a circular tear of dura mater measuring 0.5 cm in diameter. The brain was oedematous and was fixed for three weeks in 10% buffered formalin prior to being sectioned with coronal cuts. Dissection revealed right to left shift of the midlines structure. A circular injury measuring 0.5 cm was present in the right frontal region. This injury penetrated into the parenchyma from the base in the frontal region upwards and maintained the same diameter through the frontal end of the parietal lobes. The entire distance from the anterior cranial fossa bone defect to the parietal lobe measured 7 cm.

Wide foci of hemorrhages were present in the right hemisphere and characteristic petechial hemorrhages continuing throughout coronal cuts. Examination of the other organs was unremarkable. Routine histological investigation applying haematoxylin and eosin staining was performed on various organs and revealed a detachment of the upper epidermal areas mainly extends through the basal-cell layers with flattened and stretched epidermis on the eyelid skin. The deeper parts of stratum papillare and underlying upper layers of the corium were characterized for wide erythrocytes accumulation. The eye samples collected on the round laceration were stained with trichromic dye and presented the discontinuation of corneoscleral coat, choroids, until posterior camera and vitreous space with wide spread erythrocytes infiltration. Brain sections showed intraparenchymal diffuse hemorrhages.

The examination of the pitchfork showed a perfect compatibility with eye and intracranial lesions. No fingerprints from the father-in-law were collected on the pitchfork.

According to the autopsy findings and histological data, death was attributed to brain hemorrhages. The tool that caused the death was the pitchfork, and the mechanisms of trauma were consistent with an accidental trauma.

Furthermore, the circumstantial data confirmed the hypothesized death scene: it was an accidentally self-inflicted stab penetrating injury due to pitchfork.

Pitchfork, Self-inflicted Stab Lesions, Penetrating Head Injuries

G81 Head Injury Associated With Posterior Distraction of the Spine in a 4.5 Months Old Baby: Analysis of the Lesional Mechanisms

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After attending this presentation, attendees will understand the analysis of lesional mechanisms in association with lesions of head and spine in a young baby.

This case report concerns a 4.5-month-old boy measuring 62.5 cm and weighing 5.5 kg who was treated by an emergency team for a cardio-respiratory arrest at the parent's house. He was declared dead upon arrival at the hospital. The first explanation by the mother was that the child had been dropped and it suffered an accidental fall down the stairs. Quickly, the theory of an accident fall was denied by the two parents.

The postmortem CT scan of the entire body showed a right parietooccipital fracture with cerebral lesions. The medicolegal autopsy found a contusion with abrasion of parietooccipital region with a bending of head, a huge hematoma associated with bone defect, diastatic fracture and extradural and subdural hemorrhage, cerebral contusions and oedema. Skin ecchymosis (three ecchymosis in right temporal region and one ecchymosis in left frontal region) was also noted. The dissection of the spine by posterior incision showed a fracture of the right part of the neural arch of T12 with extra and subdural hemorrhage of the medullar cord associated with haematic infiltration of the posterior part of the intersomatic spaces extensive on 7 cm and a small ecchymosis of the anterior part of T12 body. Because of the initial story indicating the child fell, an opening of the joints of the four limbs was performed and no macroscopic lesion were noted. The knee and wrist joints were removed for anatomopathological analysis. There was no congestion of the internal organs.

The anatomopathological findings confirm the macroscopical description consistent with premortem lesions. They pointed out an infra-clinical fracture of the right knee and a haematic infiltration of the left radio-ulnar membranous.

The spine lesions were consistent with impact of the parieto-occipital region associated with a violent anterior flexion of the spine leading to posterior distraction lesion of the spine. The infra-clinic lesion of the right knee and the left wrist suggest a violent projection of the baby against a hard surface (like a wall) followed by a fall.

This case report shows the significance of carrying out a complete dissection of the spine and the spinal cord and performing an opening of the limb joints and a removal for anatomopathological analysis in cases of suspected of non accidental injury in a baby.

Child Abuse, Lesional Mechanisms, Head and Spine Injury

G82 Genetic Testing of Sudden Cardiac Death Victims: From a Forensic to a Multidisciplinary Approach

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After attending this presentation, attendees will learn a practical, ethically, and legally acceptable approach to cases of sudden cardiac death thought to be of genetic etiology.

This presentation will impact the forensic community by demonstrating an interdisciplinary approach in cases of sudden cardiac death believed to be related to channelopathies.

Sudden cardiac death is considered as the most important cause of death in western countries. In cases of sudden, unexpected deaths and especially in young people, a forensic autopsy is required, frequently followed by complementary investigations, in order to determine the cause of death. However, it happens that even after an autopsy is performed in accordance with international recommendations, the cause of death remains unexplained. Such cases, called also autopsy negative sudden deaths, are not rare (6% to 40%) and are often considered to be due to a sudden cardiac arrhythmia.

Thanks to the progress made in molecular biology, it is admitted that most cases of sudden cardiac death of children and young adults are

related to genetically determined cardiac diseases. Some of them have a morphological substrate at autopsy as hypertrophic cardiomyopathy. But those related to channelopathies are impossible to detect without genetic analysis. Postmortem genetic testing referred to as molecular autopsy was recently carried out by many authors in cases without morphological explanation of the sudden death and allowed to identify pathogenic mutations described already in clinically known arrhythmic syndromes. However, it is also possible to perform genetic testing to refine the diagnosis of a hypertrophic cardiomyopathy in cases without evident morphological substrate. The genetic cardiac disease may explain the death, but it may also be at the origin of a traffic accident with a loss of car control or drowning. The channelopathies may also be involved in cases supposed to be related to intoxications. Therefore, it is important to consider the genetic screening in forensic investigations.

The legal and ethical aspects of genetic testing in forensic investigation are complex. In Switzerland, the investigating magistrate may mandate genetic testing in the forensic context in order to determine the cause of death. In fact, the particularity of medicolegal autopsy is that during the investigation procedure and in contrast to a clinical context the genetic tests can be carried out without the consent of the dead person or proxy consent. The consent is however necessary for any research activity. Genetic screening is important to establish the cause but also to detect the asymptomatic carriers in order to prevent sudden death in other family members. This prevention involves a multidisciplinary collaboration. In Lausanne, such collaboration was established between services of cardiology, medical genetic, toxicology, and forensic medicine.

This presentation will be illustrated by autopsy cases for which the interpretation of the results of the genetic screening is explained in the light of other autopsy findings. The interdisciplinary collaboration as well as the juridical and ethical aspects of genetic analyses in cases of sudden cardiac death will also be briefly discussed.

Sudden Cardiac Death, Channelopathies, Molecular Autopsy

G83 Unexpected Death of 24-Year-Old Male With a Phenotype Strongly Suggestive of Lujan-Fryns Syndrome

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After attending this presentation, attendees will be acquainted with features of a rare genetic disorder which may be of great interest in common forensic practice, but at the same time is very difficult to be recognized.

This presentation will impact the forensic community demonstrating that in certain cases sudden and unexpected death could be attributed to peculiar genetic disorder which has not been described until now in forensic literature.

The presented case concerns unexpected death of a 24-year-old male shortly after his discharge from the hospital where he was admitted due to severe psychiatric behavioral disorder. He had been treated in the course of three months with the following final diagnoses: moderate mental retardation, non-organic non-specified psychosis, and significant behavioral disorder which needs special care and treatment. He was sent home in the phase of psychiatric symptoms' remission. Heteroanamnestic data obtained from the family members revealed his

cognitive and behavioral impairment many years before hospitalization; in addition, they described the physical status of the young man two days after his hospital discharge-frequent vomiting, severe abdominal pain, fever and exhaustion. Thus, he refused to eat and *ante finem* he even couldn't open his mouth. Together with other family members, his mother tried to help him by giving food and water, but all the efforts were in vain – he died in his bed. The police report confirmed all statements given by the deceased's family.

The external examination showed distinct facial dysmorphism (elongated narrow face, prominent forehead, long nose, maxillary hypoplasia, and small mandible), as well as marfanoid stature with long slender extremities. The internal examination disclosed aortic narrowing (circumference of 4.5 cm at the valves level), right aortic arch, low heart weight (240 g) with normal thickness of the left and right ventricle wall. The large intestine was widened, tensed, and full of gases and liquefied feces. No other pathological abnormalities were noticed in all other examined organs. Microscopically, slight congestion and edema of all tissues were found; specific staining for elastic fibers (Verhoeff method) showed rupture of elastic lamina and scarcity of elastic fibers with cystic degeneration of aortic media.

The postmortem toxicological screening detected the presence of clozapine and fluphenazine (neuroleptics) in the blood and bile, as well as clozapine and midazolam (benzodiazepine) in the stomach content. These findings fitted well the data in the medical records informing that the man received depot intramuscular injection of fluphenazine decanoate (25 mg) three days before his release and was instructed to continue with his therapy at home by taking clozapine (50 mg three times a day), lorazepam (2.5 mg three times a day) and midazolam (15 mg when needed at night). In the conclusion of the autopsy protocol, the cause of death was attributed to paralytic ileus due to antipsychotic therapy applied.

On the basis of the case circumstances, collected medical records, heteroanamnestic data and the autopsy findings - including peculiar facial appearance along with both macroscopical and microscopical cardiovascular features (narrowing of aortic root and ascending aorta and mediocystic degeneration of aortic wall), there was a strong suspicion on the Lujan-Fryns syndrome. In the available forensic literature the case of the Lujan-Fryns syndrome with fatal outcome is not found.

The Lujan-Fryns syndrome is defined by X chromosome-linked mild to moderate mental retardation, distinct facial dysmorphism (long narrow face, prominent forehead, long nose, maxillary hypoplasia, and small mandible), marfanoid stature with long slender extremities and behavioral problems. The genetic defect is not known; therefore the diagnosis is based on the presence of the clinical manifestations.

Lujan-Fryns Syndrome, Paralytic Ileus, Antipsychotics

G84 Fatal Air Embolism During Hemodialysis

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By attending this presentation, attendees will learn of this extremely rare complication of dialysis, understand the most likely cause, and the difficulties in verifying the diagnosis.

This presentation will impact the forensic science community by reminding them of this rare complication (almost exclusively related to human frailty thwarting an otherwise foolproof system), its presentation and diagnosis.

Systemic air embolization during renal dialysis is so rare it is not referenced in any major neurology text since 1976. The most recent

articles found by computer search even mentioning this complication are from 1985 and 1989.^[1,2] This reflects the effectiveness of safety devices built into hemodialysis systems in recent decades. Air embolism can occur, however, in dialysis setting through improper use or technique with venous access outside the monitored system.

A 53-year-old man had undergone renal dialysis thrice weekly for three years because of end-stage renal disease. While on dialysis his general health otherwise was good. He was normotensive, without evidence of cardiac disease, and with normal blood glucose determinations. He had been evaluated and approved as a candidate for renal transplantation and was awaiting a donor organ.

Early on a Saturday morning he reported to the dialysis facility for his final session of the week, along with eleven other patients. This Saturday the facility was understaffed with one of two nurses (RNs) missing and one patient care technician (PCT) absent. Nevertheless, the preparation and dialysis proceeded normally for the patient through the rinse-back phase. Disconnected from the dialysis machine, he had a routine sitting blood pressure check recorded as 169/86. He then positioned himself for the routine standing blood pressure check but complained of lower extremity cramping (a common complaint in dialysis patients) and sat back down on the dialysis chair. The PCT hurriedly plugged in the line of a half-filled saline bag hanging on the machine. This is a routine treatment for post-dialysis cramps or hypertension (a BP of 86/47 was recorded).

It is important to note here that the patient is disconnected from the machine and its safeguards against air in the system. The saline bag (which should have been full) and its line are outside the machine and have no air alarm. The line from the bag is connected to an existing venous access in the forearm. The bag ran empty or nearly so and was hand pumped by the PCT to get every bit of saline out of it, while calling for help. A full saline bag was quickly obtained and replaced the empty one, but no one recalled having cleared the air from the new bag and its line.

The patient fell back in the chair, unconscious and unresponsive. He could not be revived. An ambulance was called and transported the patient to a hospital. There was no venous access during transport. On admission, he remained unconscious and unresponsive. A non-contrast CT of the head showed scattered small round low-density areas on the convexity of the cerebral hemispheres suggesting air embolism. On two subsequent daily CT studies, the air shadows were gone but massive swelling of the right cerebellum with subtentorial herniation consistent with acute infarction.

Electrocardiography suggested an anterior myocardial infarction. A cardiac catheterization showed ventricular changes consistent with infarction, but coronary arteriography showed a remarkably clean coronary arborization, given his history, with only minimal to mild atherosclerosis and no occlusive disease through five and six bifurcations. Patent coronary arteries and a subendocardial infarct were confirmed at autopsy.

The mechanism and route of systemic air embolism via venous access will be discussed.

References:

- 1 Cohle SD, Graham MA. Sudden death in dialysis patients. J Forens Sci 1985; 30:158-166.
- 2 Air embolism associated with hemodialysis. Health Devices. 1989; 18(11) 406-7.

Renal Dialysis, Fatal Complication, Air Embolism

G85 Traffic Accident Deaths? The Importance of Autopsy

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After attending this presentation, attendees will understand Portuguese law which determines that a forensic autopsy in victims of traffic accidents must always be performed in cases of immediate death or death without medical assistance. The importance of the autopsy in these situations is obvious, since the accident is not always the cause of death. Situations of apparent victims of traffic accidents that were suicides or homicides have been described as well as natural deaths.

This presentation will impact the forensic science community by presenting several practical cases of apparent traffic accident victims in which the autopsy presented some surprises and totally different situations from those initially expected.

The need of a full autopsy and the demanding of complementary exams in these cases, namely histological, must be emphasized, reminding the fact that several judicial errors can occur in countries where a forensic autopsy is not routinely performed. Insurance rewards can be incorrectly taken into account, homicides cannot be detected, an accidental aetiology can be given to a suicide situation.

Traffic Accidents, Autopsy, Natural Death

G86 Undiagnosed Preeclampsia-Eclampsia Leading to Maternal Death

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After viewing this presentation, attendees will appreciate how common preeclampsia-eclampsia is, the necessity for early diagnosis of the disorder, and the dangers encountered when it goes undiagnosed.

This presentation will impact the forensic community by bringing attention to a frequent complication of pregnancy that can be deadly if overlooked by healthcare providers. With more attention and continuing research, this disorder will be better understood, and future mothers who suffer from the disorder will potentially be saved.

Preeclampsia-eclampsia is a common hypertensive disorder of pregnancy with significant global morbidity and mortality. This disorder can be effectively treated with early recognition, but imposes serious risks for both the mother and the fetus when left untreated. Physicians sometimes fail to realize developing preeclampsia and, as a result, place both the mother and fetus in grave danger. The cause of this disorder is currently unknown, but many different ideas have been considered. Perhaps with a better understanding of the etiology of preeclampsia-eclampsia, physicians will less frequently overlook its warning signs.

The case of an 18-year-old pregnant black female found unresponsive on a pullout sofa in her apartment is reported. The decedent had received regular prenatal care at a local hospital. Medical records disclosed that she exhibited significant proteinuria of 8.8 g/24 hr five days prior to her death, with relatively normal blood pressure measurements. Instead of being admitted to the hospital, her physician elected to send her home on bed rest. Autopsy records revealed that the decedent was 38 weeks pregnant at the time of death, with autopsy

examination revealing some well-known sequelae of preeclampsia-eclampsia, including intracerebral hemorrhage and platelet and fibrin microthrombi of the kidneys that indicated a thrombotic microangiopathy. Hepatocellular necrosis was also observed. The singleton pregnancy revealed an unresponsive male fetus with no evident developmental abnormalities. The cause of death was listed as complications of preeclampsia, with extensive intracerebral hemorrhage. **Preeclampsia-Eclampsia, Maternal, Death**

G87 Rupture of the Left Ventricle Due to Blunt Trauma - A Pediatric Case Study

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The goal of this presentation is to describe cardiac rupture following thoracic or abdominal trauma, which is relatively unknown, particularly in the pediatric traumatology.

Cardiac tamponade due to traumatic rupture of the chambers of the heart, in particular the left ventricle, after blunt thoracic trauma is described only sparsely in the literature. Most cases involve multiple thoracic trauma following motor vehicle accidents. To the best of knowledge, blunt traumatic injury following a household accident has not been described.

The case study will be presented of a five-year-old victim of a household accident, in which two concrete basins apparently fell on him. He died quickly despite attempted resuscitation.

The autopsy showed an ecchymotic scrape in the lumbar region as the only external lesion, with no bone injuries, bilateral pulmonary contusions at the base of both lungs, hemorrhagic extravasation of the diaphragm and mediastinum, hemopericardium, and massive damage to the apex of the left ventricle. Pathological exam confirmed the traumatic origin of the cardiac rupture, with no underlying pathology.

The mechanisms described in the literature that result in such lesions, the mechanism which the authors believe most probable in this case, and the importance of background information will be discussed. In this case study, lack of specific information concerning the accident prevents a definitive conclusion of the exact mechanism that caused this massive trauma particularly due to the fact that the external examination couldn't find any lesion in favor of a thoracic or abdominal traumatism. It is unknown if such an isolated case of a lesion causing almost immediate death has previously been described in the literature.

Blunt Thoracic Trauma, Left Ventricular Rupture, Autopsy

G88 Postmortem Examination of Coronary Artery Stents Using a Hand-Held Rotary Tool

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The goal of this presentation is to describe a practical technique for postmortem evaluation of coronary artery stents.

This presentation will impact the forensic community by permitting evaluation of intra-luminal patency, thrombosis, and restenosis of coronary artery stents and assist in determination in assigning cause and manner of death.

Since the development of the intra-luminal coronary artery stent in the late 1980's the use of coronary stents has increased dramatically worldwide. In 2005 one or more stents were placed within coronary

arteries of 620,000 patients in the United States. Numerous clinical studies have shown the benefits of coronary artery stents in the treatment of coronary artery disease; however, the main early complication with an intra-luminal coronary artery stent is thrombosis, while the primary long-term complication is in-stent restenosis. Today, stent surfaces and coatings are designed to prevent thrombogenesis and many elute drugs that inhibit neointimal proliferation to reduce in-stent restenosis. Despite advances in stent technology, stent thrombosis and in-stent restenosis remain common complications that can lead to myocardial ischemia, infarction and possible death. Discovery of clinically significant stent complications at autopsy can be crucial for the pathologist trying to determine the cause or manner of death. However, evaluation of coronary artery stents at autopsy is challenging and has been limited to postmortem angiography, serially sectioning the stent with a low-speed diamond saw or simply by visual examination of the stent lumen and estimating any luminal narrowing. Most medical examiner offices cannot afford the expense, space, or training required for postmortem angiography or a low-speed diamond saw to examine coronary artery stents.

A hand-held rotary tool can serially section coronary artery stents with minimal deformation of the stent, distortion of the luminal space or disruption of intra-luminal contents. The excised coronary artery stent is serially sectioned in 2 -3 mm increments. When laid out in cross-section from proximal to distal, the sections of the stent and surrounding coronary artery can be assessed and photographed. Luminal contents can be removed by careful dissection using 20-gauge needles. Subsequent histological evaluation can determine if the intra-luminal material is postmortem clot or premortem thrombus. Sectioning of coronary stents with a hand-held rotary tool is affordable, easy to master, and permits objective assessment of intra-luminal coronary artery stent patency, thrombosis or restenosis.

Forensic Science, Coronary Artery Stent, Hand-Held Rotary Tool

G89 Detection of Wild Game DNA in Maggot Tissue

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After attending this presentation, attendees will learn a new technique to assist conservation or game officers in the identification of illegally harvested wild game through the detection of DNA specific to several game species in maggot tissue. The attendee will learn how to rear, collect and preserve maggots, identify insect developmental stages as well as perform molecular analyses to identify non-human DNA.

This presentation will impact the forensic community as well as game law enforcement by demonstrating that entomological evidence can be useful in criminal investigations other than determining a minimum postmortem interval. To date, molecular analyses are useful to identify game species through their DNA; however, analyzing insect tissue for the presence of animal/bird DNA may provide another technique useful in wild game management and conservation.

Poaching wildlife is a problem faced by many conservation and game officers and many people are caught and convicted each year, but it is a crime that even more offenders get away with. Annually, there are approximately 1,000 big game poaching cases prosecuted. Unfortunately, many cases do not reach the court of law due to either the lack of personnel required to patrol over 26,000 square miles of forested game lands or lack of evidence required to identify the game species in question. The use of entomological evidence in human death-scene investigations in terms of estimating the minimum postmortem interval has been well documented as well as to some degree with wildlife. In

addition, insect evidence can be used to differentiate between human and animal DNA through molecular analyses of the food stuffs in maggot crops. The purpose of this study was to examine maggot tissue (crop or entire body) and determine if wild game DNA could be detected using PCR analysis. The objectives for this study were to develop protocols using current PCR technology to identify and compare wild game DNA isolated from Dipteron larvae, and determine if larval developmental stage influenced the isolation and identification of wild game DNA.

Three species of forensically important flies were reared in the laboratory (Calliphoridae: *Calliphora vicina* and *Lucilia cuprina*; Sarcophagidae: *Sarcophaga haemorrhoalis*) on approximately 350 g of deer, bear, coyote, bobcat livers. Bear, deer, coyote, fox, and bobcat livers were obtained from either euthanized animals or vehicle strikes. They were frozen immediately after removal. Fly larvae were collected at mid-molt from each larval instar, preserved in 95% ethanol and identified for species and age confirmation. After identification, maggots were individually preserved in 1.5mL of 95% ethanol and shipped in centrifuge tubes to the Wildlife Forensics Laboratory in East Stroudsburg University for PCR analysis.

Before DNA extraction, maggots were washed to remove potential external contaminants. Each maggot was individually soaked for 2 min a 1.5mL tube containing 1mL of 20% bleach. The bleach was removed and each maggot was rinsed twice with 1 mL of sterile distilled water. Each clean maggot was with iris scissors, then a ventral incision was made from the posterior to anterior end of the maggot. If possible, the crop was removed with forceps. In some circumstances, either the entire anterior inside of the maggot was removed or the entire maggot was extracted.

Amplifications were performed using Promega PCR Master Mix.

Each reaction included 1 μ L of each primer (5 pmol/ μ L) and 5 μ L of DNA extract. The PCR program consisted of an initial denaturation cycle of 95°C for 3 minutes, 45°C for 1 min and 72°C for 1 minute-30 seconds, then continued with 33 cycles of 94°C for 1 minute, 45°C for 1 minute and 72°C for 1 minute-30 seconds, with a final extension at 72°C for 3 min 30 s. The success of PCR reactions was determined using an agarose yield gel stained with ethidium bromide. Sequences were aligned and edited using Sequence Navigator software (Applied Biosystems). Quantitation of crop extractions showed the amount of DNA recovered varied with the species analyzed. The extractions produced at least 1.0 ng/ μ L. The samples analyzed produced the correct mtDNA haplotype for deer.

Maggot Tissue, Wild Game, DNA

G90 Conversion of the Wyoming State Crime Laboratory From FM-BIO Slab Gel Technology to the AB 3130 Genetic Analyzer for CODIS and Casework Sample Analysis

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After attending this presentation, attendees will have gained an understanding of the work involving validation of the forensic methodology used with an Applied Biosystems 3130 Genetic Analyzer for genotyping CODIS. This validation includes the study of precision, reproducibility, concordance, sensitivity and the ability to resolved mixtures of biological samples.

This presentation will impact the forensic community due to its validation of methodology for use on an instrument and associated kit technologies is vital to obtaining precise and accurate profiles of genetic samples for case work or the CODIS database.

For a method to be validated for forensic analysis it must meet several guidelines put in place by the Scientific Working Group on DNA

Analysis Methods. The data must show a degree of precision and reproducibility based on known laboratory controls. To validate such a system it must be shown that there is no contamination between samples run on the instrument. A series of non-probative samples must be run to verify that the protocols are suitable for samples that could be encountered during forensic casework.

The validation was performed with the Profiler Plus™ and the COfiler™ allelic kits and all the samples were analyzed using the Genemapper ID™ software. To ensure the reproducibility and precision of the instrument a series of allelic ladders were injected. The allele calls and the peak heights were analyzed and confirmed that the protocols performed by the Wyoming State Crime Laboratory (WSCL) were conservative enough to meet the stringent standards necessary for forensic investigation. A series of fifteen samples were amplified, run and analyzed with the standard WSCL protocols. These samples had been analyzed before on the WSCL's AB 310 genetic analyzer and had known profiles. The experimentation with the 310 concluded that the instrument was capable of producing profiles that matched the known profile. These studies demonstrated that no contamination between samples injected on the instrument occurred. With each study, negative controls were performed across the board with each sample showing no contamination.

The data obtained from the validation of the Applied Biosystems 3130 at the WSCL. It is important for those using the AB 3130 genetic analyzer to be familiar with how the instrument and associated kit technologies were validated and the experimentation that was performed.

3130, Validation, CODIS

G91 A Rapid Penta STR Screening Method by Microchip Capillary Electrophoresis

Maurice J. Aboud, BSc, 10720 North West 66th Street, Apartment #113, Miami, FL 33178*

After attending this presentation, attendees will understand the development of a fast and portable DNA screening method that uses microchip electrophoresis for forensic DNA applications. Attendees will gain an understanding for how this system operates, the limitations of the system, and how these limitations were surmounted to achieve the desired resolution on the microchip.

This presentation will impact the forensic community by development of a multi-loci penta DNA system in combination with an STR micro-chip electrophoresis system that provides a new tool for quick and portable screening in forensic DNA analysis.

Due to the ever-increasing forensic DNA caseloads and the potential need for remote forensic DNA analysis, DNA analysis systems that are both quick and portable are needed. While short tandem repeat (STR) DNA analysis by capillary electrophoresis is capable of high resolution and has a large power of discrimination in forensic identification, these instruments are not portable and require a relatively long sample run time. It is on this basis that this study aims to develop a rapid and portable DNA screening method using a commercially available microchip electrophoretic system. Generally speaking microfluidic systems require fairly long channels and complex detection systems for proper resolution and identification of forensic DNA. However there currently exists commercially available systems, such as the Agilent 2100 Bioanalyzer, which have a small footprint and utilize chips with short channels and reduced resolution. Such portable systems might be valuable in situations where evidence screening is necessary in remote locations. However due to its lower resolution, most STRs will not properly separate on such a system. In this project the development of mini-Penta STRs as potential tools for microfluidic analysis was investigated. These five base STRs should produce more consistent results in such circumstances.

The design and development of such a portable system capable for forensic DNA screening with high enough resolution for single allele separation required that the following issues be investigated in order to increase the resolution. First the analysis of the current Penta STR markers available from Promega Corporation and redesign of these primer sets to reduce amplicon size and improve the mobility and separation within the micro-channel. Secondly, the development of a denaturing polymer for single stranded DNA separation to be used on the microchip that would take advantage of the improved resolution in single stranded DNA assays. Finally, the development of a Penta multiplex STR kit that would increase the power of discrimination for forensic samples and become a more powerful forensic tool.

These studies were designed to overcome the limitations of current microchip systems for portable forensic applications by trying to increase the resolution of the short micro-channels. It is with these changes that the resolution of the system should be capable of separating between five base pair repeats accurately and robustly.

This research will address the problems and limitations encountered with the current systems such as poor resolution, large amplified DNA fragments, and the ability to only detect double stranded DNA on the currently commercial available microchip systems such as the Agilent 2100 Bioanalyzer. As a result of this research the development of a multi loci penta DNA system in combination with an STR microchip electrophoresis system should provide a new tool for quick and portable screening in forensic DNA analysis.

DNA, Penta STR, Microchip

G92 How Does Season Affect the Release of Ninhhydrin - Reactive Nitrogen Into Grave Soil?

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After attending this presentation, attendees will understand that seasonality can significantly affect the rate at which ninhydrin - reactive nitrogen (NRN) enters grave soil and that the dynamics of grave soil NRN can contribute to the estimation of postmortem interval (PMI).

This presentation will impact the forensic community by serving as a fundamental investigation into the estimation of extended PMI. Accurate estimates of extended PMI are currently difficult to achieve.

During the summer months, when temperatures are warm, bodies tend to decompose at a more rapid rate. Recent research has shown that a body releases NRN into grave soil during decomposition. At present, few studies have investigated NRN in grave soil when decomposition begins during colder months. The release of NRN has primarily been used to locate graves, but more recently, has been investigated for its use in estimating PMI. To investigate this use, researchers decomposed carcasses in winter and summer to compare the release of NRN into grave soil.

The experimental site was located at the University of Nebraska Agricultural Research Development Center located approximately 48 km north of Lincoln, Nebraska, USA. The site is a pasture that is intermittently grazed by cattle and horses. The soil at the site is a deep silty clay loam of the Yutan series (Mollie Hapludalf). The climate is temperate midcontinental characterized by hot summers, cold winters, and moderately strong surface winds. Average annual precipitation is 695 mm. Approximately 75 percent of the precipitation occurs between April and September. Mean annual temperature is 9.8°C with mean minimum and maximum temperatures ranging from 0 C (January) to 31°C (July). The vegetation at site is dominated by non-native grass

(smooth brougham) and forb (white clover) with some native vegetation, including daisy fleabane, yellowwood sorrel nut sedge, and pasture rose.

Swine (*Sus scrofa*) carcasses (~40 kg) plus a control (no cadaver) were used. Swine were killed with blunt force trauma to the cranium and placed on their right side on the soil surface facing west. Swine were killed and placed on the soil surface during February 2008 (winter) and June 2008 (summer). Soil samples were collected (0-5 cm depth) from adjacent to the cadaver at intervals of 15 days for the initial 30 days. This experiment was replicated three times, which resulted in a total of six cadavers.

The concentration of NRN during the summer months was greater than during the winter months. Elevated levels of NRN were observed during the summer months after 15 and 30 days postmortem. In contrast, a significant increase in NRN was not observed during the initial 15 days of decomposition during the winter months. These results demonstrate that NRN would not be an accurate method to test for the presence of grave soil during the initial 15 days of death. As decomposition in terrestrial ecosystems is primarily biologically mediated, this influx was likely more rapid during the summer months because of greater insect and microbial activity. A more accurate way to measure postmortem interval during the winter months would be to use degree days, which will be presented along with measurements of NRN after 60 and 90 days.

Forensic Taphonomy, Postmortem Interval, Temperature

G93 Consumption of Fly Artifacts After Deposition and Translocation of Bloodstains by *Calliphora vicina* (Diptera: Calliphoridae)

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By attending this presentation, attendees will learn of two newly observed behaviors through which *Calliphora vicina* can alter bloodstain patterns.

This presentation will impact the forensic community by contributing information to the current literature regarding the behavior of *Calliphora vicina* when exposed to blood. Blow fly behavior can alter bloodstain patterns at crime scenes, which can lead to inaccurate crime scene reconstruction.

The purpose of this study was to observe the behavior of *C. vicina* when exposed to an expired bloodstain pattern and their effect on bloodstains on wallpaper, white textured wall, and white laminate floor.

The experiment was conducted using eight microscenes (0.46 m³ wooden boxes) that had two glass walls and a plexiglass ceiling to enable easy observation and documentation. The other surfaces consisted of a textured, white painted wall, a wallpapered wall, and a white laminate floor. A holding cage was attached to each microscene, in which ten flies were placed. Four of the microscenes were control scenes and no flies were placed in their holding cages. The holding cages were designed to allow the flies access to the microscene without human intervention.

Fresh human blood was used within ten minutes of being drawn. In each microscene, approximately three milliliters of blood were poured into a pool in a corner of the microscene. The donor then put three milliliters of blood in his mouth and expired blood into the microscene. The blood was directed towards the interface between the wallpaper and white painted wall. The flies were allowed entry to the microscene for 72 hours and had access to sugar and water.

Flies moved from the holding cage into the microscene within 10 minutes and began feeding on the blood within five hours. All deposited

artifacts that were observed were produced from defecation. No artifacts with long tails were made while the flies were exposed to light. Blow flies were observed feeding on fly artifacts, sometimes within seconds of the deposition of the artifact. Some of the artifacts were completely consumed by the flies. During the last half of the experiment, the flies fed on artifacts in equal or greater proportion to the bloodstain pattern. A small drop of blood was translocated by the mouthparts of the flies. The mouthparts were swept across the wall in an arc, beginning at the original source and ending at the new droplet, without leaving a trail of blood. The flies were observed feeding on the bloodstain pattern until the experiment ended.

The consumption of fly artifacts may occur because the artifacts could be easier to digest than pure blood, in the same way that regurgitated blood is easier to digest. However, defecated artifacts are unlikely to be as nutritious as pure blood. Translocated blood droplets may cause additional confusion when analyzing bloodstain patterns, especially if a reliable method is developed to distinguish fly artifacts from human blood. It is unknown how common this behavior is or whether it could significantly alter the overall bloodstain pattern. It is important for crime scene investigators to consider the behavior of blow flies when attempting to reconstruct a crime scene based on bloodstain pattern analysis. However, many more experiments are needed before this subject is thoroughly understood.

Forensic Entomology, Expirated Blood, Blow Fly

G94 Decomposition of Child-Sized Remains in Dumpsters

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After attending this presentation, attendees will have an increased understanding of the decomposition of child-sized remains placed in a dumpster.

This presentation will benefit the forensic community, as well as those in the fields of the postmortem interval estimation and rate of decomposition research. It may benefit investigations of children killed and placed in dumpsters. The research demonstrates that a child-sized carcass placed in a black plastic bag and in a closed dumpster will decompose at a slower rate than one placed in a dumpster unbagged. Both pigs in dumpsters decompose more slowly than a control pig outside the dumpster.

The results of this research will benefit forensic science in the fields of postmortem interval estimation and rate of decomposition research. It may benefit investigations of children killed and placed in dumpsters. The research demonstrates that a child-sized carcass placed in a black plastic bag and in a closed dumpster will decompose at a slower rate than one placed in a dumpster unbagged. Both pigs in dumpsters decompose more slowly than a control pig outside the dumpster.

Research on child-sized remains has been done by depositing pigs in a variety of ways including surface deposit, shallow grave, covered by branches and debris, suspended by a rope, and rolled in carpet (Morton and Lord, 2002). However, there is not much study, if any, on the decomposition of child-sized remains in a dumpster, despite the forensic cases where children's bodies have been disposed of in this fashion. The aim of the research is to understand the environmental and taphonomic factors that affect the postmortem interval (PMI) on child-sized remains in a dumpster.

This thirty-day project began on June 15, 2008 and ended July 15, 2008. Three small pigs, which were humanely dispatched, were used as child-sized remains. Pigs were chosen because their internal structures and progression of decomposition are similar to humans. Two pigs were placed on plywood in individual dumpsters and the third was placed on plywood on the ground as a control. The control pig was not covered but protected on all sides by a chain-link fence.

A four-lead temperature coupler was placed with each pig and programmed to take hourly temperature readings for the duration of the project. Each pig was weighed daily using a digital scale and their girths measured. An incised wound was also placed behind the right shoulder of each pig.

Each board was weighed without a pig and then with a pig subtracting the difference for obtaining the weight of each pig. The two dumpsters were each two cubic yards in size with two plastic lids. The lids were kept closed except for collecting data.

The pigs in the dumpsters had temperature leads placed in the following locations: in the mouth, underneath the pig (between the pig and the plywood), hanging loose inside the dumpster and hanging outside the dumpster. The control pig had a temperature lead in the ground approximately two inches in front of the pig in lieu of the temperature lead hanging loose inside the dumpster; other temperature leads were placed in the same positions as with the pigs inside the dumpsters. Data collection was performed each day. Information recorded included weather conditions, body temperature, container temperature, and carcass weight loss. Photographs were also taken of each carcass.

General decomposition patterns were observed on each of the specimens. Fly succession following the usual pattern for the region was noted on all three specimens. As measured by weight loss, the control pig decomposed at a faster rate than either pig in a dumpster. The pig in a bag in the dumpster decomposed more slowly than the pig not in a bag in the dumpster. The initial data suggests that the decomposition rate of remains placed in a dumpster is noticeably inhibited.

Decomposition, Dumpsters, Taphonomy

G95 Inadvertent Administration of Lidocaine: Illustration of Two Cases

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After attending this presentation, attendees will have viewed two cases showing that the inadvertent administration of lidocaine can lead respectively to death and to serious tetraparesis linked to loss of the cognitive functions.

This presentation will impact the forensic community by describing two cases that show how the inadvertent administration of lidocaine can lead respectively to death and to serious tetraparesis linked to loss of the cognitive functions.

Case 1: In the first case, a 35-year-old man who for many years has been affected by protruded disk between L4-L5 causing right lumbosciatic neuritis, during an orthopedic examination, was administered lidocaine and Thiocolchicoside injection in right paravertebral lumbar area.

Soon after the man started to feel worse, and over an hour, showed sudden loss of consciousness, seizures, acute respiratory insufficiency, arterial hypertension, and severe tachycardia. The man was transported to the local emergency room where he arrived comatose. The cerebral CAT showed small gas bubbles in the cornua of the lateral ventricles and suprasella cistern.

Despite the pharmacological treatment, the man suffered serious seizures with heart attack and subsequent death. After the family's

complaint, by an order of the legal authorities, the external examination and the autopsy were performed two days later.

External examination: The man was 175 cm tall and his weight was 76 kg. No injuries were found in his body; the external examination showed only some puncture marks on the right wrist, on the antecubital fossae and on the back of the left hand, and subcutaneous tumefaction in right paravertebral lumbar region, on which there was a puncture mark 4 cm from the spinous apophysis of L5.

Autopsy findings: The forensic autopsy revealed brain edema and congestion of cerebral veins. There was no lesion in the scalp and in the galea capitis and no intracerebral hemorrhage was found. Pulmonary edema, pancreas and kidney congestion were found. The heart showed hypertrophic left ventricular and septal wall and left ventricular chamber dilatation. The section of subcutaneous tumefaction in right paravertebral lumbar region, saw in the external examination, showed a rounded formation, circumscribed by a fine membrane, of soft and elastic consistency, dark red complexion, contains a blood clot. The section of lumbar vertebrae and the following extraction of the conus medullaris allowed to find, at the level of the L5, a blood infiltration in the posterior dural sac and underlying arachnoid.

Histological Findings: The microscopic examination showed multivisceral congestion. Myocyte cellular hypertrophy and contraction-band necrosis of left ventricular and septal wall were observed. Severe left anterior descending coronary artery stenosis, softening of temporal cortex, white substance edema and neuronal cerebral and bulbar cytotoxic edema, spinal cervical cord edema were also noted. The terminal conus medullaris at the level of the L5 showed blood infiltration in the posterior dural sac and underlying arachnoid, soft and adipose tissue hemorrhagic extravasation.

Case 2: In the second case, a 58-year-old woman who for ten years had cervical pain due to protruding disk between C5-C6 was submitted to lidocaine infiltration made laterally to the cervical spinous apophysis.

Soon after, the doctor noticed the progressive decrease of the radial pulse, the loss of consciousness and the cardiac activity, so he started the external cardiac massage. After 15 minutes, the emergency medical doctor made an intracardiac injection adrenaline, after which there was a restarting of the cardiac activity. The woman was transferred to a hospital where she fell into coma.

The cerebral CAT showed many gas bubbles in the suprasellar, perisellar, and temporal periencephalic space, left sylvian valley and cornua of the lateral ventricles.

Currently the woman shows a serious situation of rigid-spastic tetraparesis and loss of cognitive functions.

Discussion: In the first case, vascular-peridural iatrogenic inoculation and the consequent sistematical diffusion permitted the neurotoxic damage lidocaine and epileptogenic action thiocolchicoside. The toxic cerebral effects destabilized the pre-existing ischemic cardiopathia, serious but clinically asymptomatic, causing the death of the man.

In the second case, at first the anaesthetic damaged the cervical orthosympathetic chains nerve ending, leading to a reflex inhibition of spinal cardiac-vasomotor centers and consequently to a hypovolemic shock, an then produced a direct neurotoxic damage of the S.N.C., both responsible of the quadriplegia.

Lidocaine, Coma, Tetraparesis

G96 Asphyxia by Confinement: The Death of a Man Kidnapped and Segregated in a Small Underground Cistern

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The goal of this presentation is to illustrate a particular case of homicide of a 68-year-old Caucasian man who was found dead inside an underground cistern, tied with ropes and chains.

This presentation will impact the forensic community by presenting the unpredictability of death by asphyxiation from confinement of a man unlawfully restrained for the purpose of extortion.

The air of confined environments can be subject to alteration by shares of various causes. Those persons who stay indoors need to have available a sufficient volume of air appropriately refreshed.

The sensitivity of the subject varies in relation with the temperature of moving air (compared to room temperature), the direction of air current, and conditions of the subject.

In February 2007 a male corpse of the apparent age of 65-70 years was found inside a cistern built underground, three meters deep, and used to conduct the passage of water (size of 3x3x3 meters, closed tightly with a metal lid of 63x63 cm).

The analysis of clothing made it possible to identify the victim; it was a Caucasian 68-year-old man who had disappeared a month before the discovery.

From data carried out during inspection, the victim was lying on the ground and immobilized by the presence of several girdles consisting of a rope and a chain.

The rope, surrounding the sides, kept him in contact with water and blocked any possibility of his movements. The chain consisted of steel mesh fixed at both of wrists and left ankle, as follows: the right wrist was linked to the left ankle at a distance of ten mesh chain links. This position forced the bending of the left knee over 90° and the extension of the right arm, not allowing any movement of the arm or the leg.

The left wrist was also linked to the left ankle by a chain at a distance of 22 cm, allowing the bending of forearm and arm; this chain also passed below the rope tied to waist passing on the left side.

The external examination of the corpse showed chromatic-emphysematous state of putrefaction; negroid face, with disjunction of hair in large areas of the scalp, eyeballs completely concave for colliquation and evaporation, easy detaching of skin grafts; massive destruction of nasal cartilage and perioral soft tissues, with exposure of dental arches and jawbone.

There were also larvae in various stages of maturation (pupae of 1 and 2 stage) and skin erosions caused by their destructive action. Several skin areas were affected by the presence of fungal growth on the right side, in particular: the neck, the chin, the right auricle, the upper right region of chest, the stump of right shoulder, and the periumbilical region.

Some skin areas were blackish and partially wrinkled (head, neck, upper region of chest, and upper limbs), while others were affected by phenomena of maceration with detachment of skin (hands, feet, right thigh, and both legs).

There were no signs of constriction on the neck. Under the hypogastric area, umbilical region, right wrist and left wrist, there were impressions caused by the rope and the chain. The autopsy showed advanced putrefaction in all organs, in particular in the brain, pancreas, and adrenal glands.

The histological examinations made it possible to detect signs of vitality on the skin of wrists and, in particular, there was oedema and intralveolare hemorrhage swelling and bleeding intralveolare and, inside the blood vessels, the red blood cells seemed conglutinate with focal

fibrin blood clots. Histological examination of the heart showed only a moderate atherosclerosis in coronary vessels.

The toxicological tests carried out on tissues and fluids have ruled out the presence of drugs and/or psychotropic substances, and showed the presence of 7% of carboxyhemoglobin.

On the basis of putrefaction, the presence larval and the conditions under which he was forced, it is estimated that the death could be traced back presumably, in a variable range of about 20 days before its discovery. The increase in CO₂ in the blood was responsible for a respiratory acidosis with consequent iperpnea-vasodilation, sweating, dehydration, peripheral venous stasis, ispisatio sanguinis, red cell lung clots, and cardiorespiratory failure that led to the death the subject.

Asphyxia, Confinement, Kidnapping

G97 50 Years Later: How Insect Evidence is Key in Turning Over a Wrongful Conviction in Canada's Most Notorious Case – *Regina v. Steven Truscott*

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After attending this presentation, attendees will understand the history and cultural impact of R. v. Truscott, and the evidence that lead to overturning this miscarriage of justice.

This presentation will impact the forensic community by illustrating the use of modern evidence in reanalysis of older cases, the importance of having forensic analyses based on scientific evidence and value of recreation experiments.

The body of 12-year-old Lynne Harper was discovered at 1:50 p.m. on June 11, 1959 in a woodlot northeast of Clinton, Ontario. She had been raped and strangled using her blouse. Insect evidence was photographed and collected both at the scene and autopsy, and the insects were reared to adult for identification. However, the insect evidence was not used in the 1959 trial or 1960 appeal. Stomach content analysis was used to pinpoint a 45 minute period for the time of death, two days prior (7:00 – 7:45 p.m., June 9, 1959). Based predominantly on this time frame and some circumstantial evidence, Lynne's classmate, 14-year-old Steven Truscott was convicted of her murder and scheduled to be hanged on December, 1959. A temporary reprieve on November 20, 1959 postponed his execution and on January 22, 1960, his death sentence was commuted to life imprisonment. Truscott was the youngest person to be sentenced to death in Canada, and his case provided the major impetus toward abolition of the death penalty in Canada. Truscott always maintained his innocence. After serving his sentence, Truscott was released and in 2001, he filed for review of his 1959 murder conviction. Fresh evidence was presented at hearings held at the Ontario Court of Appeal in 2006-2007. This new evidence included testimony of three forensic entomologists, with three other forensic entomologists filing reports (but not called to testify) on the insect evidence. Based on the analysis of the insect evidence, a recreation experiment of insect evidence and a reanalysis of the pathology evidence on stomach content analysis, the original estimate of time of death was considered to be unreliable. Truscott was with numerous witnesses prior to 1900 h and after 8:00 p.m. on June 9, 1959, thus the estimate of time of death was the most critical evidence in the original 1959 trial and the 2006-2007 appeal. In 2007, his conviction was declared a miscarriage of justice and Truscott was acquitted of the murder.

Forensic Entomology, Wrongful Conviction, Historical Cases

G98 First Insect Succession Study on a Human Cadaver in Texas

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After attending this presentation, participants will be introduced to the first succession of insects observed on a human cadaver in Texas.

This presentation will impact the forensic community by providing information on the succession patterns and abundances of forensically important insect species attracted to a human cadaver.

These data can potentially be used to determine a more refined estimate of the period of insect activity (PIA) on human remains discovered in the southwestern United States. Correctly identifying arthropod species found associated with a body allows for time approximations to be made based on development data and behaviors. The PIA is divided into two ecological phases termed the pre-colonization (pre-CI) and post-colonization (post-CI) intervals. Insects arrive at bodies in waves or series. The pre-colonization interval (pre-CI) is defined by insects being initially attracted to remains without colonizing the resource. Various species arrive at different times based on seasonality and abiotic factors. Insects are attracted to a body in a predictable pattern based on its stage of decomposition. Many of these insects will colonize (post-CI) the resource once the remains are discovered. Succession patterns may be influenced by the condition of the body and the area in which it is located. The following factors about the condition of the body may influence the rate of colonization, species richness, and abundance: direct sunlight, partially shaded, indoors, urban, rural, buried, or submerged. Applying the knowledge of arrival time (pre-CI), colonization patterns (post-CI), and associated behaviors allows for a better assessment to be made concerning approximations in the length of time a body may have been at a specific location.

Blow flies (Diptera: Calliphoridae) were initial colonizers of the human remains in this study. Over the duration of this study three blow fly species were regularly collected in the vicinity of the body: *Cochliomyia macellaria*, *Chrysomya rufifacies*, and *Phormia regina*. There were also *Piophilidae casei*, as well as Muscidae and Sarcophagidae species collected from the body. Coleoptera species also will colonize a body because of the readily available food resource of dipteran larvae as well as decomposing materials. Five beetle families were collected near or around the body: Cleridae, Histeridae, Silphidae, Staphylinidae, and Dermestidae.

C. macellaria is one of the initial colonizers in warmer temperatures while *P. regina* is more active during cooler weather. The diversity of flies collected may be an indicator of the range of temperatures experienced during the study. The hairy blow fly larva, *C. rufifacies*, is a facultative predator and will feed on larvae of previous colonizers such as *C. macellaria*. The hairy maggot blow fly can be distinguished from other maggots on a resource by the spine-like projects on each segment. It was interesting to note that there was a delayed colonization of Calliphoridae. Abiotic factors such as temperature may have influenced the colonization times or other unaccounted factors may have influenced the delay of oviposition but it is important to note that the body was not immediately colonized. Various ants from the family Formicidae and fleas, *Xenopsylla cheopis*, were also collected during this study. Postmortem ant bites on a body have been previously documented in other studies. Fleas collected near the body do not imply that the subject was infested; rather it may represent the environmental fauna and the

potential pests they carry. This study appears to have followed known succession patterns expected for the arthropod species collected; however, this is the first study in the state of Texas to examine insect succession patterns using a human cadaver.

This study is also important because it allows forensic entomologists to better assess delay in colonization estimations of insect activity on remains as it relates to the pre-CI. The specific time when a body is placed out into the field can be compared to estimations based on entomological development data. Establishing the accuracy of time estimations using development data for those insects collected from the remains may lead to more refined methods for calculating how long a body has been in a particular area prior to colonization. It is noted that this is a primary study with many more conditions to be replicated as potential body recovery sites and thoroughly analyzed to gain a better understanding of attraction, colonization time, development, and interactions among insect species on a human resource.

Insect Succession, Human Cadaver, Texas

G99 Comparison of Biological Sensors to Detect Human Remains: Canine Versus Hymenopteran

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After attending this presentation, attendees will have a greater understanding of principle of associative learning and its use to train vertebrate and invertebrate species to detect human remains in unknown samples.

This presentation will impact the forensic community by providing information on the use of canines and conditioned insects to screen soil samples for the presence of human remains.

A tremendous amount of effort in the scientific community has focused on deciphering how animals, as well as plants, receive and interpret environmental stimuli. In regards to forensics, these efforts have primarily targeted the development of biological sensors, such as canines, for tracking missing individuals or escapees from custody. Other efforts have evaluated the use of canines to detect explosives or narcotics in places frequented by people.

In recent years the U.S. Department of Defense has initiated research examining the ability of arthropods to detect and locate compounds of human importance. *Microplitis croceipes* has served as a model for a number of studies to detect plant pathogens, explosives, and human remains (Lewis & Martin, 1990; Takasu & Lewis, 1993, 1995, 1996; Rains 2004, 2006). These efforts have translated into the development of a biological sensor that is capable of detection at the nanogram level.

While the use of cadaver dogs in detecting human remains is widely accepted, there is little research that scientifically validates the capabilities or mechanisms by which the dogs function. This study compared cadaver dog performance to that of the trained wasps in terms of threshold and accuracy. Five nationally certified and experienced cadaver dogs with "real world finds" were tested in two types of evaluation paradigms. The cadaver dogs varied in age from three to nine years and consisted of two Border Collies, one Rottweiler, one Labrador Retriever, and one Doberman Pinscher. Cadaver dog threshold was equal to *M. croceipes* as the dogs were able to detect and alert to the presence of human remains using 0.02 grams of soil from beneath a human cadaver mixed with 20 grams of background soil.

Two types of presentation trials were utilized. The first trial set consisted of singular jar presentation in a room. This matched the presentation to the conditioned wasps but was not a traditional method of training or evaluation for testing detector dogs. The second trial, which was conducted upon the end of the first trial, consisted of a scent line-up with all four targets present. Targets were placed approximately three feet apart in a single row line. This is a traditional presentation utilized in research and training of scent dogs.

No type one errors were seen with the dogs; however, there were type II errors. Training biases may account for some of the error margin. Target odors are most often placed into containers for preserving and storing the target for continued use. Preservation of training aids necessitates the use of containers, cages, and other devices which can subsequently become a visual cue for the dog. Most research performed on scent detection dogs involve line ups or concealed target odors to avoid visual cueing. Placing containers in plain sight may have lead to a bias based on expectations by the dog's previous experience. Cadaver dog training scenarios typically include at least one target odor within a designated search area; therefore the dog is expecting to find something. This defines a need for cadaver handlers to continue to train their canine partners on scenarios involving visual negative targets to reduce association between a visual target and alerting, thereby increasing their efficiency on real world searches.

Cross contamination, residual scent, indoor ventilation systems, and container placement may have also contributed to the type II errors. Cross contamination can also occur due to residual scent. A recent study indicated that dogs can detect human remains odors of human corpses on carpet squares even though the squares did not come into direct contact with the corpse (Oesterhelweg, 2008). Since so little is still known about detector dogs, research that help define thresholds and other factors is essential in increasing the effectiveness of these dogs.

Canine, *Micropititis Croceipes*, Biological Sensor

G100 Generating Development Data for Forensically Important Flies That Are Difficult to Rear in the Laboratory

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After attending this presentation, attendees will learn how carrion fly development data can be obtained for species that are not suitable for rearing under common laboratory methods.

This presentation will impact the forensic community by providing rearing techniques for blow flies that have minimal development data due to their difficulty to rear in a laboratory setting. With these data forensic entomologist can generate more accurate development data for commonly encountered forensically important blow flies leading to increased accuracy and precision in postmortem interval estimations.

Forensic entomologists have so far been unsuccessful in their attempts to establish laboratory colonies of some of the more commonly encountered carrion insect species. Therefore, it has been difficult to produce the growth models often used to estimate a minimum postmortem interval based on specimen age of these species. Notable examples of this technical problem in North America are the green bottle flies *Lucilia illustris* and *Lucilia coeruleiviridis*. It has been found that a wild-caught *L. illustris* female will lay eggs in a laboratory cage, but the resulting f1 generation will not mate under these standard rearing

conditions. *Lucilia coeruleiviridis* presents an even more difficult problem, in that post-feeding *L. coeruleiviridis* larvae, either collected from a corpse or obtained from a wild adult female, will not pupate under laboratory conditions. The larvae have been observed to go into an extended wandering stage lasting several days only to eventually shrivel and die.

It was hypothesized that post-feeding *L. coeruleiviridis* larvae require a larger pupation medium volume than is typically used for laboratory culture. The hypothesis that rearing *L. coeruleiviridis* eggs obtained from wild females in containers much larger than those used in this research would have an effect on their development was tested. *Lucilia illustris* was similarly investigated because of the lack of developmental data currently available for this species as well.

During midsummer at the study site in northwest Indiana, 11 piglet carcasses were exposed to short duration (max 2.5hrs) fly activity and inspected for eggs every half hour. Once eggs were observed, the piglets were individually placed on (approximately 0.11 m³) leaf litter, collected on site, in large plastic storage tubs (approximately .16 m³). Breathable cloth-like material was immediately secured over the plastic tubs to exclude further oviposition. Ambient (outside) and interior container temperatures were monitored. Adult flies that emerged from a container were collected daily and identified.

Aspects of development will be discussed for three of the blow flies that were successfully reared to adulthood in this experiment; *L. illustris*, *Lucilia sericata*, and *L. coeruleiviridis*. Physiological time calculations for *L. illustris* were compared to those reported by other authors. Both *L. coeruleiviridis* and *L. illustris* developmental data were contrasted to the extensively studied *L. sericata*, because some investigators have used *L. sericata* growth models to estimate *L. coeruleiviridis* age. Under these conditions *L. coeruleiviridis* total development time was numerically longer than that of *L. sericata*. Total development time of *L. illustris* was comparable but slightly more accelerated than that of *L. sericata*.

The procedure used in this experiment provides forensic entomologists with a means of obtaining growth rate data for flies that were previously difficult to rear. Having data on these forensically important flies can be used to increase precision and accuracy of estimations of the postmortem interval.

***Lucilia*, Postmortem Interval, Forensic Entomology**

G101 Insect Pupal Cases as Decay-Resistant Reservoirs of Human Soft Tissue Radiocarbon Content

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After attending this presentation, attendees will understand how above-ground nuclear testing in the 1950s and early 1960s dramatically increased environmental levels of radiocarbon. These elevated levels have been incorporated into all organisms living since that time and thus can serve as temporal markers. Potentially, radiocarbon measurements of postmortem human tissues can be used forensically to establish year-of-birth and/or year-of-death. One advantage of this approach is that it functions independently of chemical or biological methods for the determination of postmortem interval or age-at-death and thus might augment current methods for establishing these parameters.

This presentation will impact the forensic community by outlining the possibility of determining year-of-death of human remains in advanced stages of decay based on the radiocarbon content of insect pupal cases obtained from the surrounding soil. Remains in advanced stages of decay pose particular challenges for determining postmortem

interval, and other temporal parameters. The presentation has two objectives: (1) to outline a hypothesis and an experimental design, and (2) to canvas the forensic science community for suitable samples.

Over the past sixty years, environmental levels of radiocarbon have been rapidly changing. Previous work in this laboratory has established that radiocarbon levels in human soft tissues essentially reflect levels in the contemporary environment. Therefore measuring radiocarbon levels in postmortem tissues and correlating these with known levels in the past environment can indicate Year-of-Death. Direct measurements on tissues from known age/known year-of-death donors have shown promise and quantified the potential precision of this approach to approximately ± 2.5 years.

The paradox of suggesting such an approach is that in many environments, soft tissues disappear within short spans of time due to natural process of decay. What are required are decay-resistant proxies of soft tissue radiocarbon content. The hypothesis of this study is insect pupal cases might fit the bill. Just as humans take on the radiocarbon content of ingested foods, insect larvae feeding on decaying human remains take on the remains' radiocarbon content. Although emergent adult insects leave, pupal cases are left behind. Large numbers are often encountered in the soil surrounding decayed remains long after soft tissues have disappeared.

Preliminary measurements on samples generated from field tests will be presented as well as measurements on paired samples of soft tissues and pupal cases obtained from a Medical Examiner's Office archives. The design of future experiments will be discussed.

Admittedly, the approach is potentially complex. For example, direct measurements of radiocarbon levels in different human tissues show tissue-specific variation. These differences are the consequence of rapidly changing environmental levels and differences in metabolic turnover rates. Consequently, one might expect that insect larvae feeding on different tissues of the same individual might be differentially labeled. On the one hand, this might reduce the precision of Year-of-Death estimations. However, if species-specific differences in larvae feeding behaviors exist among the succession of insects that infest decaying remains, this might result in species-specific differences in pupae radiocarbon levels. Such differences might be exploited to advantage. Clearly experimental data is required.

The approach is intriguing. It would require a trivial modification of existing sample collection practice: merely collecting a larger than normal number of pupae. It is potentially a new avenue for the forensic estimation of Year-of-Death.

Radiocarbon, Year-of-Death, Pupal Cases

G102 Reconstruction of Decay Processes of a Dead Child's Body in a Plastic Garbage Bag

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After attending this presentation, attendees will know how important questions concerning a homicide case were answered by step-by-step reconstruction using pig cadavers and special knowledge of various disciplines.

This presentation will impact the forensic community by underlining the statement that "extraordinary" methods are sometimes helpful in forensic taphonomy and moreover emphasize the cooperation of scientists from different disciplines.

The remains of a 10-year-old girl hidden in a plastic garbage bag in a wooded area in Northern Germany were recovered. The girl had been reported missing three months earlier. Her body was in a stage of advanced decay, the soft tissue had been entirely liquefied, colored

grayish pink and foamy in sections, whereas the bare skeleton was visible. The bones were complete and the arrangement of the skeleton indicated that the body had originally been left in *anteflexion* with bent knees. The foot bones were still inside the shoes and the underpants were positioned around both ankles indicating preceding sexual abuse. No evidence as to mammalian-feeding defects neither to preceding blow fly (Diptera: Calliphoridae) activity was observed. Only some skipper flies (Diptera: *Piophilidae*, "Cheese Skippers"), well known as late colonizers, were detected. Considering the climate of northern Germany the question had to be answered. Could a dead body get into that advanced state of decay within three months time without addition of any chemical substances? Extensive toxicological investigations merely resulted in high concentrations of calcium (1120 mg/kg) in the liquefied tissue. The influence of hydrogen peroxide was considered but excluded because large quantities of the long scalp hair were found still in its original brown color.

Experiments with pig cadavers (n=14; 20-30 kg) in plastic bags under equivalent environmental conditions revealed that soft tissue was liquefied equally with the skeleton left in anatomical position in those cases without addition of any chemical substances (e.g., quick lime). The pig cadavers where quick lime was added (1:3, 1:10, 1:30) were found with rather dry and hard soft tissue, aridity was increasing with the concentration of quick lime. By following investigations in a specialized microbiological laboratory *Clostridia* species (*C. limosum*, *C. novyi*, *C. sordellii*, *C. sporogenes*) were detected in the remains of the child as well in the liquefied porcine tissue. These *Clostridia* species are reported to produce both histolytic and cytolytic enzymes. Also the foamy consistency of the soft tissue could be explained due to the well documented gas producing activity of *Clostridia* species. Furthermore high calcium levels equivalent to these in the original specimens were determined in the liquefied porcine tissue.

In summary it was concluded, that the body of the child inside the plastic bag reached the state of liquefaction without addition of any chemical substances. The environment inside the closed plastic bag without oxygen supply promoted a shift to benefit the development of the anaerobic bacteria like *Clostridia* species. Hence high concentrations of histolytic and cytolytic enzymes secreted by these microorganisms resulted in a relatively fast liquefaction of the soft tissue. These conclusions were also in accordance with the crime scene analysis (closed plastic bag above ground, underpants around ankles of the corpse) indicating a fast disposal of the dead body after sexual abuse.

Decay Processes, Plastic Bag, Taphonomy

G103 Unusual Methods of Suicide in Chicago, Illinois, Cook County

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After attending this presentation, attendees will learn about some unusual methods of suicide recently observed in Chicago, IL during the first half of 2008. This paper is being introduced during a time of economic strain within the United States.

This presentation will impact the forensic community by making attendees aware of the unusual methods of suicide are being observed in Chicago, IL.

In 2004, according to the National Institutes of Health (NIH), suicide was the eleventh (11th) leading cause of death in the United States, accounting for 32,439 deaths. The major risk factors for the commission of suicide are well known and include a history of depression, substance abuse, stressful life events, family history of suicide, and prior suicide attempt. Males are four times (4X) more likely to commit suicide compared to females. Recent research has suggested

the risk of suicide may be the result of an imbalance of neurotransmitters in the brain, thus emphasizing the importance of diagnosis and the role of antidepressants in the treatment of depression.

Firearms, suffocation, and poisoning were the most common methods chosen by individuals to commit suicide, although the methods differed between the sexes. Males tend to commit suicide using firearms, whereas females commit suicide by poisons. Non-Hispanic whites commit suicide at the highest rate. Although some data is similar to that published by the NIH, the authors will introduce a total of eight individuals who committed suicide by unusual methods rarely seen in a major metropolitan area.

One case involves a white male with multiple shotgun wounds who was found in his secure residence. The second case involves a white male inflicting sharp force injury to his dialysis catheter causing exsanguination and air embolism. Two cases, a white male and white female, involved the “death by Hibachi” method, which is accomplished by carbon monoxide intoxication from burning charcoal in an enclosed environment. At autopsy, both cases revealed bright cherry-red lividity and the carbon monoxide level ranged from 54%-80% saturation. One case involved a white female chemistry student who ingested acetylferrocene, an orange crystalline powder that is extremely toxic once ingested, and who died of liver failure. One case involved a white male hanged with simultaneous electrocution from a manmade apparatus. One case involved a white male who used ligature strangulation as a means of suicide. Finally, the last case involving a white male is noteworthy and unusual in the sense that the commission of suicide was performed with the production of hydrogen sulfide gas. This is a most unusual case of suicide from medical examiners office but deserves mention as this method is becoming increasingly popular overseas.

Suicide notes were left at the scene in only three cases, a similar frequency seen in prior reports. Two detailed suicide notes were recovered from individuals performing the “death by Hibachi” method. The third suicide note was recovered from the male inflicting sharp force injury to his dialysis catheter.

With the introduction of the internet, old as well as new and more unusual methods of committing suicide are available to the population. As seen in this research, the “death by Hibachi” method would take time to plan and execute (i.e., spending time on the internet, buying and burning the charcoal, taping the doors in the room and writing detailed suicide notes).

All cases involved non-Hispanic white individuals, similar to that seen in the NIH data. In this study, there was a preponderance of males committing suicide (6:2). In each of the cases, the reasons for committing suicide coincide with the NIH data (i.e. depression, stressful life events). Although one of the cases involved a male using a firearm as a means of suicide and one case involved a female using a poison to commit suicide, these were not common means of suicide as people seldom kill themselves by inflicting multiple shotgun wounds and ingesting acetylferrocene. Additionally, people seldom commit suicide via means of ligature strangulation. The remaining cases also illustrate uncommon and unusual methods of suicide. In this small study, six of the eight individuals had a prior documented suicide attempt.

Suicide is one of the most preventable deaths in the society and the recognition and treatment of depression is underscored. However, the medical examiner/coroner will continue to examine suicide deaths especially in economic hardship as recently experienced in the United States. This paper serves to introduce some uncommon methods of suicide recently observed during the 2008 year.

Suicide, Unusual Methods, Chicago, IL

G104 Mass Fatality Investigation Due to Combustible Dust Related Industrial Explosion and Fire

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After attending this presentation, the attendee will recognize the dangers of combustible dusts and their relation to industrial deaths, and better understand unique features of mass fatality investigation in an industrial setting and an active fire scene.

This presentation will impact the forensic community by exposing practitioners to the under-recognized dangers of combustible dusts and the complexities involved in mass fatality in an industrial/fire setting.

Combustible dust is an under-recognized industrial hazard. The United States Chemical Safety Board identified over 280 events with 837 casualties (including 119 deaths) in the period 1980 to 2005. The industries involved are varied and include organic dusts (wood, sugar, grains, etc.), metal powders (magnesium, aluminum), chemical manufacturing, plastic production, pharmaceutical production, and coal handling/processing. In fact, “any industrial process that reduces a combustible material and some normally noncombustible materials to a finely divided state presents a potential for a serious fire or explosion” (NFPA’s Industrial Fire Hazards Handbook). In fact, sugar may seem harmless but is recognized as a strong explosion hazard (Bureau of Mines – “The Explosibility of Agricultural Dust”). In addition to the usual fire-triangle components (fuel, fire, and oxygen), a combustible dust explosion requires sufficient quantity and concentration of dust in a confined space. A major risk in such settings is the rapid dispersion of previously quiescent depots of dust particles follows a lesser primary explosion. With a significant fuel reservoir abruptly literally shaken loose and into the ambient air, a more devastating secondary explosion can be anticipated if the reservoir ignites. Safety procedures can reduce the risks associated with combustible dusts, especially related to the fuel, dispersion, and ignition but are less effective in controlling the confinement and ambient oxygen.

Shortly after 9 p.m., a series of explosions rocked the second largest cane sugar refineries in the United States (responsible for ~15% of total national production). The fires took days to extinguish due to the nature of the incident – a large depot of molten sugar remained ablaze in one of three storage silos despite significant efforts to put it out. Up to an estimated 100 personnel (of 472 total) were reported working in the affected plant area at the time of the blast. Of these, upwards of 40 individuals were seriously injured and a total of eight individuals were eventually reported missing and presumed dead. Recovery efforts, including law enforcement and medical examiner staff, to locate the presumed deceased proceeded while the silo fire was actively burning and scene stability was questionable. Over the ensuing days and weeks, the bodies of the dead were recovered and identified. The extensive thermal damage to those who remained in the burning plant longest posed identification challenges due to fragmentation and calcination. At the conclusion of the medicolegal investigation, all eight dead on scene were identified and the remains were re-associated with the appropriate individual. An additional five fatalities occurred related to extensive burn injuries, for a total 13 deaths. The case resulted in extensive media scrutiny and eventually the third-largest fines in OSHA history.

This presentation reviews the nature and dangers of combustible dust related fires. Specific issues related to the death investigation process and body recovery are addressed. The investigative outcomes, including recognized risks and identified cause are presented.

Combustible dust, Explosion, Sugar

G105 Worker Fatalities by Hydrogen Sulfide Poisoning: Autopsy and Toxicological Findings

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After attending this presentation, attendees will have an understanding of some particular aspects of Hydrogen Sulfide poisoning which is an important cause of work-related death.

This presentation will impact the forensic community by emphasizing the fact that Hydrogen Sulfide (H_2S) is a harmful and lethal chemical, and accidents may occur upon exposure to it in its natural gaseous state in various work environments.

The goal of this presentation is to recount the story of the deaths of five men who, while working in a truck tank which transported liquid sulfur, were poisoned by Hydrogen Sulfide. Variations in pathological and histological findings, coupled with toxicological results, and crime scene investigations will be illustrated.

Hydrogen Sulfide is a powerful, rapidly acting, colorless, poisonous gas. H_2S has a specific gravity (1.19) higher than air, and its presence can be detected by its characteristic odor of rotten eggs. Acute occupational poisoning and fatalities have been reported from exposure to H_2S in industrial settings, sewage disposal facilities, and septic tanks. This gas is very unstable and thiosulfate is its major metabolized substance. For this reason, the presence of thiosulfate is known to be a useful indicator of Hydrogen Sulfide poisoning in forensic analysis.

Case History: Five workers were found motionless in an empty truck tank which had previously contained liquid sulfur. They were soon removed from the tanker; four of the five men had already died. The fifth man, who was also the youngest, died at the hospital the following day. Crime scene investigation revealed that the first of the victims began the cleaning operation of the truck tank when he became unconscious. One by one, fellow colleagues attempted to rescue their co-workers, each succumbing to the toxic gas, and each falling into unconsciousness, ultimately followed by death.

Autopsy Findings: The workers had a mean age of 37.6 years (range 20-64). External examination of the bodies revealed congestion of the head, neck, and shoulders with cyanosis of lips and fingernails in all cases. The ocular conjunctiva showed marked hyperemia and a few petechiae. Two workers displayed traces of solid yellow sulfur on their faces and on the soles of their shoes. One of the workers, who was 23-years-old, displayed a very characteristic greenish discoloration of his eyes, anterior cervical region, and precordia. Only one worker showed signs of putrefaction. Two of the men presented with blunt force injuries on the occipital areas with subgaleal contusions which resulted from falling.

Upon internal examination, it was noted that the lungs of all the workers were heavy with edema and congestion which was also present in the kidneys and spleen. The 23-year-old worker displayed a greenish discoloration both in the thorax muscles, as well as on the surface of the stomach. There were no remarkable findings related to the other organs except for slight cerebral edema which was present in all five victims. In addition, an aortocoronary bypass graft was present in the oldest victim. Microscopic examination revealed passive congestion which was evident in the lungs, spleen, kidneys, and adrenal glands. Massive

hemorrhagic edemas were found in all the workers, most notably in the youngest victim who died 12 hours after the tragic event.

Toxicological results: Toxicological analyses of peripheral blood vessels (femoral) were negative for alcohol and illicit drugs in all of the workers. Thiosulfate in the heart blood was quantified using a gas chromatography-mass spectrometry (GC/MS) technique after derivatization with pentafluorobenzyl bromide. Each of the victims had a blood thiosulfate level that, according to other international reports, was enough to determine that the cause of death was due to fatal hydrogen sulfide poisoning: thiosulfate levels ranged from 2.6 mg/l (first worker in who entered into the tank) to 183 mg/l.

The analyses performed on air samples collected from inside the truck tank, as well as analogous trunk tanks used for liquid sulfur transport revealed that H_2S air concentration levels were high to have caused these occupational fatalities.

Hydrogen Sulfide, Worker Fatalities, Thiosulfate

G106 Suicide by Hanging in Harris County, Texas

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After attending this presentation, attendees will have comprehensively reviewed the features of suicidal hangings, including demographic characteristics of the decedents, frequency and types of injuries identified at autopsy, ligature characteristics, and scene investigation information. This review will provide the attendee with a reference base for common and uncommon findings in suicidal hangings.

This presentation will impact the forensic community by providing insight into the case findings and epidemiological characteristics of suicidal hangings presenting to the Harris County Medical Examiner's Office from the large diverse population of Harris County, Texas.

Suicidal hangings comprise 19% (320) of the 1676 suicides that occurred in Harris County, Texas from January 1, 2004, through June 30, 2008. Hanging was the second most common method of suicide after firearm wounds. An upward trend in the total number of hangings was recorded over this four and one-half year period, with 51 hangings occurring in 2004, 73 in 2005, 71 in 2006, 81 in 2007, and 43 in the first half of 2008. Although the total number of suicides in Harris County also increased over this period (from 298 in 2004 to 424 in 2007), the percentage of hangings compared to total suicides increased, with hangings comprising 17.1% of the total suicides in 2004 and 21.8% of the total suicides in the first half of 2008. Accounting for the approximated 7% population increase in Harris County from 2004 through 2007, the actual rate of suicidal hangings increased slightly over this period, from 1.3 per 100,000 people in 2004 to 2.1 per 100,000 in 2007, as did the rate of total suicides, from 8.1 per 100,000 in 2004 to 10.8 per 100,000 in 2007.

The majority of the decedents who hanged themselves (81%) were male, a trend that is common for other methods of suicide. Female decedents comprised 19% of the suicidal hangings and 24% of the total number of suicides in the period examined. The ages of decedents hanging themselves over the period studied ranged from 10 to 80. Children were over-represented in the hanging category when compared to total suicides. Ten percent of the decedents hanging themselves were under the age of 18, compared to 3.8% of the decedents committing suicide by all methods. Senior citizens were under-represented. Decedents over the age of 65 comprised 2.5% of suicidal hangings compared to 11.5% of all suicides in the time period studied.

The majority of decedents who hanged themselves were Caucasian (54.4%), followed by Hispanic persons (31%), African-American persons (10.1%), and persons of other race/ethnicity (4.5%). The breakdown of ethnicity for people dying by suicide by all methods was

similar, with 68% white, 18% Hispanic, 11% black, and 3% other race/ethnicity. In suicidal hangings as well as suicide by all methods, white persons appear to be over-represented when compared with the population breakdown of Harris County, in which approximately 37% of the population is white.

Of the 320 suicidal hangings examined, 260 (81%) took place in the decedent's residence or property immediately surrounding the residence (yards, garages, utility sheds, and other outbuildings). Of the remaining 19% of cases, the more common locations of the hangings included parks, fields, or wooded areas (15 cases), jails or other correctional facilities (13 cases), places of business (11 cases), and motels or hotels (8 cases). Hanging was the only method of suicide used by incarcerated persons over the four and one-half year period studied. Approximately one-fifth of the decedents (62 cases) were transported from the scene of the hanging and received medical care prior to being pronounced dead. The remaining four-fifths of the decedents were pronounced dead at the scene of the hanging.

The types and frequency of injuries of the internal neck structures identified at autopsy such as hemorrhage of the neck musculature, fractures of the hyoid bone, and fractures of the tracheal and laryngeal cartilages as well as injuries of the spine will be reviewed in detail. In addition, the various types of ligatures recovered, ligature positioning, and positions in which the decedents hanged themselves will be discussed. The prevalence of factors such as previously diagnosed mental illness, physical illness, and prior suicide attempts in decedents who hanged themselves will also be examined.

Hanging, Suicide, Epidemiology

G107 Death in a Tanker Truck

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After attending this presentation, attendees will understand the need for thorough investigation of work-related fatalities and will be familiar with the autopsy presentation of death by inhalation of caustic substances.

This presentation will impact the forensic community by suggesting strategies for investigating occupational deaths by using interagency communication and cooperation.

In this case, a 23-year-old man was cleaning the inside of a tanker truck which had been used to carry 50% potassium hydroxide. The procedure for cleaning the tank included a confined space entry procedure, consisting of 21 pages of instructions.

The cleaner used spray head to flush the tank with water at least four times, then used a fan to dry the tank. The tank would be checked for adequate oxygen concentration using a digital meter. A worker would then go into the tank, using a safety harness, mask, ladder, personal air monitor, personal motion detector, and protective equipment. A second worker, acting as the safety attendant, remained outside the tank. Ventilation was introduced by using an air hose inserted into a small hatch in the tank. The worker would remove any remaining chemical using a high-pressure water hose, hand dry the tank, and inspect it for corrosion. During the cleaning procedure, the truck engine was off.

On the day this case occurred, the decedent was working alone. Fifteen minutes after he entered the tank, another worker checked on him and found him unresponsive at the bottom of the tank. He was removed from the tank using his safety harness, and taken to a hospital, where he was pronounced dead.

Autopsy showed pulmonary edema, and pulmonary and gastric hemorrhage. Toxicology was negative except for vitreous urea nitrogen of 30 mg/dL.

The supervising Coroner's investigator and Chief Medical Examiner-Coroner visited the scene and discussed the procedures used for cleaning the tank with employees of the transportation company. In addition, Coroner's staff met with the involved police agency and representatives of California Department of Industrial Relations, Division of Occupational Safety and Health. The Material Safety Data Sheet for potassium hydroxide and the medical literature provided additional information.

The cause of death was determined to be pulmonary edema due to potassium hydroxide exposure and other undetermined factors. Dehydration was given as a contributing condition.

The medical literature contains reports of chronic obstructive lung disease following sodium hydroxide inhalation. However, rapid death after potassium hydroxide inhalation has not been reported. The mechanism of death proposed for this case is that the caustic potassium hydroxide produced widespread pulmonary edema, with rapid degradation of respiratory function. The exothermic reaction of potassium hydroxide and water may have contributed to death by heating the inside of the tank.

Given the non-specific autopsy and toxicology findings, additional investigation was essential in determining the cause of death for this decedent. Through cooperation between the Coroner, law enforcement, and occupational health agencies, the cause of death could be established in this case.

Occupational Health, Potassium Hydroxide, Inhalation

G108 Agonal Sequences in Eight Filmed Hangings: Analysis of Respiratory and Movement Responses to Asphyxia by Hanging

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After attending this presentation, attendees will have a better understanding of the pathophysiology of human asphyxia by hanging.

This presentation will impact the forensic community by providing new insights into the body responses to asphyxia by hanging, based on results from the Working Group on Human Asphyxia.

Introduction: In the conducting of investigations and trials, forensic pathologists are often asked questions related to body responses in human asphyxia. Those questions are very difficult to answer considering the paucity of literature. Animal studies have been conducted, but the extent to which those results can be applied to human is doubtful. As for direct human experimentation, it is of course out of question for obvious ethical concerns. To palliate these limitations, the Working Group on Human Asphyxia was formed in 2006 at the 58th Meeting of the AAHS in Seattle. This working group has for main objective to regroup filmed hangings in order to give new insights into the pathophysiology of human hanging.

Methods: A total of eight filmed hangings from three different countries (Canada, Switzerland, and United-States) were analyzed: two filmed suicides and six autoerotic deaths. Hangings were of different types: free hanging, hangings with feet on the ground, hanging kneeling and hanging almost lying face-down. The hanging ligatures also varied widely, from cloth band to ropes with or without padding and electric

cords. All victims were adult males. Those filmed hangings were compared in terms of loss of consciousness, convulsions, decortication and decerebration rigidities, loss of muscle tone, last muscle movement, and respiratory responses. The time frame at which each of these responses occurred was taken by two judges.

Results: With the time 0 representing the onset of hanging, rapid loss of consciousness was observed (at 8 – 18 seconds), closely followed by appearance of convulsions (at 10 – 19 seconds) in all cases. A complex pattern of decerebration and decortication rigidity was then observed in all cases. Last isolated muscle movement occurred between 1 minute-2 seconds and 7 minutes-31 seconds. High similitude was observed for respiratory responses: onset of very deep respiratory attempts between 13 and 24 seconds, last attempt between 1 minute-02 seconds and 2 minutes-05 seconds.

nd : no data/– not observed

	Case #1	Case #2	Case #3	Case #4	Case #5	Case #6	Case #7	Case #8
Movement Responses								
Loss of consciousness	13s	nd	18s	nd	10s	8s	10s	12s
Convulsions	15s	14s	19s	18s	13s	11s	10s	14s
Decerebration	46s	19s	21s	nd	1min19s	31s	11s	26s
Decortication #1	21s	1min08s	1min00s	nd	59s	33s	26s	31s
Decortication #2	1min11s	1min32s	1min04s	nd	–	–	34s	–
Loss of muscle tone	1min38s	2min43s	2min04s	nd	1min52s	–	–	–
Last muscle movement	4min10s	3min01s	3min01s	nd	7min31s	1min02s	nd	nd
Respiratory Responses – Very Deep Respiratory Attempts								
Start	20s	21s	22s	24s	13s	19s	13s	16s
End	2min00s	2min47s	2min04s	nd	2min5s	1min02s	nd	nd

Conclusion: Despite differences in the types of hanging, similarities could be revealed regarding rapid loss of consciousness and onset of convulsions, pattern of decortication rigidity and respiratory responses. To date, this is a unique study of agonal movements in asphyxia by hanging. The importance of inter-laboratory collaboration in extending this project by adding other available filmed hangings is discussed and the importance of the Working Group of Human Asphyxia (WGHA) is further emphasized.

Asphyxia, Hanging, Physiopathology

G109 Dead Victim Identification: Age Determination by Analysis of Bomb-Pulse Radiocarbon in Tooth Enamel

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After attending this presentation, attendees will understand how biological samples produced in the past 60 years can be dated using the radiocarbon bomb-pulse. Specifically, they will learn how the 14C content of dental enamel can be used to determine year of birth of persons born after 1945.

This presentation will impact the forensic community by providing a technique that improves the accuracy in age determination of dead victims, such as suspected homicides and victims of mass disasters.

Background: Determining the age of an individual is an important step in dead victim identification, particularly in suspected homicide cases and in mass disaster work. Age determination can be performed with high precision up to adolescence by analysis of dentition, but establishing the age of adults has remained difficult. The enamel of individual permanent teeth is formed at distinct, well-characterized time points during childhood. After being laid down, there is no turnover of

enamel, so its ¹⁴C concentration reflects the level in the biosphere at the time of enamel formation. Atmospheric testing of nuclear weapons doubled the global ¹⁴CO₂ level between 1955 and 1963. After adoption of the Partial Test Ban Treaty in 1963, the level of atmospheric ¹⁴CO₂ started to decrease exponentially with a mean life of about 16 years due to transport into large carbon reservoirs such as the oceans and losses to space. The enhanced level of ¹⁴C worked its way up the food chain from CO₂ so that all living things are labeled with the pulse.

Material and Methods: The concentration of ¹⁴C in tooth enamel from individual teeth and related it to the known concentration in the atmosphere over time (1950 – present) to establish the time of tooth formation was measured. The dates were then used to estimate the year of birth of the person. To this end, the crown of the tooth was cut away from the root at the level of the cervical line. The crown was then immersed in 10N NaOH, before being placed in a water-bath sonicator. The enamel was then washed with DDH₂O and re-submersed in 10N NaOH during approximately four days to remove all dentin until pre-treated for accelerator mass spectrometry (AMS) analysis.

Results: The technique matched ¹⁴C content in enamel to known age very well along the bomb spike curve. The absolute difference between estimated age and true age was 1.1 ± 0.9 years for teeth from Scandinavian subjects, implying a much higher precision than any previous method. Analysis of teeth from deceased subjects from other continents showed similar accuracy, suggesting that the geographical variation of the bomb-pulse radiocarbon does not significantly influence the readings. For teeth formed before 1955, the ¹⁴C analysis can only tell that the person was born before the nuclear tests (birth year of person before 1945 - 1952, depending on type of tooth analyzed), but with absolute certainty.

Conclusion: AMS analysis of teeth offers a precise age determination that can be applied in forensic casework, particularly to assist in investigations of unidentified human cadavers. If radiocarbon determination and aspartic acid racemization analysis of teeth are combined, information of both the year of birth and the year of death can be established.

This work was supported by the Human Frontiers Science Program and Wenner-Gren Foundation.

Age Determination, Radiocarbon, Tooth

G110 Postmortem Injury Detection in an Aviation Mishap: Computed Tomography Imaging Versus Autopsy

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After attending this presentation, attendees will understand the utility and limitations of postmortem computed tomography (CT) analysis of traumatic injury victims compared with standard autopsy.

This presentation will impact the forensic community by demonstrating how CT imaging can complement the conventional autopsy in the injury detection of aviation mishap victims.

Purpose: This study compared and contrasted the sensitivity of CT imaging versus autopsy in the postmortem detection of injuries sustained in an aviation mishap.

Methods and Materials: Four male victims from an aviation mishap were studied with whole-body CT examinations prior to conventional autopsy. Autopsies were conducted by forensic pathologists and autopsy reports created without reference to the CT

imaging studies. Blinded to autopsy reports, two radiologists then retrospectively interpreted each study in a consensus fashion. Images were evaluated for fractures, dislocations, and soft tissue abnormalities resulting from traumatic injury. Radiology interpretation was compared to autopsy reports to determine the sensitivity of each method in detecting these injuries. CT studies were then re-examined to review missed or discordant findings in order to determine if a successful imaging correlate with the autopsy results could be obtained.

Results: Autopsy and CT imaging detected a total of 236 fractures and dislocations. Autopsy detected 139 (59%) and CT imaging detected 231 (98%) of these findings. In regions of the body that were not fully explored during the autopsy procedure (e.g., posterior vertebral body elements, scapula, and ribs), the CT images frequently revealed fractures not recorded on the autopsy reports. Autopsy and CT imaging detected a total of 56 soft tissue abnormalities. Autopsy detected 55 (98%) and CT imaging detected 14 (25%) of these findings. The detailed description of soft tissue abnormalities found in the autopsy reports was frequently not appreciated with CT imaging. Some of these soft tissue abnormalities were apparent in retrospect after being un-blinded to the autopsy reports.

Conclusion: The use of CT imaging is a useful adjunct to autopsy in the postmortem detection of injuries following an aviation mishap. CT imaging demonstrates high sensitivity for the detection of fractures and dislocations but is currently limited in the detection of soft tissue injuries.

The views expressed in this article are those of the authors and do not necessarily reflect the official policy or position of the Department of the Navy, Army, Department of Defense, or the United States Government.

Computed Tomography, Traumatic Injury, Aviation Mishap

G111 Usefulness of Systematic Histological Examination in Routine Forensic Autopsy

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After attending this presentation, attendees will be aware of the considerable discrepancy rate between macroscopic and microscopic findings provided by standard histology in forensic autopsy.

This presentation will impact the forensic community by showing that histology is an important feature regarding forensic autopsy quality and is still essential to confirm, refine, or refute macroscopic findings.

Material and Methods: A prospective study was carried out on 1,786 autopsies performed in the department of pathology and forensic medicine at the Raymond Poincaré hospital from 2003 to 2007, for which standard histological examination was systematic according to autopsy protocol (including microscopic sections of the heart, lungs, liver, kidneys, pancreas, spleen, thyroid, adrenal glands, prostate and neuropathological study after brain formalin fixation). Histological sections were stained with haematoxylin and eosin. From all these autopsy cases were randomly selected 428 cases for which microscopic sections were reviewed by two forensic pathologists. SIDS cases and skeleton cases were excluded from the study. For each case, information provided by histology regarding respectively cause and manner of death, death mechanism, prior medical condition of the deceased, and documentation of eventual traumatic lesions were analyzed. Discrepancies between gross anatomic and microscopic findings were also studied.

Results: The mean age of the population was 46.2 years (range 5-91 years). The sex ratio (H/F) was equal to 2.46. Bodies showed respectively putrefaction in 92 cases, mummification in one case and diffuse carbonization in 15 cases. Concerning manner of death, the

majority of the cases were natural deaths (n=130, including 63 cases of sudden death), followed by suicide (n=113), accident (n=104). Homicide and undetermined manner of death were respectively found in 40 and 41 cases. The most frequent causes of death were blunt force injuries (n=73), cardio-vascular diseases (n=90), mechanical asphyxia including drowning (n=62), acute intoxication (n=59) and gunshot wounds (n=47). No cause of death was found in 32 cases. Mechanism of death not shown by gross anatomic findings was discovered by histology in about 40% of the cases (n=173). The main mechanisms of death found were respectively cardiac arrhythmogenic substrate (n=98), acute myocardial ischaemia (n=17), pulmonary infection (n=17), vital alimentary aspiration (n=14), fat embolism (n=13), pulmonary thromboembolism (n=5), diffuse axonal injury (n=3), disseminated intra-vascular coagulation (n=2) and sickle cell crisis (n=2). Cause of death was established only by histology in 8.4 % of the cases (n=36). In the 32 cases for which no cause of death was found, histology showed possible mechanism of death in 11 cases corresponding to a cardiac arrhythmogenic substrate. Microscopic findings affected the manner of death in 13% of the cases (n=56). Histology provided complementary information about prior medical condition of the deceased in about 49% of the cases (n=211). Traumatic lesions were better documented by histology in about 22% of the cases (n=94). The majority of discrepancies between microscopic and gross autopsy findings involved the liver, the heart, and the lungs. According to these results, microscopic findings are relevant if adequate sampling for histology is performed during autopsy. In most of the studied cases, histology can be considered contributory regarding respectively mechanism, cause and manner of death, prior medical condition of the deceased and traumatic lesions documentation.

Conclusions: According to the results of this study, systematic standard histology for the main organs should be used in routine forensic autopsies.

Forensic Autopsy, Histology, Cause of Death

G112 Radiology Students and Morgues: A Mutually Beneficial Relationship

Nancy S. Adams, BS, 202 Milford Street, #155, Tupelo, MS 38801*

After attending this presentation, attendees will be better informed of the benefits that may be realized by affiliating with a radiologic technology program to provide radiology students with clinical morgue experience.

This presentation will impact the forensic community by making people aware of the improvements to radiographic image quality that may be accomplished when radiology students are allowed to observe autopsies and assist with forensic radiographs. A secondary benefit is recognized in preparing the radiologic technologist to assist with other skills such as evidence collection and preservation.

Interest in the forensic sciences has grown significantly in recent years as events and the media have focused attention on forensic investigations, and the radiologic sciences are no exception. Due to most morgues and medical examiner facilities being totally separate from hospitals today, the radiology student and radiology practitioner do not have adequate experience in forensic imaging. As radiology equipment becomes more and more sophisticated, and imaging techniques such as virtual autopsies and 3D CT reconstruction are utilized more frequently, the skills of the board-certified technologist will be in greater demand. Due to the nature of the work, it is important for the student to have some knowledge of the expectations and working conditions to aid in determining if this is a field they may wish to pursue. Just as the student obtains knowledge and experience in a broad range of imaging modalities to decide on a career path after graduation, an introduction to the morgue and forensic imaging should be available as well. Many times the radiologic technologist must image living and deceased

subjects in the emergency department, and if that technologist has some forensic training and background, preservation of evidence would be complied with, observation and interview skills would be enhanced, and the images obtained would provide proper legal documentation.

The morgue or medical examiner's facility can benefit by having students and instructors available who are well-versed in recognizing imaging artifacts, equipment and image processing malfunctions, and are able to troubleshoot and correct or at least identify the problem. They can develop proper exposure techniques and set up guidelines; train morgue assistants in obtaining better images; recognize foreign objects and implants; position to overcome superimposition of structures or demonstrate an anatomical part more accurately. In addition, the instructors work with the students to compare ante-and postmortem images and reproduce an antemortem position if necessary for comparison. An additional benefit includes access to board-certified instructors who are available to the facility for consultation, physically or electronically. A financial benefit to the facility may also be considered, as the students and instructors are not paid employees, and may assist in reducing overhead by maintaining the x-ray and image processing equipment in proper working order. And as a final benefit, the facility may be able to recruit exceptional candidates for employment, many of whom will have a bachelor's degree and may seek additional training as a multi-skilled individual.

This presentation describes an arrangement between a radiologic technology program and a medical examiner's facility and the mutual benefits both groups have enjoyed to date, including the development of a forensic radiography handbook suitable for both the novice radiographer and the morgue assistant involved in taking forensic x-rays.
Radiology, Student, Education

G113 CT Autopsy Imaging in the State Medical Examiner Setting: Logistic Issues, Techniques, and Findings

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The goals of this presentation are to describe this research experience with logistic and technical aspects of the development of a CT autopsy imaging service for the state medical examiner's (ME) investigation of traumatic death, describe and compare CT imaging autopsy appearances with the ME's autopsy findings, and consider the future potential of CT imaging autopsy.

The logistic and technical challenges to the development of a CT autopsy imaging service require educational efforts and infrastructure development. Imaging autopsy is an accurate tool for the detection of most major injuries and causes of death resulting from blunt trauma or drowning. This presentation will impact the forensic science community by demonstrating how CT imaging autopsy has the potential to replace conventional medical examiner autopsy in some deaths resulting from accidental blunt trauma and may facilitate rapid retrieval of ballistic fragments in cases where forensic autopsy is required.

The medical examiner community has shown interest in the use of CT autopsy imaging, but faces problems of access due to financial, technical, transportation, interpretation, and related difficulties in incorporating this tool into regular practice as compared to CT imaging

in the clinical care of the living. Sharing collective experience, both positive and negative, in addressing these issues is important in identifying its long-term role in the medical examiner setting.

The logistic and technical challenges to the development of a CT autopsy imaging service require educational efforts and infrastructure development. Imaging autopsy is an accurate tool for the detection of most major injuries and causes of death resulting from blunt trauma or drowning. CT imaging autopsy has the potential to replace conventional ME autopsy in some deaths resulting from accidental blunt trauma and may facilitate rapid retrieval of ballistic fragments in cases where forensic autopsy is required.

CT Imaging, Autopsy, Logistics

G114 Intersecting Fractures of the Skull and Gunshot Wounds: Case Report and Literature Review

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After attending this presentation, attendees will have a clear example of Puppe's rule utility in gunshot wounds analysis and will learn the advantages of a Multi-Slice Computed Tomography approach in such cases.

This presentation will impact the forensic community by demonstrating the ability of CT scanning to show gunshot wounds to the skull vault including entrance wound, exit wound with beveling, direction of the bullet path as well as differentiation between entrance and exit wounds using intersecting fractures (Puppe's rule).

This paper highlights the ability of CT scanning to show gunshot wounds to the skull vault including entrance wound, exit wound with beveling, direction of the bullet path as well as differentiation between entrance and exit wounds using Puppe's rule.

This rule, established by the German forensic pathologist Puppe in 1903, states that when two or more fracture lines of the skull produced by different blunt forces intersect, it is possible to reconstruct the sequence of injuries.

The intact skull allows fracture lines to develop normally while the presence of bone damages causes the subsequent injuries to stop in the point of intersection with the previous wounds. In other words this means that fracture lines produced by subsequent impacts are arrested at pre-existing fractures of the skull.

No exceptions to this rule have been found in systematic investigations on skulls, glass, and eggs stricken with subsequent blows.

Although multiple gunshots cause an extensive and sometimes very complex pattern of fractures due to the hydrodynamic effect produced by the bullet traversing the temporal cavity of the brain, in the majority of cases, Puppe's rule can be usefully applied.

This principle gains interest in sequencing multiple gunshot injuries and in determining the direction of fire. However, it may be useful also in differentiating entrance from exit wounds, especially if specific distinguishing features are absent (i.e., internal/ external beveling of the skull).

Herein a case of a 76-year-old man who shot himself in the mouth with a Walther PPK 7.65 handgun (caliber 9x17 mm) is reported.

Prior to autopsy a total body multislice computed tomography scan (MSCT) was performed. MSCT scanning was executed on a MX 8000

Quad Diamond select unit (Philips Medical Systems, Andover, MA). In areas of forensic importance, axial MSCT was performed with 4 x 1, 25 mm collimation. The duration of MSCT scanning was approximately 15 min. Using an open-source workstation (OsiriX version 3.1) it was possible to calculate two-dimensional sagittal and coronal reformations and three-dimensional reconstructions.

Major radiological findings were: a bone defect of the hard palate, a complex pattern of fractures of the ethmoid bone with hemorrhagic filling of the ethmoid sinus, an anterior pneumoencephalus, a fracture of the anterior cranial fossa and a bone defect of the vault with external beveling of the outer table.

The abrupt termination of a fracture line belonging to the exit wound pattern (parietal bone) at a pre-existing damage caused by the entering bullet (temporal fracture originating from the entrance wound), well documented by the 3D-CT reconstruction, was used as an adjunctive tool to better distinguish the entrance from the exit wound.

This paper describes a clear visual example of Puppe's rule utility in the analysis of gunshot injuries of the skull and highlights the importance of postmortem forensic radiology.

In fact, MSCT allowed the investigation of the anatomical sites that are hardly accessible at autopsy (such as paranasal sinuses, temporal and ethmoid bones, etc.) and offers different views and angles of imaging improving the quality of the investigation.

Gunshot Wounds of the Skull, Intersecting Fractures, Puppe's Rule

G115 Sudden Cardiac Death Due to Atrophy and Fibrous and/or Fatty Substitution of Right Ventricle: Pathologic Substrates and Postmortem High Resolution MRI

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After attending this presentation, attendees will be introduced to some cases arrived to observation of Section of Legal Medicine of Palermo about sudden cardiac arrhythmogenic death, in order to show the possible disease that can cause death. This presentation emphasizes the difficulty of making diagnosis of Arrhythmogenic right ventricular cardiomyopathy (ARVC) without genetic analysis: myocardial atrophy and fatty/fibro-fatty substitution is diagnostic of ARVC at autopsy only in absence of any other cardiac and extracardiac remarkable injuries.

This presentation will impact the forensic community by demonstrating how data showed highly frequent association between ARVC and the fatty variant with cardiomyopathic pattern. MRI is more sensitive to detect the fatty variant with the cardiomypathic pattern rather than fibro-fatty and/or infiltrative substrate. With this presentation authors will show cases reached to their attention in the last years, characterized by atrophy and fibrous and/or fatty substitution of right ventricle's muscle, with consequent sudden cardiac arrhythmogenic death. Besides, authors will try to make differential diagnosis between different nosologic entities compatible with histological findings, in order to reach the most probable diagnostic hypothesis.

ARVC is a primitive disease of myocardium with not-well-known aetiology, characterized by structural and functional abnormalities of right ventricle, that consist in an hemodynamic, rhythmic and electric disarrayes, due to progressive myocardial atrophy with fatty or fibro-fatty substitution.

Sectorial or widespread atrophy of the myocardium of free wall of right ventricle is the typical morphologic case, with normal characteristics of left ventricle and interventricular sept. Loss of myocardium set the trans-lightning of the wall, that appears to be yellowish for the fatty substitution and/or whitish for the fibrous substitution. Another constant find is the right ventricular dilatation, from mild to severe, with hypokinesia or akinesia of the muscle.

Less frequent are noticed single or multiple right parietal aneurysms, more often at the back side, infundibulous or apex. Besides, frequently there's mural thrombosis of right ventricle and septal fibrosis. This can cause a consequent bilateral atrial dilatation with the high risk of auricular thrombosis with possible systemic and pulmonary embolism.

From 1990 to 2006 474 autopsies of sudden cardiac death (SCD) were performed. In this series, ARVC accounted for 27 cases (16.4%), including 21 males and 6 females (16 to 43 years old; median 26 years). Circumstances of death were during physical exercise in 20 cases, and at rest in seven cases. The family history of ARVC and/or SCD was negative.

The transmural loss of the myocardium in the right ventricular free wall was diffuse in 11 cases and segmental in 16 cases. External bulging of right ventricular free wall and left ventricular was present in four and six cases respectively. The myocardial atrophy was replaced by fatty tissue in 20 cases and by fibro-fatty tissue in seven cases. The interface between residual cardiomyocytes and tissue replacing the myocardium (fatty or fibro-fatty), was wave front (cardiomyopathic pattern) in 21 cases, and lacelike (infiltrative pattern) in six cases. Active myocarditis was detectable in the fibro-fatty variant only. MRI describe the fatty replacement on T1-weighted images with moderate inter-intra observer variability, thus sequende like "fat suppression" or "triple inversion recovery" to evaluate fatty replacement might provide a significant improvement in the diagnosis of ARVC.

The data showed highly frequent association between ARVC and the fatty variant with cardiomyopathic pattern. MRI is more sensitive to detect the fatty variant with the cardiomypathic pattern rather than fibro-fatty and/or infiltrative substrate.

With this presentation cases reached to their attention in the last years, characterized by atrophy and fibrous and/or fatty substitution of right ventricle's muscle, with consequent sudden cardiac arrhythmogenic death will be discussed. Besides, authors will try to make differential diagnosis between different nosologic entities compatible with histological findings, in order to reach the most probable diagnostic hypothesis.

Sudden Cardiac Death, Arrhythmogenic Right Ventricular Cardiomyopathy, Magnetic Resonance Imaging

G116 Autopulse® Associated Injuries

Kathryn H. Haden-Pinneri, MD, Harris County Medical Examiner's Office, 1885 Old Spanish Trail, Houston, TX 77054; Dwayne A. Wolf, MD, PhD, Harris County Medical Examiner's Office, JAJ Forensic Center, 1885 Old Spanish Trail, Houston, TX 77054; and Jennifer C. Love, PhD, and Roger A. Mitchell, Jr., MD, Harris County Medical Examiner's Office, 1885 Old Spanish Trail, Houston, TX 77054*

By attending this presentation, attendees will become familiar with the Autopulse® resuscitation device and the variety of internal injuries that can be associated with its use.

This presentation will impact the forensic community by educating forensic pathologists about the visceral and skeletal injuries associated with the use of automated chest compression devices so that they are not misinterpreted as perimortem trauma.

Automated devices have been utilized to assist with cardiopulmonary resuscitation (CPR) for many years. The most commonly encountered device is an Automated External Defibrillator

(AED) which provides rapid defibrillation for those patients with shockable rhythms. The newest device is a portable automatic external chest compression device. The Autopulse® Non-Invasive Cardiac Support Pump is one of these devices. Originally developed by the Revivant Corporation and subsequently purchased by Zoll Medical Corporation, the Autopulse® provides consistent, uninterrupted chest compressions through a load distributing band which squeezes the entire chest. Utilizing the device frees the emergency medical technician normally assigned to do chest compressions to perform other life saving activities while transporting the patient.

This FDA-approved device consists of a short backboard and a load distributing disposable compression band, called a LifeBand®. The patient is placed on the board and the band is secured around his or her chest. The band automatically sizes the patient, calculating the size, shape and compliance needed without requiring any patient information to be entered. Once started, the Autopulse® rhythmically constricts the entire rib cage, compressing at a rate of approximately 80 beats per minute. The LifeBand® can be placed over AED pads, but must be removed for standard paddle defibrillators. Compressions continue for as long as necessary or until the device is stopped. Standard protocol is for patients to receive manual chest compressions before the device is started.

Houston, Texas became a test center for the use of the Autopulse® with devices installed in all Houston Fire Department first responder vehicles. During a two month period, the Autopulse® was utilized on 264 patients, 156 (59%) of whom died and met criteria for medical examiner jurisdiction. Of these cases, 54 (35%) were autopsied. Nearly all patients had the external stigmata associated with Autopulse® use, a finding previously reported in the literature. More importantly, though, a significant number had internal injuries. The most common finding, after the external abrasions, is posterior rib fractures associated with posterior intercostal muscle hemorrhage, an injury previously not associated with manual chest compressions. Other injuries include liver and spleen lacerations, hemoperitoneum, vertebral body fractures, and mesenteric lacerations.

A subsequent study at the Harris County Medical Examiner's Office of patients who were resuscitated utilizing the Autopulse® was undertaken to determine if body habitus or bone strength played a role in occurrence of injuries. A total of 58 cases were reviewed and 36 (62%) were found to have posterior rib fractures. Rib fractures occurred fairly equally amongst younger individuals with robust bone as well as older individuals with osteoporosis. Furthermore, the overall size of the chest did not appear to be associated with an increase or decrease in rib fractures or visceral injuries. However, band placement, evidenced by the characteristic skin abrasions, and body habitus were associated with bone and visceral injuries.

Data is still being analyzed in the utility of the Autopulse® in mainstream resuscitation. Some studies have shown improvement in survival over manual compressions, while others did not. Over 4300 units have been installed and approximately 24000 LifeBands™ have been used clinically, and these numbers are likely to increase. A comprehensive understanding of biomechanics and resultant bone and visceral injuries is crucial for forensic pathologists charged with the responsibility to differentiate between Autopulse® and traumatic injuries. It would be prudent to have a policy in place with the EMS responders in your area such that they are not used on patients with traumatic injuries and they should never be utilized on children.

Autopulse®, Autopsy, Posterior Rib Fractures

G117 Migration of a Bullet in the Lumbosacral Spinal Canal: A Case Report and Review of the Literature

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After attending this presentation, attendees will understand rare cases in common medicolegal autopsy practice, descriptions of different types of spinal canal migration reported in the literature, and mechanisms and conditions that could induce a bullet migration.

This presentation will impact the forensic community by explaining a well known but relatively rare phenomenon in common medicolegal autopsy practice.

Reported here is a case of a 22-year-old man who was hit by a gunshot on the left part of the chest in the sixth intercostal space. The bullet had a previous course in a first victim.

The X-Ray examination of the body of the 22-year-old man showed a metallic object projected at the level of L1. At autopsy, examiners described that the bullet during its trajectory induced a pulmonary lesion, gastric perforation, pancreas, and hepatic lesion and left renal vein and artery perforation. The bullet then entered the spinal canal through the L1-L2 intervertebral foramen. Classical laminectomy at the lumbar level was performed, the dura was opened, and the bullet was found at the L5-S1 level. This case illustrates a bullet migration due to gravitational forces as its kinetic energy decreased after an intermediary target (the first victim) and collision with body structures.

The different cases reported in the literature, particularly the different types of migration will be discussed. If migration of T10-S1 seems to be more frequent, some authors reported a C1 to S2 or cranium to L4 migration. In one case, a migration from S1 to L4 level in the cranial direction, because of the patient's position, was also described. The different mechanism of migration and the symptomatic effect of this phenomenon will also be discussed.

Bullet, Migration, Spinal Canal

G118 Homicide-Suicide in Tours France: 2000-2007

Pauline Saint-Martin, MD, and Patrick O. Byrne, MD, Service de Médecine Legale, Hôpital Trousseau, Centre Hospitalier Régional Universitaire de Tours, Tours, 37000, FRANCE*

After attending this presentation, attendees will learn about the characteristics of homicide-suicide in a French rural area in an eight-year period, as only one study on these events has been conducted in France.

This presentation will impact the forensic science community by expanding knowledge of homicide-suicide in France. An important stage could be the creation of a national surveillance network, so that studies could be conducted over the whole country and over a long time span, allowing the possibility of preventive intervention.

Introduction: Homicide-suicide (HS) has been defined by a homicide committed by a person who subsequently commits suicide within one week of the homicide. These events are relatively uncommon but they have often drawn the media's attention. HS occupies a distinct epidemiological domain that overlaps with suicide and domestic homicide. Two major classifications have been proposed. Both are based on victim-offender relationship and motive. Few statewide studies of HS events have been conducted, but no data from France are available, except one Parisian study. This study of the characteristics of

all HS in Tours, France during an eight-year period was compared with results obtained in other international studies.

Material and Methods: Case records of the Institute of Forensic Science of Tours were reviewed for 2000-2007. The age and sex of the perpetrator and victim, the relationship between them, the method of death, and the circumstances were noted.

Results: Sixteen HS involving a total of 33 decedents occurred during the 8-year period. It represents 11% of the total case of homicides within this period, for a population of 871,000 persons. All offenders were male, with a mean age of 68 years. In 11 events (68%), the offender used a rifle for both the homicide and suicide. Most victims were female (14/17), with a mean age of 64 years. Fourteen events occurred at home. Five were suicide pacts, during which one person killed the other before committing suicide. In these cases, a suicide note was always found.

Discussion: Data were similar to those obtained in other studies. The victim was often a female who was younger than the offender and her intimate partner. The most frequent apparent motive was the breakdown of the relationship. Suicide pacts were also frequent. Shooting was the most frequent used method of both homicide and suicide. Availability of firearms in this rural area of France can be explained by an important activity of hunting. The percentage of HS related to the total number of homicides was important and this result confirmed one epidemiological law of HS: the lower the homicide rate, the higher the percentage of HS. One limitation of study was the limited number of cases. However, a research strategy should be developed in France to expand knowledge of these events. A phase of this strategy could be the creation of a national surveillance network, as well as preventive interventions.

Homicide-Suicide, Suicide Pact, Amorous Jealousy

G119 Sudden Deaths Associated With Sexual Activity

Albert Y. Chu, MD, Sharon M. Derrick, PhD, and Luis A. Sanchez, MD, Harris County Medical Examiner's Office, 1885 Old Spanish Trail, Houston, TX 77054*

Attendees will review of non-homicidal sudden deaths associated with sexual activity that occurred in Harris County, Texas, from January 2004 until the present. The goal of this presentation is to describe the epidemiological characteristics, autopsy findings, and toxicology results in this group of decedents.

This presentation will impact the forensic community by describing a population of decedents that commonly present to medical examiner and coroner's offices, including a description of the relatively high prevalence of substance abuse in this population.

Because deaths associated with sexual activity often occur suddenly and outside of the care of a physician, they are frequently reported to the local medical examiner or coroner's office. The extent of the resulting death investigation may range from no additional investigation to a full autopsy with histologic and toxicologic evaluation, depending on the circumstances of the particular case, office-specific guidelines, and the judgment of the individual pathologist/investigator. To further characterize this group of decedents and thereby aid in the investigation of similar deaths in the future, a review of sudden deaths associated with sexual activity was performed.

A review of cases from the Harris County Medical Examiner's Office from January 2004 until the present identified 35 cases of sudden death associated with sexual activity (excluding homicides). These cases fell into three broad categories: (1) collapse occurring either during or immediately around the time of sexual intercourse (22, 62.9 percent), (2) individuals found unresponsive in adult-oriented establishments (theaters, video booths, etc) (11, 31.4 percent), and (3) cases of autoerotic asphyxiation (2, 5.7%).

Autopsies were performed in 29 of 35 (89.7%) of all cases and toxicology testing (including at least a screen for stimulants) was performed in 25 of 35 (71.4%) of all cases. The population was overwhelmingly male, with a male to female ratio of 10.7 to 1. The mean age was 57.6 years. Atherosclerotic and/or hypertensive cardiovascular disease represented the most common natural cause of death, and was identified in 29 of 35 (82.9%) of all cases. The mean heart weight was 543.9 grams among natural deaths and 490.0 grams among deaths attributed to substance abuse.

Deaths were attributed to substance abuse in nine of 35 (25.7%) of all cases and nine of 25 (36.0%) of cases in which toxicology testing was performed. Of these, only five of nine (55.6%) had a known history of substance abuse. Among cases in which toxicology testing was performed, substance abuse-related deaths occurred in five of 14 (35.7%) of individuals having sexual intercourse and four of nine (44.4%) of individuals found in adult-oriented establishments. Cocaine was the most commonly identified drug of abuse, followed by methamphetamine and methylenedioxymethamphetamine. One case of inhalant abuse (ethyl chloride) was identified. Atherosclerotic and/or hypertensive cardiovascular disease was identified in six of nine (66.7%) of deaths attributed to substance abuse.

The high prevalence of cardiovascular disease that researchers observed is consistent with previous studies of myocardial infarction and/or sudden death associated with sexual activity. Less recognized by the existing medical literature is the significant prevalence of substance abuse in this population, including those decedents with no known history of drug use. The results of this review suggest that a history of sudden death in association with sexual activity warrants at least a toxicologic analysis for stimulants in order to classify accurately the cause and manner of death, even in the absence of a known history of substance abuse.

Sudden death, Sexual, Toxicology

G120 Sex Killer: Sexually Related Trauma and Deaths - Forensic Aspects

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After attending this presentation, attendees will know the description of potentially dangerous sexual practices and their consequences involving death.

This presentation will impact the forensic science community by the knowledge and the awareness of these particular sexual practices and their consequences involving death.

Introduction: Many men and women practice a broad range of voluntary sexual activities, most of which are harmless. Many minor injuries of the genital, oral, and anal areas do occur but most of them only require symptomatic therapy. The only erotic activities with an unacceptable risk for injury are vaginal insufflations during pregnancy, and fist fornication. Some forensic deaths are indirectly linked to sexual activity. Three cases of deaths with unusual fatal mechanisms during sexual activities are reported.

Materials and Methods: Forensic investigations of the crime scene and the autopsy findings of three cases: two women and one man will be presented. Another living woman with important genital lesions provoked by sexual activity was examined by a forensic pathologist and gynecologic doctor. The pelvic and abdominal lesions are described.

Results: In Case 1, a 35-year-old woman was found dead in her bed. The death was attributed to asphyxia by strangulation. At autopsy,

anal and sphincter injuries and massive rectal hemorrhage were seen, due to rectal fist insertion (fisting). Her husband was sentenced for murder by strangulation and sexual assault. Case 2 presents a 42-year-old man was found dead in his car in the driver's seat, his clothes (trousers and underpants) pulled down around his ankles. Police and forensic investigations supposed voluntary sexual practices with a prostitute, such as oral sex. At autopsy, investigators observed an internal thoracic hemorrhage linked to a ruptured aortic aneurysm. The sexual activity brought about the tearing of aortic tissue. Case 3 presents a 48-year-old woman performed voluntary sexual activities such as vaginal and rectal fist and foreign body insertion (alcohol bottle into the base) during heterosexual activity. The surgeons observed haematomas of the vulva, major labia, minor labia, and anal area. A colostomy was performed for the anal sphincter injuries and a surgical act to drain off the haematomas. In Case 4, a 37-year-old woman was found dead in her bed. A large quantity of blood was observed between and over the thighs. Her husband specified that the blood resulted from menstruation. At autopsy, vaginal injuries and massive hemorrhage were observed, due to vaginal fist insertion (fisting). The cause of death was vaginal hemorrhage due to the fisting. Toxicological analysis showed she was drunk. Her husband pretended that she consented to this sexual activity. He was sentenced for sexual assault leading to the death by hemorrhage.

Discussion: Anal and/or vaginal fist or foreign bodies being inserted are uncommon and potentially dangerous sexual practices. Forensic investigations, the autopsy, toxicological and histopathological findings, and the manner and the mechanism of death for three persons will be discussed. The insertion of a clenched hand and forearm into the vagina or rectum during heterosexual activity and indirect performing aortic rupture on pre-existing lesions during oral sex are linked to the cause of death. The frequency of such fatal outcomes or sexual activity of anal and vaginal penetration, the injuries observed, the cause of death due to these acts (exsanguinations by traumatic damage to the canal anal and to the vagina or/and air embolism), the consequences of these practices, the relationship between the perpetrator and the victim and the special features at the scene, are discussed and compared to the literature. Indeed, foreign bodies, arm, and forearm inserted into the rectum and the vagina with associated hemorrhage and perforation have been well documented in medical literature. However, death following these acts has very rarely been reported. Such cases remain rare but have to be reported to alert the forensic pathologists, investigators, and coroners. In a larger range, the public must be aware of the role of such sexual activity and their consequences involving death.

Fisting, Hemorrhage, Erotic Death

G121 Conducted Electrical Weapons — A Review of the Medical Literature

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After attending this presentation, attendees will have gained a working knowledge of the existing medical literature on conducted electrical weapons such as the TASER X26.

The presentation will impact the forensics community by improving knowledge of the existing medical research on conducted electrical weapons which may be important especially for those who make determination of death decisions.

Conducted electrical weapons are used to control violently resistive subjects. The devices discharge a small electric current that stimulates both afferent sensory neurons causing pain and efferent motor neurons causing involuntary sub-tetanic muscle contraction. The use of these devices is growing in the United States since it fills a large void in the

use-of-force continuum. There is controversy in the lay press and medical literature regarding the use of these weapons and the sudden, in-custody death phenomenon. Some groups have claimed that these devices have caused several hundreds of deaths. This presentation is a review of the existing medical literature on these devices. By attending this presentation, attendees will develop a comprehensive understanding of the existing medical literature on conducted electrical weapons and will develop and understanding of questions that remain to be answered. The existing animal studies, case reports, and human prospective studies will be examined. The focus will be particularly on the existing prospective human research.

The presentation will examine issues such as cardiac safety, respiratory effects, and the impact of the devices on other physiologic parameters such as blood chemistries, pH, stress markers, and temperature. The presentation will examine the use of these devices in the presence of cocaine, and in the presence of cardiac pacemakers and internal defibrillators. The difference between animal data and human data will be discussed.

It is important for the forensic community to be knowledgeable about the existing research and the questions that are still not answered, particularly those individuals who make determinations of cause of death.

Conducted Electrical Weapon, TASER, In-Custody Death

PATHOLOGY/BIOLOGY

G1 Decapitation Due to Car Accident: Description of a Case and Review of the Literature

Francesco Ausania, MD, Antonio Oliva, MD, PhD*, Fidelia Cascini, MD, Massimo Senati, MD, Vincenzo L. Pascali, MD, PhD, and Francesca Cittadini, PhD, Catholic University, School of Medicine, Institute of Forensic Medicine, Largo Francesco Vito 1, Rome, ITALY

The occurrence of complete decapitation as consequence of car accident is an extremely rare event, while suicidal decapitation by hanging has been reported sporadically in forensic literature. The goal of this presentation is to describe a case of decapitation with complete degloving injury of the neck in a man involved in a traffic accident and we review other similar cases reported in literature.

This presentation will impact the forensic community by demonstrating how in such deaths, the concordance of crime scene investigations, autopsy findings and the presence of eyewitnesses if any, should be the ideal situation to achieve a reliable medico-legal analysis.

The occurrence of complete decapitation as consequence of car accident is an extremely rare event, while suicidal decapitation by hanging has been reported sporadically in forensic literature. Decapitation is usually seen in pedestrians run over by trains, and also in motorcyclists who impact against the tail board of trucks. Complete transection of pedestrians and occupants of cars is seen in road accidents with vehicles traveling at a high speed. In a recent report, Kibayashi has described a case of decapitation of a front seat passenger in a single vehicle accident. Another report described the vertical iron bar of a grill fence penetrating the neck and decapitating the driver of a two-wheeler scooter. Here we describe a case of decapitation with complete degloving injury to the neck, of a man involved in a traffic accident, and we review other similar cases reported in the literature.

A 55-year-old Caucasian man was driving his car at a speed of about 120 km/h near the city of Rome when the vehicle skidded off the road, hit another vehicle coming from the opposite direction, and finally impacted the road barriers. The decapitated body of the victim was extracted from the driver's seat, and the head was recovered outside. The immediate police report found that the victim was not wearing a seatbelt. At the autopsy, the body was that of a Caucasian man, decapitated at the first cervical vertebrae. The decapitation site had irregular, ragged and contused margins. Multiple abrasions on the face along with closed fractures of the facial bones and mandible were present. Internal examination of the head revealed diffuse subscalpular hemorrhages, and multiple fractures of the skull bones. The brain was edematous and slight subarachnoid hemorrhage was of the left temporal lobe. There were compound fractures of both humeri, multiple fractures of the ribs on both sides, and closed injuries of the shaft of left femur. Toxicological analysis revealed the presence of alcohol at the following blood concentration 2g/L. No other drugs were detected. Death was instantaneous owing to complete severing of vital neck structures.

Topography, morphologic nature of the wounds, and severity of the injuries of car occupants depend on several factors such as speed at the moment of impact, nature of the collision, active, and passive protection of the occupants, and sitting position. Several efforts and experimental studies have been made to explain the possible mechanisms provoking decapitation following vehicle accident. This injury, in the majority of cases, has been associated with failure to use seat belts, fast driving speed, and road barriers. In this case, it is plausible that because of the high-speed crash, the decapitation was provoked by an external object, such as road-barriers or structural elements of the vehicle being pushed back into the cabin and acting as a sharp-force to the neck. It is believed that in such deaths, the concordance of crime scene investigations, autopsy findings, and the presence of eyewit-

nesses, if any, should be the ideal situation to achieve a reliable medico-legal analysis.

Road Accident, Decapitation, Neck Injuries

G2 Unusual Gunshot Wound Death of a Sex Offender on the Way to Jail in the World of CSI

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After attending this presentation, attendees will learn to assess an unusual case where the evidence at the scene makes it difficult for the medical examiner to decide homicide, suicide or accident and to evaluate peculiar scene circumstances involving ballistic evidence.

The presentation will impact the forensic community by showing how important it is to look at all the evidence at a scene and at an autopsy before making a decision about the manner of death.

A 36-year-old man was dropped off by his wife at a bus stop. He was taking the bus to jail for a nine year sentence in a juvenile sex offender case. He was found two days later on the back road of a rural area. He was sitting in the driver seat of the family car that had been in storage, suffering from a gunshot wound to the leg. He had a tourniquet tied around the injured leg. He had been dead for an unknown period of time and had started to decompose in the summer heat.

Crime technicians noted an unusual finding. Although there were no bullet holes through the car, there was a handgun on the ground outside the driver's door. There was a wooden dowel taped to the barrel of the gun, and a nylon string was tied to the trigger guard of the gun with the other end tied to the steering wheel. Lastly, there was an athletic sock covering the handle of the gun.

The autopsy was routine. The deceased was a healthy man, in the early stages of decomposition. There was a gunshot wound to the right thigh that entered the anterior medial thigh and exited the posterior medial thigh. Dissection revealed that the bullet transected both the femoral artery and vein. The cause of death was exsanguination from a gunshot wound to the leg.

The manner of death was less clear. What was the reason for the wooden dowel and the gun with the sock over the grip? There are several scenarios possible. The first scenario is that the man was attempting suicide because of his conviction and because his relationship with his wife was troubled, but did not want his death to look like a suicide. He used the sock to hide fingerprints and had the dowel taped to the gun so that he could hold the gun far enough away to look like a distant shot. Since he was holding the gun by the taped dowel he needed the string to pull the trigger and then he may have intended to jettison the gun, string, and dowel before dying. He successfully shot himself in the leg, but died in the driver seat of the car before he could get rid of the evidence.

The second scenario is an attempt to look like a holdup or an assault. The individual again knows about fingerprints, gunshot residue and range of fire determination. He rigged the gun to pull the trigger and shoot himself in an attempt to look like someone else shot him. Perhaps he wanted to go to the hospital and delay the start of his jail sentence or obtain sympathy from his wife. But he shot himself in the wrong area of the thigh and although he put a tourniquet on the leg, he bled to death before he could get help.

The third scenario is an accident. Perhaps he was doing something with the string and the dowel that could never be understood, unless the victim himself explained it, and he was accidentally shot. He lost too much blood to drive himself to get help, and he died at the scene.

Questions remain unanswered as to what his motive was. Also, why was the string tied to the steering wheel? Did he use some of the string to make a tourniquet and tie the end of the string to the steering wheel just to prevent the string from blowing away? Why wasn't he able to get help in time? Why was he in this rural area? It is also unclear where he acquired his knowledge of ballistics, but the complex scenario suggests familiarity with the world of CSI.

These are questions that may never have a final answer. But this is a good example of the need for thorough scene examination, background investigation, and straightforward autopsy technique. This presentation will discuss the evidence for each manner of death in this unusual gunshot wound case.

Range of Fire, Ballistics, Unusual Death Scene

G3 The Effect of Clothing on Decomposition Rate: A Teaching Model

Phillip L. Watson, PhD, Ferris State University, 808 Campus Drive, 2004 ASC, Big Rapids, MI 49307*

The goal of this presentation is to illustrate the difference in decomposition rates and insect colonization under identical environmental conditions.

The presence or absence of clothing can alter the decomposition rate. This is a difficult concept to teach unless there is a method that can be duplicated to show both conditions under identical conditions. This study will impact the forensic science community by determining the rate of decomposition of a clothed and unclothed pig as a function of summer environmental conditions.

The presence or absence of clothing can alter the decomposition rate (Anderson 2001, Kelly 2006). This is a difficult concept to teach unless there is a method that can be duplicated to study both scenarios under identical conditions. This study was conducted to determine the rate of decomposition of a clothed and unclothed pig as a function of summer environmental conditions. Insects were collected twice a day until the dry-remains stage occurred, and climate consisting of temperature, relative humidity, rainfall, and wind speed data was collected on an hourly basis. The data show increased activity of forensically important insects to be a function of both temperature and clothing. The delay of the clothed victim to reach the dry-remains stage was significantly different than the victim without clothing. The stages of larvae collected from the clothed victim were also significantly smaller than the larvae collected from the unclothed victim at all collection dates until the unclothed victim was no longer attractive to forensically important flies.

Data collection to be demonstrated will be larva size and species composition on each pig over time. Comparisons were done as an ANOVA test and a species-diversity comparison for all days. Results will be used to set up teaching mock crime scenes to illustrate the effects of clothing on PMI calculations.

Clothing, Decomposition, Flies

G4 Improved Estimation of Time Since Death With Multiple Protein Markers and Automated Analytical Methods

Behnoush Memari, MS, Kenneth G. Furton, PhD, and Alberto Sabucedo, Florida International University, 11200 South West 8th Street, Miami, FL 33199*

After attending this presentation the attendee will learn how degradation of cardiac Troponin I (cTnI) and Troponin T (cTnT) analysis can help forensic scientists narrow their estimate of postmortem interval.

This presentation will impact the forensic community by improving the precision and rate of postmortem interval (PMI) estimates using an automated analytical method to better assist law enforcement in many criminal, civil, and forensic investigations.

Knowledge of the time since death (PMI) has enormous legal, criminological, and psychological impact; but currently suffers from uncertainties on the order of days to weeks without mathematically defined confidence information and a lack of technological advances. The main principle of the determination of the time since death is the calculation of a measurable date along a time-dependent curve back to the start point. Characteristics of the curve slope and the start point are influenced by internal and external, antemortem and postmortem conditions which need to be taken into consideration. Current methods utilize temperature-based algorithms intended to model the cooling of the body after death in order to estimate the postmortem interval which introduces considerable inaccuracy due to influencing factors. Livor mortis, rigor mortis, and to a lesser degree, algor mortis also have been used to estimate the postmortem interval. Forensic pathologists agree that these characteristics only provide "postmortem windows." Quantitation of the vitreous fluid potassium level has been of some value in evaluating the early postmortem interval, but the accuracy of this method is dependent on external conditions, the availability of vitreous fluid and the purity of the sample. For practical purposes, a simple, relatively inexpensive assay performed on readily available cardiac tissues, less dependent upon external factors, and providing data that could be plotted on a reproducible control curve would be of value in determining the postmortem interval accurately.

Cardiac Troponin I (cTnI) and cardiac Troponin T (cTnT) are proteins found in heart tissue as selective markers of cardiac muscle damage, and investigation of these proteins for determining time since death shows great promise in mammalian heart tissue. These proteins are good substrates for several enzymes released in cardiac tissue upon death (necrosis); the proteolytic breakdown of these proteins in postmortem cardiac tissue can be exploited to determine the PMI. This technique takes a small sample of cardiac tissue that is homogenized and the proteins are then extracted with magnetic microparticles, separated by SDS-PAGE and visualized by Western blot, which is probed with mouse monoclonal antibodies against cardiac TnI and TnT. This step is followed by labeling and precipitation with a colored substrate to monitor degradation patterns. The area of the bands within a lane is quantitated by scanning and digitizing the image using commonly available scanners. This methodology is also migrated to more automated capillary electrophoresis.

The results show a linear relationship between the percent protein degraded and the log of the postmortem time. A fresh "reference" human heart tissue obtained at time T_0 was incubated to obtain a temporal degradation profile. Comparison of human cardiac tissue samples with unknown time of death can be evaluated qualitatively against the "reference" human heart tissue. The time of death can be estimated by matching the "degradation fingerprint". Similarly, a calibration curve ($r > 0.95$) can be obtained with the percent cTnI degraded plotted against the log of the time postmortem using the reference human heart tissue. This curve can be used to estimate the time of death relative to the "reference" tissue based on the percent degradation. The data indicate that the degradation of cTnI in heart tissue shows very spe-

cific bands during a postmortem interval of a week. The Troponin T is a more stable protein in comparison to Troponin I, so the degradation of cTnT takes longer. Combining the data obtained from the cTnI and cTnT can then be used for extended PMI estimates. Frozen human cardiac tissue samples at known times of death were analyzed by both the semi-quantitative and the qualitative techniques and both show similar agreement with the known time of death. Overall, the data demonstrates that this technique represents a major advance in time of death determination providing a fast and reliable semi-quantitative biochemical marker from a protected organ versus other measurements. Tissue cardiac Troponin I and Troponin T shows excellent characteristics as a time of death marker in the extended postmortem interval which is difficult to estimate with current methods.

TnI (Troponin I), TnT (TroponinT), Postmortem Interval (PMI)

examine the relative levels of DNA degradation and these results were compared with profiles of the extracted samples generated from an ABI Prism® 310 Genetic Analyzer. Comparisons made between bone, blood and tissue samples and corresponding non-degraded blood samples were used to estimate relative rates of degradation. Studies on the effects of inhibitors on these samples will also be discussed.

The results of this study indicate that there is a timeline that degradation follows as samples that were 8 weeks or older have, when compared to more recent remains, a substantial reduction in the amount of extractable DNA. This study also indicates relative rates of decompositions based on sample conditions and helps provide a comparison of different extraction and amplification procedures using real samples with known history.

DNA, Degradation, Environmental

G5 The Effect of Environmental Degradation on DNA With Respect to Time and Conditions

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The goals of this presentation are to show the effects of environmental degradation of DNA due to environmental conditions and exposure over time and to show the development of degradation curves and a degradation timeline based on type of burial.

This presentation will impact the forensic community by providing an estimation of decomposition of rates of nuclear DNA and provide information concerning the best method for recovery of information from degraded samples.

The goal of this presentation is to show the effects of environmental degradation on DNA with respect to time and environmental conditions in order to develop a better understanding of these effects on the analysis of tissue and bone samples. Ultimately these studies will assist an analyst in determining the relative age of an individual sample, whether a lack of PCR activity is due to degradation or PCR inhibition, and what quantity of DNA must be recovered from the sample in order to generate an optimal genetic profile.

This study will examine the rate of decomposition of human remains under a variety of conditions, focusing on the quality and quantity of DNA that can be recovered over time. Control blood samples will be utilized to provide a clear estimate of initial quality of the DNA. The effect of different types of burial environments on DNA will then be investigated. Three types of samples will be obtained: above ground, in water, and underground burials. The focus of this study will be to determine the rate of degradation of DNA between samples based on the type of burial and the environmental conditions. Both real time PCR and STR amplification will be used to estimate these effects. Due to the advances in rtPCR techniques and the development of mini STR kits, current capabilities for the analysis of such samples have greatly improved. However, laboratories need guidance on when to use specialized analytical systems for degraded samples and when more traditional large multiplex kits can be used. Ultimately it is expected that these experiments will provide guidelines on how such samples should be prepared and analyzed.

Tissue, blood, bone, and nail samples have been obtained from the University of Tennessee Anthropological Center and extracted using QIAGEN Blood and Tissue kits and amplified using an Alu based Real-Time PCR method. The 25mg Lfor samples tissue samples typically yielded concentrations of well over 1ng/ μ L less than 4 weeks old. For samples 4 to 6 weeks old, a yield of between 1.0ng/ μ L and 0.1ng/ μ L was observed. More highly degraded samples obtained after 8 weeks yielded even lower concentrations of DNA. A variety of amplicon sizes were used with real time PCR to next

G6 The Role of Scene Investigation in Uncovering Staged Suicides

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After review of this presentation, the audience will understand the need for careful documentation of a death scene and retaining a healthy dose of skepticism when investigating apparent suicides. The audience will also understand the need for good communication between agencies in relaying discrepant findings and their potential significance in these investigations.

This presentation will impact the forensic community especially death scene investigators by emphasizing the need to adhere to standard guidelines when investigating all death scenes and to treat each scene as a potential homicide. This presentation will also impact the medical examiners' offices that must provide justification for performing autopsies on suicides.

Scene investigation is a vital component along with findings from a postmortem examination in ascertaining the cause and manner of death. Failure to approach a scene with an open mind where the cause and manner of death seem obvious results in an inability to recognize subtle discrepant clues or leads to irrevocable loss of valuable information. Careful investigations of death scenes where homicide is obvious are almost second nature for law enforcement officials and medical death investigators. Similar careful investigations may be lacking where the manner of death looks like suicide, natural or accident especially when investigators have determined the manner of death before analyzing the scene. Such an approach to scene investigation may lead to erroneous conclusions in homicides that have been staged to look like suicides. Although these staged deaths have been discussed in the forensic literature, most of these cases involved the perpetrator staging the scene to look like a hanging.

Two case studies of homicides that appeared to be suicides will be presented. One death involved a woman who had recently been diagnosed and surgically treated for cancer who was found dead in bed with a gunshot wound to her head. The other case involved a woman who was having marital difficulties and was found in her vehicle while the engine was running in her closed garage. In both cases, the investigators recognized inconsistencies and processed each scene as if they were dealing with a potential homicide. In the case of an apparent self-inflicted gunshot wound to the head, the investigator's concern over blood stain patterns that were inconsistent with the information that this investigator was obtaining from the home-health nurse and decedent's grandson led to the appropriate work-up of the scene and, eventually, to the prosecution of the grandson for homicide. An investigator's observation that a woman's blouse was on backwards in the apparent carbon monoxide poisoning, aided in the correct determination of manner of death due to a more thorough examination of the vehicle, remainder of the house, and decedent at the scene. Communication of the investigators' suspicions to the forensic pathologist in both cases enabled an even more careful examination and documentation of injuries.

Death Investigation, Suicide, Blood Stains

G7 Intrauterine Sudden Death: Study of the Fetal Morphological Substrates

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After attending this presentation, attendees will understand the risk factors, causes, and prevention of many fetal deaths as well as ancillary studies utilized for proper diagnoses.

This presentation will impact the forensic community by serving as an educational resource through discussing sudden fetal death in such cases as funicular thrombosis due to anticardiolipin antibodies, chorioamnionitis, deciduitis, cervicitis, and intrauterine Botallo's duct closure due to aspirin

Healthy pregnancy derives from the anatomic and functional relationship between all the components of the pregnancy including, the fetus, placenta, and the mother. If the normal relationship between these elements fails because of intrinsic or extrinsic factors, a pathological pregnancy leading to fetal death may occur. To evaluate the morphological substrates leading to sudden death, an accurate evaluation of the fetal autopsy and examination of the placenta, together with the determination of chromosomal pattern, serological and microbiological evaluation, and total body X-rays are mandatory for a correct diagnosis of the death. An exact diagnosis of fetal sudden death may help prevent the event from recurring in future pregnancies.

For a pregnancy, to be normal, it needs a complex anatomical-functional cooperation between three different biological systems: fetus, placenta, and pregnant mother. The interruption of this kind of connection, due to intrinsic or extrinsic causes, produces a pathological pregnancy that can result in fetal death. In olden times, fetal deaths were not considered a competence of obstetricians, pediatricians, or pathologists, so it was not possible to establish the cause of death and identify the death-risks for subsequent pregnancies. On February 2, 2006, the Italian government issued a law establishing the role of pathologists in the sudden fetal death after 25th week. According to this rule, the pathologist must identify all the anomalous morphologic substrates, by performing a careful autopsy examination, with total body X-rays of the fetus, serological/ microbiological tests, and placental screening tests, in doing so to promote primary and secondary prevention. An essential role is obtaining an accurate medical history.

This retrospective study describes the causes of 1836 fetal deaths occurring after the 25th week, from January 1987 through December 2006. 314 sudden fetal deaths (38.8%) were observed. In this group there were 176 males (56%) and 138 females (44%), ranging in age from 26 weeks to 42 weeks of pregnancy; 127 (40.5%) fetal deaths occurred before the 37th week of pregnancy. 258 of 314 fetuses showed maceration due to intrauterine death. Some fetuses of this group showed signs of distress. Maternal risk factors were identified in 251 (80%) of the fetal deaths including hypertension (35%), diabetes (20%), bigeminal pregnancy (18%), and central placenta previa (7%).

The fetal sudden deaths were due to placental causes in 283 (90%) cases, fetal causes in 16 (5.1%) cases, maternal causes in 10 (3.4%) cases and unknown causes in 5 (1.5%) cases.

The placental causes were: 130 (46%) funicular disorders; 54 (19.2%) amniotic membrane disorders; 99 (35%) chorionic villi disorders.

The fetal causes were: 12 cardiomyopathies; 4 intrauterine Botallo's duct closure.

Maternal causes were: 7 mother's sudden deaths due to amniotic and thrombotic pulmonary embolism; 3 uterus ruptures.

Most of sudden intrauterine fetal deaths are caused by funicular and chorionic villi disorders. It is possible to prevent sudden fetal death in cases of funicular thrombosis due to anticardiolipin antibodies, chorioamnionitis, deciduitis, cervicitis, and intrauterine Botallo's duct closure due to aspirin. Genetic tests are important in the deaths due to cardiomyopathies. The sudden fetal deaths, occurring after 40° week, are related to maternal risk factors so it's important advance the delivery.

Fetal Sudden Death, Autopsy Guidelines, Prevention

G8 Fatty Acid Methyl Ester Profiling of Bacterial Spores for Microbial Forensics

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After attending this presentation, attendees will be familiar with the use of fatty acid profiling to determine the source of bacterial spores grown on several different culture media and the forensic applications of gas chromatographic (GC) techniques for examining the fatty acid composition of the membranes of organisms isolated from biological evidence.

This presentation will impact the forensic community by introducing a technique that may assist investigators in determining the culture methods employed to produce a microbial agent used in a biocrimes or act of bioterrorism.

Fatty acids are components of bacterial membranes that can be regulated by the cell in response to the types of available nutrients present in the culturing media. Therefore, genetically identical bacteria that are grown on different media substrates can vary in their fatty acid composition. Previously, fatty acid methyl ester (FAME) profiling has been used in clinical settings for bacterial strain identification, but has not yet been applied for forensic applications.

In this research, three hypotheses were tested. First, whether a clinical method for FAME profiling of bacterial cells can be adapted for use with bacterial spores. Second, can reproducible FAME profiles be produced from minimal amounts of evidence (<3mg spores). Third, can a database of FAME profiles of spores grown under a variety of well-established conditions be used to reliably identify the medium used to grow the spores of an unknown sample.

For this work, 22 different culture formulations were used to prepare and process *Bacillus cereus* T-strain (BcT) cultures. Fatty acid extraction and GC profiling were performed on spores from each media preparation using two different analytical techniques: (1) the clinical FAME method ("Rapid Method") which requires approximately 30 mg of biological material and two hours to process, and (2) the more forensically relevant method ("Instant Method") which requires only 1 mg of biomaterial and approximately 15 minutes of processing time. The effect of media substrate on spore fatty acid composition was examined using Cluster Analysis (CA) and Principal Component Analysis (PCA) of all generated profiles.

FAME profiles from both methods and each media substrate were used to construct two BcT strain spore databases. Similarity indices calculated between FAME profiles with the Sherlock Microbial Identification System (MIDI) software were used to evaluate the variability and reproducibility of the spore database data.

The results of this research suggest that FAME profiles from spores grown on most of the surveyed media substrates can be statistically distinguished using CA and PCA. Oleic Acid appears to be specific for Columbia Blood Agar and Tryptic Soy Agar with Blood indicating that certain fatty acids may be diagnostic for specific media types. In addition, reproducible fatty acid profiles were generated from less than 1mg of dry spores using the "Instant Method." Results will be presented for comparison of 'blind' spore profiles against the profiles in the BcT spore-media databases. These studies will demonstrate the potential usefulness of FAME profiles for forensic microbiology.

Fatty Acid, *Bacillus*, Bioterrorism

G9 Suicidal Intoxication by Copper Sulphate

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The goal of this presentation is to present a case of suicidal intoxication by an unusual chemical compound.

This presentation will impact the forensic community by demonstrating how Intoxications (accidental, suicidal or homicidal) with copper sulphate are rare, as can be seen in the few cases described in forensic literature.

Introduction: Portugal is traditionally an agricultural country; therefore intoxications by pesticides are very common, especially with paraquat and organophosphorous. Copper sulphate is a fungicide used to control bacterial and fungal diseases of fruit, vegetables, nut, and field crops. It can also be applied in water treatment systems to control algae. This pesticide is available as dust, wettable powder, and liquid concentrate. In Portugal its major application is in vine plantation.

Copper sulfate solutions may irritate eyes, skin, respiratory and mucous membranes. Poisoning by this compound may affect the central nervous system, liver, kidneys, and capillaries, frequently causing renal failure and haemolytic anaemia.

Despite Portugal's major wine production, intoxications (accidental, suicidal, or homicidal) with this compound are relatively rare, as can be seen in the few cases described in forensic literature.

An 81-year-old male, diabetic with chronic renal insufficiency was admitted at the hospital with suspicion of voluntary ingestion of copper sulphate. Four days later he died. He was admitted in the Nephrology unit with acute renal failure and anaemia, and was treated with intensive hemodialysis and blood transfusions. Later on, he developed metabolic acidosis and there was a worsening of his anaemia. During admittance a 1.5 mg/L copper concentration was detected in his blood.

At the autopsy, it was possible to see a green coloration of the nails, ascitis, and pleural effusion on the right side. Samples from heart, kidneys, lungs and liver were taken for histopathological examination. The major microscopic changes were bilateral severe lesions of chronic pyelonephritis, renal arterioarteriolosclerosis, epithelial cytoplasmic vacuolization, and basophilic discolouration of the renal proximal convoluted tubules, perivenular hepatotoxic lesions with necrosis, and mainly mononuclear sinusoidal and portal inflammatory cell infiltration.

Clinical features indicative of acute intoxication by copper sulphate were renal failure, anaemia, and high copper concentration in blood (the normal concentration being 1 mg/L). Nevertheless, autopsy findings weren't significant; the most common features like gastric and esophageal erythema or ulceration were absent. The diagnosis was based on the microscopic alterations. In fact, not only was there evidence of renal histologic changes related with diabetes and chronic renal insufficiency (arterioarteriolosclerosis, chronic pyelonephritis), but also lesions suggesting copper sulfate poisoning: epithelial cytoplasmic vacuolization and basophilic discolouration of the renal proximal convoluted tubules. Furthermore, the histopathologic lesions observed in the liver were another clue to determining the diagnosis.

Copper Sulphate, Intoxication, Suicide

G10 Visceral Leishmaniasis in Turkey: Sociocultural Issues in Forensic Epidemiology

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After attending this presentation, attendees will appreciate how socio-cultural and epidemiological issues are integrated into forensic sciences.

This presentation will impact the forensic community by demonstrating how a forensic scientist can participate in enlightening socio-cultural problems encountered by a developing nation.

Forensic epidemiology has been an emerging forensic science discipline dealing with diseases that create legal issues. Recognition of any parasitic infections requires an understanding of factors such as clinical symptoms and anamnesis, migration, and geography of the human settlement. Among the parasitic diseases, Visceral Leishmaniasis (VL) is one of the most difficult agents to identify and control and in turn is an important disease for the population as a whole. Therefore to control its effect on people, among the initial steps is to track the course of the disease and to plan the therapy. Furthermore, elapsed time during the diagnosis of the illness should be limited to a minimum. Because when the diagnosis is delayed the treatment may take longer. This situation may kick back as a serious problem about the illness of the patient and the application of the treatment. In the meantime, problems encountered during treatment such as difficulties in diagnosing psychosocial disorders and inability to identify the problems in every health center, must be solved.

The purpose of this presentation is an epidemiological assessment of VL encountered by patients during the course of the illness and its sociocultural impact on their lives.

The study includes nineteen patients (with a range of 1-17 years with a mean of 7.5 years) who were initially diagnosed as suffering from VL. From each patient, blood samples (5 ml), bone marrow and a personal health history (anamnesis) were obtained. The blood and marrow samples were analyzed using standard diagnostic tests designed for VL.

Results of the diagnostic tests indicated that eleven (7 males, 4 females) of the nineteen patients showed VL. Of these affected people, six were from Istanbul, two from Kastamonu and the remaining from the cities of Kütahya, Izmit and Hatay. Migration (change of residence) history was not known for six (2 male and 4 female) patients. History was known for five (4 males and 1 female) patients who moved to a different town. However, before moving to a different town, children were first taken to a local hospital for diagnosis. This visitation may have taken anywhere from 1.5 to 8 months. Some parents were not content with the results and did not get the help they needed. Eventually, these families moved their residence to a place (with a distance of 100 to 1,000 km from hometown) where they thought there were better treatment facilities (state or university hospitals). In two cases families changed their residence three times; one from Kütahya, Afyon and then to Istanbul and the other from Bursa, Çanakkale, and back to Istanbul). Parents of three (affected by malaria, leptospirosis) of the remaining eight children also moved their household to Istanbul where there are better healthcare facilities. However, the decision to change residence from the eastern and southeastern towns to Istanbul is a commonly seen migration pattern in the country. Otherwise, almost all hospitals are well equipped to cope with malaria and leptospirosis.

With the improvement in socioeconomic level and income, it has become easy to change residence to far away places in Turkey. Yet such migration has also made the transmission of disease agents relatively simple. The study shows that VL is sporadically present in many parts of country. There is no clear evidence of the transmission of this blood parasite from a

host to a person. In one case in Istanbul the host was thought to be a wild street dog living in a relatively poor residential area. The study indicates that the disease is haphazardly handled primarily due to a lack of medical procedure and guidelines to follow in dealing an infectious disease. Some parents of such victims seem to have spent their life's earnings to search for a remedy for their children by moving from one town to another in search of a better hospital or treatment center. In conclusion, it should be stated that infectious diseases are extremely serious and must be handled by a state medical procedure. As an important aspect of forensic epidemiology, such information must be communicated to all medical centers in and around the country. This procedure in dealing with an infectious disease is also important for doctors to avoid potential legal issues arising from wrong diagnoses and causing hardship for the patient and family.

Forensic Epidemiology, Medical Guidelines, Visceral Leishmaniasis

G11 Child Abuse: Practical Case of Autopsical, Radiological, and Anatomopathological Studies

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The goal of this presentation is to illustrate the potential of postmortem multislice computed tomography (MSCT) and magnetic resonance imaging (MRI) in cases of death secondary to child abuse.

This presentation will impact the forensic community by providing an example of forensic application of the MSCT and MRI.

A 17-month-old male baby was discovered pale and unconscious in his bed by her mother at home. An attempt of cardio-pulmonary massage was immediately begun by the father of the child. The medical rescue team was called by the mother. The reanimation attempt was unsuccessful and the rescue physician could only objective the death of the child. The reanimation performed was slight, with oxygen mask apposition and cardiac massage. No injection was performed. The external examination performed at home revealed that rigor mortis was already present and revealed the presence of numerous ecchymoses. The explanation of the parents was thought to be inconsistent with the corpse examination. The police investigators discovered that the family of the baby was known by the social services. Furthermore, a brother of the dead child had already been taken away from his family because of neglect. The dead child had been hospitalized one month prior because of a left humeral fracture. The parents explained that the child suffered form minor beta thalassemia and heterozygous drepanocytosis. The circumstances of home death of this baby were unclear and a medicolegal autopsy was ordered. Postmortem multi-slice computed tomography (MSCT) and magnetic resonance imaging (MRI) examinations were performed in order to determine cause of death of the baby and make an exhaustive visceral and skeletal study.

Imaging study:

- A full body MSCT exploration was performed the day of death. Axial MSCT was performed with a 16 x 0.75 mm collimation on a Sensation 16 unit (Siemens, Erlangen, Germany). Two- (2D) and three dimensional (3D) reconstructions were obtained on a Leonardo workstation (Siemens, Germany). 2D reconstructions were obtained using Multi Plane Reconstruction (MPR) and Maximum Intensity

Projection (MIP) modes. 3D reconstructions were obtained using Volume Rendering Technique (VRT) mode. Image interpretations were performed by a board-certified radiologist.

- A focused cerebral postmortem MRI was also performed the day of death. Axial acquisitions were performed in spin-echo T1-weighted, T2-weighted, and T1-weighted gradient echo sequences. Image interpretations were performed by a board-certified pediatric neuroradiologist.
- A postmortem full body radiological study was performed in the medico-legal department. This study consisted of skull radiographs (antero-posterior and lateral incidences), thorax, abdomen and pelvis radiographs (antero-posterior incidence), upper and lower member radiographs.

Autoptical and anatomo-pathologic studies: autopsy was performed by two board-certified forensic pathologists. All three body cavities (cranium, thorax, and abdomen) were examined. Anatomo-pathology was performed after a fixation in 10% formalin.

Results of the different explorations were finally compared:

Imaging study:

- *MSCT:* On cranial CT, diffuse oedema was visible with loss of the gray/white matter differentiation. Spontaneous pericerebral hyperdensities were visible in left frontal and right temporo-parietal areas. No skull or face fracture was visible.
 > On thoracic CT, no pleural or pericardic effusion was noted. Lungs appeared oedematous-congestive. Bone analysis revealed presence of 4 left rib fractures, with different MSCT aspects. One fracture concerned the posterior arch of the 6th rib, with osteosclerosis of its edges, attesting of the beginning of its consolidation. Two concerned the anterior arc of the 7th and 8th rib with a MSCT visible callus, attesting to their old productions. The last fracture was on the 9th rib, displaced, without MSCT consolidation sign.
 > On abdominal and pelvic level, no bone traumatic lesions were visible. No visceral lesion was clearly visible, but the natural contrast due to lack of internal fat (as is common in adult cases) was obviously bad. However spontaneous intra hyperdensities were visible within the mesenteric root and in intra peritoneal situation behind the abdominal anterior wall. They were interpreted as possible fresh blood.
 > The appendicular skeleton exploration confirmed the presence of a right humeral fracture with a callus, attesting to its old production.
- *MRI:* Bilateral subdural haematomas were visible in subfronto-parieto-temporal areas with varying signal intensities. They appeared as acute hematomas, with spontaneously hyper- and hyposignals on T2-weighted images. Subdural pericerebral hypersignal on gradient echo images were visible in left frontal and right temporo-parietal areas. A right frontal meningeal hemorrhage was also present. Interpeduncular and intra ventricular haemorrhages were also noted. Petechial haemorrhages within the posterior part of the corpus callosum were suspected.
- *Plain X-rays exploration:* It confirmed the callus of the right humeral shaft. Three left ribs fractures were noted, affecting the 7th, the 8th and the 9th ribs. No other bone traumatic lesion was noted.

External inspection:

The body was thin stout build, naked, measuring 79 cm tall, weighted 8.6 kg. An immobilisation of the right upper member was noted, secondary to the fracture and the hospitalisation dating from one month. Anthropomorphic measurement revealed an increase cranial perimeter of 48 cm. Numerous ecchymoses were noted on the body. Red ecchymoses were noted on the face, in peribuccal localisation,

and bi frontal regions. Ruptures of fraenulum, the tongue, and the superior lip were noted. Red ecchymotic lesions were also visible on both lower members. Brown ecchymoses of 0.5 cm in diameter were noted at the anterior face of the left hemithorax.

Autopsy and anatomo-pathology:

The scalp had a large hemorrhagic infiltration at its deep part, in right fronto-parietal regions, more limited in left frontal and right occipital regions. The right temporal muscle presented a hemorrhagic infiltration. No endo or exo cranial skull fracture was visible. However, a bilateral subdural hematoma was noted in fronto-parietal areas. A hematoma was also visible around the posterior fossa. The cervical spine was surrounded by epidural hematomas.

The chest exploration revealed presence hemorrhage around the 6th, 7th, 8th, 9th left ribs. Three calluses were found for the 7th, 8th, 9th left ribs. A consolidated callus was noted for the 6th rib. The inferior part of the right lung presented a hemorrhagic infiltration.

A perumbilical ecchymosis at the deep part of the anterior abdominal muscles was present. Many small bowel loops presented a superficial hemorrhagic infiltration.

A hematoma of the right kidney artery was found, continued by a retro peritoneal hematoma. A limited hemorrhagic intra peritoneal effusion was present.

Microscopic studies confirmed the existence of the rib fractures. The fracture located to the 6th rib presented a remodelling bone callus. The fractures of the 7th, 8th, 9th ribs presented cartilaginous callous. The right humeral shaft presented an ossifying cartilaginous callus.

Haemorrhagic infiltration was confirmed around the aorta, within the mesenteric root, the tongue, and within the anterior abdominal wall. The peri aortic, peri umbilical, and left flank haemorrhages were antemortem, contemporary of the death. The tongue lesions consisted of recent and old haemorrhages. The mesenteric root haemorrhage was antemortem, with inflammatory elements, permitting determination that it dated from several hours before death.

The subdural hematoma was confirmed to be acute. It presented polymorphonuclears and ischemic neuronal damage associated with a recent cervical spine epidural haemorrhage.

Several authors have compared postmortem imaging and autopsy results in neonatal death. MRI offers high resolution images of the entire neonate while leaving the body intact. Compared with other imaging techniques such as conventional x-ray and CT scan, the high spatial resolution and the high tissue contrast that can be generated by MRI are advantages. The different tissue contrasts that T1-, T2- or proton density weighted MR sequences provide can give additional information about the lesions or disease processes. Compared with autopsy, postmortem MRI has proven to be especially useful in the evaluation of the central nervous system. The high water content of the neonatal brain makes it difficult to handle during autopsy, even when adequately fixed. Subdural haemorrhages are the commonest type of injury found and this is in keeping with pathological evidence and studies using computed tomography. They are caused by damage to the bridging veins, which drain from the cortex into the superficial venous sinuses. It is important to note that different signal intensities of subdural haematomas do not necessarily indicate repeated bleeds at different times. Subtemporal blood is not well seen on CT, especially with its decreased multiplanar imaging capability. Extra-axial fluid collections can have the same density as cerebrospinal fluid on CT, and it is difficult to differentiate enlargement of the subarachnoid spaces and subdural effusions. MR is superior to CT when differentiating these extra-axial collections. Isolated subarachnoid haemorrhages can be difficult to detect on MR studies. MRI is useful at postmortem to direct the autopsy and brain cutting to focal areas of axonal injury.

Hart et al. in 1996 investigated the correlation between postmortem MRI of the head and autopsy findings in suspected child abuse. Autopsy was more effective in detection of subarachnoid hemorrhage, suture separation, extracranial injuries and very small hematomas. According to

these authors, MRI findings were useful in directing the autopsy and brain dissection to focal areas of abnormality. They found that postmortem MRI and autopsy were complementary and that each may disclose abnormalities missed by the other. In half of the eight cases of child abuse examined in this study, the combination of MRI and autopsy added valuable information compared with the results of autopsy alone.

In this case, combination of MRI and MSCT were able to determine the diagnosis of child abuse. Indeed, multiple fractures, of different ages were diagnosed. Skeletal fractures were suggestive of non accidental injuries because of their localisations: posterior arch of one rib, and association of recent and old fractures. Presence of an old right spiral humeral fracture was suggestive of child abuse; spiral fractures are classically secondary to torsional force. Cranial MRI was highly suggestive of intentional trauma. The MRI aspects of peri-cerebral hematoma are clearly visible compared to MSCT images. This exploration confirmed the pericerebral bleeding and objectified lesion not visible at the autopsy time as intra ventricular hemorrhage.

Limits of the MSCT are well illustrated by this case: the lack of tissue contrast because of the lack of fatty tissue is the highest limit of the technique. It does not permit a correct examination of the visceral trauma and lesions. However, diagnosis of intra peritoneal bleeding was possible and confirmed by autopsy. For skeletal trauma evaluation, MSCT was more efficient in our case than plain X-Rays. However, Cattaneo stated that radiology detected only 47%, autopsy 65%, while CT scans detected 34% of rib fractures. Rib fractures are quite unusual even in the setting of severe accidental trauma in infants and rarely if ever result from vigorous cardiopulmonary resuscitation. These injuries are usually clinically occult and typically result from excessive anteroposterior compression of the chest during shaking or with impact. Involvement of the posterior arc of the rib is most common, although fractures occur at all rib sites in abuse. Rib fractures tend to occur at multiple levels at similar points along the arcs of adjacent ribs, are often symmetric, and most frequently involve the middle ribs.

In this case, the autopsy was superior to imaging for the diagnosis of hematoma of the right kidney with a retro peritoneal hematoma and cervical epidural spine hemorrhage. The anatomo-pathology study did not confirm the suspected petechial haemorrhage within the posterior part of the corpus callosum.

This case report illustrates the potential of MSCT and MRI concerning battered child exploration in terms of determination of cause of death, visceral and skeletal evaluations, and age determination of lesions thus permitting the diagnosis of child abuse.

AAFS, Forensic Sciences, Radiology

G12 Posterior Rib Fractures in Infants Associated With Cardiopulmonary Resuscitation

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The goals of this presentation are to: (1) describe the recommended method of chest compressions for infants by the American Heart Association, (2) describe the proposed mechanism causing posterior rib fractures due to child abuse, and (3) describe how chest compressions during cardiopulmonary resuscitation in an infant could cause posterior rib fractures.

This presentation is intended to educate the attendees that posterior rib fractures in infants can occur in circumstances other than child abuse; specifically they can be associated with chest compressions performed during cardiopulmonary resuscitation (CPR). This study will impact the forensic community and humanity by demonstrating that posterior rib fractures can be related to CPR chest compressions and should not automatically assumed to be a result of abuse without supporting evidence and investigation.

A commonly held belief by forensic pathologists, pediatricians and pediatric radiologists is that posterior rib fractures in infants are highly specific for child abuse and rarely if ever result from chest compressions during cardiopulmonary resuscitation. Those who concede that rib fractures may very rarely occur due to CPR contend that the injuries involve the anterior or anterior/lateral aspects of the rib. This issue is of particular importance as rib fractures in small children are most commonly the result of non-accidental injury and therefore may be strong evidence in support of child abuse. A complete autopsy and a thorough investigation of circumstances are critical in determining the manner of death in infants. Misclassification due to overinterpretation of a single finding could have devastating effects on caregivers who may be falsely accused of abuse and therefore face litigation.

The normal immature infant skeleton has increased plasticity compared to the adult skeleton making it relatively resistant to fracture unless there are congenital or acquired disorders of the collagen matrix or mineralization. However, with enough force applied to the costovertebral angle, minute fractures of the rib head and neck can occur. Current American Heart Association guidelines suggest that CPR for infants given by health care providers be performed using the two-handed method with thumbs on the sternum and fingers encircling the chest and back. In this manner, direct pressure not only depresses the sternum but also can lever the posterior ribs at their articulation with the vertebral column at the transverse processes of the thoracic vertebrae. In instances where untrained individuals provide CPR, improper technique may also contribute to fractures. As acute fractures in many cases are quite subtle and nondisplaced, they may be missed on antemortem and postmortem radiographs even when critically examined. These fractures may also be missed at autopsy particularly if the parietal pleura is not removed. In fact, the true incidence of infant rib fractures may be underestimated due to the difficulty in their detection.

Presented here are the gross, radiographic, and microscopic findings from four hospitalized neonates and infants, aged 1 day to 3 months, who died of natural causes but were noted to have posterior rib fractures at autopsy. Three cases showed evidence of acute fractures after terminal CPR attempts. In one case, remote fractures with callous formation were identified in an infant with multiple previous CPR episodes due to complications resulting from his premature birth. These infants and neonates spent the majority of their lives within the hospital. In all cases the infants had no history of abuse, no outward evidence of inflicted injury, and no additional internal injuries consistent with child abuse. It is imperative that the presence of posterior rib fractures in an infant not be ascribed impulsively to child abuse until a thorough investigation is conducted including assessment of resuscitative techniques.

Posterior Rib Fractures, Cardiopulmonary Resuscitation, Child Abuse

G13 Role of Preoperative 3D-CT Reconstruction in Depressed Skull Fractures Treated With Craniectomy: A Case Report of Forensic Interest

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The goal of this presentation is to describe a new approach to cranial trauma treated with craniectomy: 3D-CT reconstruction based on preoperative scanning.

This presentation will impact the forensic science community by de-

monstrating how new radiological techniques and reconstruction can be utilized to assist the forensic pathologist in assessing cranial trauma after surgical intervention.

Patients affected by cranial trauma with depressed skull fractures and intracranial pressure increase generally undergo neurosurgical intervention. Since craniotomy and craniectomy remove skull fragments and generate new fracture lines, they complicate forensic examination and sometimes prevent a clear identification of skull fracture etiology.

To overcome this kind of problems a 3D reconstruction based on preoperative CT scanning, giving a picture of the "status quo" ante neurosurgery, can help the forensic examiner in identifying skull fracture origin and their means of production.

The authors report the case of a 41 year-old-man assaulted by his pusher: he presented at the emergency room with severe cranial trauma with a depressed skull fracture at the vertex, bilateral subdural hemorrhage, and multiple intraparenchymal contusions. The rapid impairment of GCS (Glasgow Coma Score) from 14 to 8 forced the surgeons to perform a craniotomy; despite such intervention neurological conditions kept on worsening (GCS of 4) and after a few hours a craniectomy was performed. The patient died after 40 days of hospitalization in an Intensive Care Unit (ICU) for multi-organ failure (MOF).

The forensic autopsy revealed the absence of various bone fragments at the vertex (consequences of the craniectomy), bilateral fractures at the anterior and medial fossa, bilateral cortical contusions at the frontal and parietal lobe, and a smaller cortical contusion at the right temporal lobe. Histological examination showed focal necrotic and hemorrhagic lesions surrounded by gliosis and several hemosiderin-laden macrophages, dating the trauma at about 30-50 days before autopsy.

Because of the absence of various bone fragments at the vertex the necropsy examination didn't allow a precise analysis of the skull fractures. Thus a 3D-CT reconstruction of the preoperative scanning was performed with SSD (surface shaded display) and MIP (maximum intensity projections) technique.

A comparative study between necropsy and radiological data differentiated the surgical from the traumatic lesions, which were produced by a cylindrical blunt object with a reduced area of impact.

A fit-matching analysis between virtual blunt objects and the skull fractures found out that the pusher had beaten the victim using a baton with a diameter of 3 cm and a length of about 1.50 meters.

These findings helped the police officers in searching for the crime weapon, which was found hidden in a bush not far from the site of the assault.

Computed tomography techniques with tridimensional reconstruction have been developed over the last 10 years and have found various applications in the forensic field. The most recent development is multislice computed tomography combined with photogrammetry-based surface optical scanning and image rendering techniques. The combination of these different techniques can be used to produce three-dimensional images of injury patterns for comparison with suspect weapons.

This technology is generally used in postmortem examination to complete or replace forensic autopsy (Viropsy®).

However, when patients suffering a trauma undergo surgical intervention, which modifies wound morphology and complicates forensic examination, a 3D-CT reconstruction based on preoperative scanning gives a picture of the "status quo" before surgical procedures and thus helps the forensic examiner in identifying wounds etiology and their means of production.

Depressed Skull Fractures, 3D-CT, Craniectomy

G14 Subway Train Related Fatalities in New York City: Accident vs. Suicide

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This study aims to describe the characteristics of subway train-related fatalities, including scene investigation, police investigation, autopsy, medical and psychiatric history, and toxicology studies.

This presentation will impact the forensic science community by contributing to literature by attempting to identify factors which will be helpful in differentiating accidental from suicidal deaths.

Determination of the cause of death in subway train-related fatalities usually is obvious. However, determination of the manner of death can be challenging. A common dilemma is the differentiation between accidental and suicidal death. In order to accurately determine the manner of death, all relevant factors must be considered, including: eyewitness accounts, physical injuries, medical and psychiatric history, scene investigation, and toxicology results. The characteristics of subway train-related fatalities were examined in order to determine which factors may be helpful in differentiating accident from suicide. Subway train-related deaths with homicide and undetermined manners also are included.

A computerized search of all medical examiner death certificates issued between January 1, 2003 and May 31, 2007 was performed for the words "subway", "train", or "tracks" to identify all subway train-related fatalities. The autopsy data, scene investigation report, police report, toxicology results, and other relevant documents in the OCME file were reviewed for each case.

Two-hundred and eleven (211) consecutive subway train-related fatalities were investigated by the Office of Chief Medical Examiner of the City of New York during the study period (approximately 1 per week). Of these 211 deaths, 175 underwent autopsy and 36 were examined only externally. External examination without full autopsy usually was done pursuant to a religious objection which must be honored under New York law unless there is a suspicion of homicide or an imminent threat to public health. The distribution of deaths by manner was: suicide (111), accident (76), undetermined (20), and homicide (4). The causes of death were either blunt trauma (206) or electrocution (5). The average age was 44 years with a range of 14 to 85, and a male to female ratio of approximately 5 to 1.

Witness accounts were available in 66% of the accidental deaths and 95% of the suicidal deaths. Ethanol was detected in 42% of the accidental deaths with an average blood alcohol concentration of 0.20 gm%, compared to 14% of suicides with an average blood alcohol concentration of 0.16 gm%. Antidepressant medications were detected in 8% of the accidental deaths compared to 21% of the suicides. Cocaine and/or benzoylecgonine were detected in 25% of the accidental deaths, compared to 3% of the suicides. Head, torso, and extremity injuries occurred in 84%, 70%, and 62% of accidental deaths compared to 90%, 80%, and 77% of suicides, respectively. There were skull fractures in 53% of accidental deaths compared to 65% of suicides. Decapitation and torso transection occurred in 1% and 3% of accidental deaths compared to 7% and 8% of suicides, respectively.

There were 20 deaths with an undetermined manner; all due to blunt trauma. Only 35% of the undetermined deaths were witnessed. There were four homicides of which two victims were pushed into the path of a subway train. In one homicide, the victim was chased into a tunnel and subsequently struck by a train. The remaining homicide involved an un-witnessed assault followed by a fall onto the subway tracks and electrocution by contact with the third rail.

Eyewitness accounts are the most helpful factor for determining the manner of these deaths. The finding that suicides have a higher rate of eyewitness accounts than accidents may be a reflection of the requirement to demonstrate intent in order to certify a death as a suicide. Without evidence of clear suicide intent, these deaths typically would be certified as accidents

or undetermined manners. A suicide note, prior expression of intent, and prior suicide attempt are other helpful factors. Physical injuries and toxicology findings are, by themselves, non-specific, but in conjunction with other factors, may be helpful. Torso transection and extremity amputation were more frequent in suicides, but occurred in accidental deaths as well. Antidepressant medications were more frequently detected in suicides, whereas cocaine and ethanol were more frequent in accidents. These factors should not be interpreted in isolation when determining the manner of death. Although there is no pathognomonic autopsy finding that determines the definitive manner of these deaths, these results may be weighed in the context of the entire evaluation along with other circumstantial and investigative findings. In un-witnessed deaths where additional information is unavailable or discrepant, the most appropriate manner of death usually is undetermined.

Subway, Accident, Suicide

G15 Cardiovascular Trauma in Motor Vehicle Collisions: A 20 Year Retrospective Study and Review of the Literature

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The goal of this presentation is to identify and classify cardiovascular trauma and injuries sustained in motor vehicle collisions. The audience participants will be able to determine cause of death due to cardiovascular injuries in motor vehicle collisions and become familiar with injury patterns and the corresponding motor vehicle collision scenarios. In addition, autopsy techniques applicable to motor vehicle collisions will be reviewed.

The motor vehicle collision has been, is, and will remain a major cause of death in the United States and internationally. Previous studies of motor vehicle collisions have led to significant advances in automobile safety and safety precautions. This presentation will impact the forensic science community by demonstrating how it is essential to continue to study motor vehicle collisions, so that even greater safety advancements and initiatives can be developed.

The motor vehicle collision (MVC) is the major cause of accidental injury and death in the United States and developed countries. Previous studies of traumatic injuries sustained in MVC have led to significant advances in safety precautions and devices. Resultant cardiovascular trauma resulting in death includes great vessel rupture, cardiac rupture, cardiac contusion, commotio cordis, and coronary artery dissection. The authors retrospectively reviewed all cases referred to the Forensic Pathology Section of the Medical University of South Carolina (Charleston, SC) over a twenty-year period from January 1988 through December 2007. Cases of MVC autopsies were examined for the presence or absence of any cardiovascular trauma. Cardiovascular trauma was defined as trauma to the heart proper as well as to the pulmonary arteries, vena cava, aorta, and major tributaries of the aorta. Other variables reviewed were the type of vehicle, number of vehicles involved, location in the car of the decedent, seat belt usage, element of ejection, airbag deployment, type of collision, site of vehicle impact, decedent demographics, injury-to-death time interval, cause and manner of death, and toxicological findings. Cases in which the cardiovascular trauma was the cause of death were further examined. Useful autopsy procedures and ancillary studies are discussed.

Motor Vehicle Collision, Cardiovascular Trauma, Autopsy Techniques

G16 Right Ventricular Lipomatosis and Fibrous Tissue in Cases of Non-Cardiac Deaths and Arrhythmogenic Right Ventricular Cardiomyopathy

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Upon attending this presentation, the audience will have a better appreciation for the fat and fibrous tissue content of the normal right ventricular myocardium, as compared to cases of arrhythmogenic right ventricular cardiomyopathy, and also appreciate the importance of selective sampling of the right ventricle to properly assess fat and fibrous tissue content.

This presentation will impact the forensic community by highlighting the regional differences normally present in the heart, which significantly impact upon the diagnosis of arrhythmogenic right ventricular cardiomyopathy, particularly in the posterior basal right ventricular myocardium.

Arrhythmogenic right ventricular cardiomyopathy (ARVC), defined as variable replacement of the myocardium of the right ventricular (RV) free wall by fatty or fibrofatty tissue with degenerative changes in entrapped myocytes, is a form of cardiomyopathy that is often familial and typically presents as sudden death in young healthy individuals. Currently, a definitive pathologic diagnosis of ARVC diagnosis is often difficult because a certain amount of fat is always present within the RV myocardium that tends to increase with age, particularly in the anterior and lateral apical regions. We aim to quantitatively establish a normal range for regional RV lipomatosis and fibrous tissue to provide a basis for the pathologic diagnosis of ARVC. Anterior, lateral, and posterior regions of apical and basal RV myocardium were sampled from autopsy cases where deaths were due to non-cardiac causes (control; n=10; age = 21-84 years) and from individuals who had documented ARVC (ARVC; n=10; age = 15-60 years). Area fractions of RV myocardium (%) occupied by myocytes, fat, fibrous tissue, or blood vessels were measured on trichrome-stained slides by computer-assisted point counting, excluding epicardial adipose tissue and subendocardial trabeculations.

The results highlight significant regional differences in lipomatosis normally present in the heart, with apical regions having significantly more lipomatosis than corresponding basal regions of Control cases ($p<0.05$). The anterior apex showed the most lipomatosis ($29.9 \pm 4.2\%$), whereas the posterior base had the least lipomatosis ($3.8 \pm 1.1\%$). Comparatively, ARVC cases had a significantly greater amount of fat than Control cases ($p<0.05$), which was most apparent between corresponding posterior regions, particularly in the basal RV myocardium, which showed a seven-fold increase in lipomatosis ($26.4 \pm 8.5\%; p<0.05$). The large content of fat normally present in anterior and lateral apical RV myocardium indicates that diagnosis of ARVC may be difficult if based solely upon lipomatosis in these areas. Significant regional differences in fibrous tissue were not seen in Control hearts, but the amount of fibrous tissue within the posterior base of ARVC hearts was significantly higher than that of Control hearts ($20.9 \pm 3.7\%$ and $12.2 \pm 1.6\%$, respectively; $p<0.05$). Thus, the substantial amount and regional variation of lipomatosis that exists in normal RV myocardium indicate that changes in lipomatosis in posterior RV myocardium, particularly at the base, are the most reliable means of making a definitive diagnosis of ARVC. This interpretation also has relevance to cardiac imaging as it relates to diagnosis of ARVC.

Arrhythmogenic Right Ventricular Cardiomyopathy, Lipomatosis, Right Ventricle

G17 Sodium Channelopathies Linked to Sudden Cardiac Death (SCD) - What is the Meaning of Carrying a Genetic Mutation?

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The goal of this presentation is to describe the use of genetic testing directed toward identifying sodium channel mutations linked to Sudden Cardiac Death as a diagnostic tool in the forensic field.

This presentation will impact the forensic community by developing guidelines on how to approach the results of postmortem molecular analysis of Sudden Cardiac Death Cases and the immediate consequences of genetic testing of the relatives.

Mutations in the SCN5A gene have been linked to a variety of diseases causing sudden cardiac death, with important variability in expression and phenotypic overlap. With the availability of postmortem molecular analysis and genetic testing of family members, it is now possible to identify carriers based solely on the presence of the genetic defect. Clinical decision making in this situation is complex and generates important ethical and medico-legal issues.

Two families, 24-328 and 24-588, originally diagnosed with Brugada syndrome after the probands experienced cardiac arrest. Clinical and genetic analysis in their members were performed. Both families had members with various electrocardiographic abnormalities including some with Brugada syndrome, long QT syndrome and conduction system disease. Both families had an important family history of sudden cardiac death. Direct sequencing of exons and exon-intron boundaries of the sodium channel gene SCN5A identified mutations in both families.

These two families illustrate an increasingly common scenario when encountering families with ion channelopathies. Because defibrillator is the only available therapeutic option at present in Brugada syndrome, physicians and forensic pathologists will be faced with extremely difficult therapeutic decisions that also have important legal, social and ethical implications, especially in children. These data indicate the need to develop guidelines on how to approach the results of postmortem molecular analysis and genetic testing of the relatives as well, especially in asymptomatic individuals.

Sudden Cardiac Death, Genetics, Brugada Syndrome

G18 SCN5A Gene Mutation Associated With Acute Myocardial Infarction

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The goal of this presentation is to describe the first sodium channel mutation to be associated with the development of an arrhythmic storm during acute ischemia.

This presentation will impact the forensic science community by presenting findings which suggest that a loss of function mutation in SCN5A gene (cardiac sodium channel) may predispose to ischemia-induced arrhythmic storm and sudden cardiac death.

Ventricular tachycardia and fibrillation (VT/VF) complicating Brugada syndrome, a genetic disorder linked to SCN5A mutations, and VF complicating acute myocardial infarction (AMI) have both been linked to phase 2 reentry. Because of these mechanistic similarities in arrhythmogenesis, the contribution of SCN5A mutations to VT/VF complicating AMI were examined.

Nineteen consecutive patients developing VF during AMI were enrolled. Wild-type (WT) and mutant SCN5A genes were co-expressed with SCN1B in TSA201 cells and studied using whole-cell patch-clamp techniques.

One missense mutation (G400A) in SCN5A was detected in a conserved region among the cohort of 19 patients. A H558R polymorphism was detected on the same allele. Unlike the other 18 patients who each developed 1-2 VF episodes during acute MI, the mutation carrier developed six episodes of VT/VF within the first 12 hours. All VT/VF episodes were associated with ST segment changes and were initiated by short-coupled extrasystoles. A flecainide and adenosine challenge performed to unmask Brugada and long QT syndromes were both negative. Peak G400A and G400A+H558R current were 70.7% and 88.4% less than WT current at -35mV ($P \leq 0.001$). G400A current decay was accelerated and steady-state inactivation was shifted -6.39 mV ($V_{1/2} = -98.9 \pm 0.1$ mV vs. -92.5 ± 0.1 mV, $P \leq 0.001$). No mutations were detected in KCNH2, KCNQ1, KCNE1, or KCNE2 in the G400A patient.

The first sodium channel mutation to be associated with the development of an arrhythmic storm during acute ischemia is described. These findings suggest that a loss of function in SCN5A may predispose to ischemia-induced arrhythmic storm and sudden cardiac death.

Sudden Cardiac Death, Myocardial Infarction, Ventricular Fibrillation

G19 Arrhythmogenic Right Ventricular Dysplasia/Cardiomyopathy a Not So Infrequent Cause of Sudden Death - A Danbury Hospital Five Year Experience (June 2002 - June 2007)

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The goal of this presentation is to increase the database of deaths due to arrhythmogenic right ventricular dysplasia/cardiomypathy in USA.

This presentation will impact the forensic science community by illustrating the victim, scenario, and autopsy findings of arrhythmogenic right ventricular dysplasia/cardiomypathy deaths so that proper cause and manner of death can be classified and the epidemiology understood.

Ten(10) cases of ARVD/Cardiomypathy were reviewed that were autopsied at Danbury Hospital, CT, since June 2002 until June 2007. This number represents 3.75% of the total (270) adult full autopsies performed in our institution during the same period.

Age, sex, and ethnic background were noted. Associated cardiac and non cardiac related diseases were reviewed.

Medications, social and family history (sudden death of sibling), as well as body habitus (obesity) were tabulated. Prior symptoms (fainting episodes, palpitations) and pre-terminal circumstances (place of death) were examined. Autopsy findings (cardiovascular and systemic) were correlated. Conclusions are compared with recent literature including review articles.

Arrhythmogenic, Right Ventricle, Dysplasia

G20 Sudden Cardiac Death in Professional Sports Persons: Natural vs. Anabolic Steroid Induced Lesions and Experimental Rabbit Model

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This presentation will increase awareness of anabolic steroid-induced cardiac lesions in professional sports-persons and illustrate comparative lesions in the rabbit model.

This presentation will impact the forensic science community by demonstrating that because controlling or banning doping in professional sports is not feasible in the present state of affairs, treating with apoptosis inhibitors might hold out hope of limiting the incidence of severe evolutive cardiac lesions.

Out of 15,000 forensic autopsies performed on coroner's orders over a 24-year period (Jan 1981-Dec 2003) in the area of Lyon, France (population: 2,000,000), WHO criteria identified 2,250 cases of unexpected sudden cardiac death. Among these, 120 were found to have occurred during recreational sport and 12 in professional sports persons. In the latter category, the associated cardiac lesions were primitive: natural in 6 cases, and, according to inquest findings, induced by anabolic steroids in the other six. To shed light on the induced lesions, animal experiments were performed, administering Norethandrolone to rabbits which were then sacrificed and subjected to pathologic examination and caspase-3 assay by fluorometry on cardiac fragments.

The natural primitive lesions were classical for such cases. The anabolic steroid-induced lesions comprised coronary thrombosis associated with left ventricle hypertrophy and lesions analogous to toxic or adrenergic myocarditis. The same lesions were found, to varying degrees, in the rabbit

models, which showed significantly elevated Caspase-3 activity as compared to controls.

Anabolic steroids would seem, to varying degrees, to induce lesions analogous to those found in myocardopathy and toxic myocarditis. Their elevated Caspase-3 activity makes these lesions apoptotic in nature.

Doping, Cardiac Lesions, Apoptosis

G21 Cocaine Induced Intracerebral Hemorrhage in a Patient With Cerebral Amyloid Angiopathy: A New Risk Factor for Stroke in Cocaine Users

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The goals of this presentation are to: (1) understand the association between intracerebral lesions and cocaine use, (2) recognize amyloid angiopathy, its relationship with stroke as well as age, and its immunohistochemical detection, and (3) recognize amyloid angiopathy as a possible contributing factor for hemorrhage in cocaine use.

Because this case represents the first reported association between cocaine-induced hemorrhage and cerebral amyloid angiopathy, this presentation will impact the forensic science community by bringing to light that amyloid angiopathy may be an under-recognized but significant risk factor for hemorrhage in older cocaine users.

Hemorrhagic stroke is a common complication of recreational cocaine use. The precise mechanism of hemorrhage in such patients is unclear, although vasospasm, ischemia, vascular thrombi/thromboemboli, elevated blood pressure, and vasculitis have all been implicated. Systemic hypertension and saccular aneurysms are generally accepted as predisposing factors for cocaine-induced stroke. The authors report the case of a 62-year-old woman who suffered left parieto-occipital intracerebral hemorrhage with herniation and death, following a cocaine binge. In addition to the gross neuropathological findings, microscopic examination showed marked cerebral amyloid angiopathy in the vicinity of the hemorrhage as well as cortical areas. To explore the issue of chronic cocaine use as a risk factor for cerebral amyloid angiopathy per se, we additionally studied brain tissue in eight patients between the ages of 60 and 80 who were positive for cocaine metabolites at autopsy, with the presumption being that patients in this age group with evidence of cocaine use at autopsy were most likely chronic cocaine users. None of these additional subjects had vascular deposits of amyloid-beta by immunohistochemistry.

In conclusion, to the best of our knowledge, this report represents the first case of cerebral amyloid angiopathy-associated intracerebral hemorrhage precipitated by cocaine. It is suspected that other cases occur but go under-reported, on the one hand because cocaine-induced stroke is widely recognized and additional predisposing factors (e.g., amyloid angiopathy) may not be specifically sought, and on the other because cocaine may not be suspected in the advanced age at which amyloid angiopathy typically presents. It is further suggested that cerebral amyloid angiopathy occurs independently of the effects of cocaine, as no vascular labeling was found for amyloid-beta in eight older subjects who were cocaine users.

Cocaine, Amyloid Angiopathy, Intracerebral Hemorrhage

G22 Can Immunohistochemical Stains Aid to Rule Out Pitfalls in Suffocation Deaths?

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The goal of this presentation is show the quantitative and qualitative expression of selected markers in specimens of tissues that are affected by various degrees of hypoxic insult using immunohistochemical methods.

This presentation will impact the forensic community by providing data that may be helpful in determining the presence of early hypoxic tissue damage via immunohistochemical methods.

In forensic practice, the identification of mechanical asphyxiation is often very difficult, especially in cases of attempted masking of the homicide, or because of putrefactive alterations of the body. In addition, postmortem dissection artifacts of the neck and their differentiation from ante-mortem bruises sometimes leave doubts at the pathologist examination.

The target of current research is focused on detecting severe tissue hypoxia by a great battery of techniques now available. However, even this limited objective has not been yet obtained with the degree of reliability required for legal purposes.

Cell death, especially in neurons or myocytes, due to hypoxic damage is the most common focus for research. However, the main problem, in the forensic context, is that a considerable period of hypoxia – usually a minimum of many minutes or even hours - is needed before changes can be detected. In autopsy samples the postmortem and agonal changes may interfere with the early changes of hypoxic damage.

Quantitative and qualitative expressions of selected markers in specimens of tissues that are affected by various degrees of hypoxia insult were evaluated by immunohistochemical method. The relationships between the expression of selected markers and temporal evolution in human tissues were evaluated: the antibody HIF-1 α , as a marker of early myocardial ischemia, due to asphyxia. HIF-1 α is the major transcription factor involved in adaptive cardiac response to hypoxia, whose expression can be a useful tool in those cases with short survival period (as recently shown by Pampin and Coll).

The authors also attempted to use TGF- β expression in neck skin, as a marker of a vital lesion and duration of survival period. TGF- β plays a general function in skin response to injury, both in inflammation and in tissue repair; and it shows different immunohistochemical expression patterns in relation to post-injury time interval.

Finally, the number of pulmonary macrophages with CD68 immunohistochemical stain was estimated.

The results were evaluated considering the possibility of false negative immunohistochemical staining in tissue with putrefactive alteration.

A total of thirteen cases of suffocation death were studied: 5 cases of strangulation, 6 of hanging, 2 of choking. Negative controls were gained from cases of precipitous death in young people and positive controls from cases of confirmed asphyxial deaths. HIF-1 α was tested in myocardial tissues, TGF- β in neck skin samples and CD68 in lung samples.

The results of the retrospective analysis encourage the authors to continue this study in further cases in order to evaluate the applicability of these tests in routine forensic practice.

Asphyxial Death, Putrefactive Alterations, Immunohistochemistry

G23 Alcohol Related Accidental Drowning in Virginia: An Epidemiological Review

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The goal of this presentation is to give viewers an understanding of the epidemiology of alcohol related accidental drowning in the Commonwealth of Virginia over a ten year period. Viewers should understand the cohorts at increased risk, which may benefit from targeted prevention strategies.

The impact of this poster on the forensic community and humanity is to identify those groups at most risk of alcohol associated accidental drowning. Targeted preventative measures may reduce from three hundred and sixty-three, the number of Virginians to die potentially preventable deaths over the next ten years. This data may also be used to develop studies and/or preventative strategies in other jurisdictions.

Certain racial, gender, and/or age groups are at higher risk of alcohol-related accidental drowning.

The Office of the Chief Medical Examiner of Virginia database was queried for cases in which the fatal agency was drowning, resulting in 1129 cases from January 1997 to December 2006. Of these, 972 were accidental in manner. Data was collected from the database on the sex, race, age, alcohol presence, and blood alcohol level of those drowning accidentally. Rates were calculated only for Virginia residents and based on population data obtained from the Virginia Department of Health Office of Vital Statistics. The 2006 population data was estimated based on changes in the population groups for the previous nine years.

Accidental drownings comprised 86.2% of the total cases studied. Of those, 37.3% were associated with alcohol. Males accounted for 92.3% of these cases. The highest number of alcohol associated accidental drownings occurred in whites (63.3%), followed by blacks (29.8%), and Hispanics (5.5%). Those aged 35 to 45 years represented 25.6% of alcohol associated accidental drownings, those 45 to 54 years 19.8%, those 25-34 years 17.4%, and 20 to 24 years 10.7%. Of those aged 18 to 64 years, 61.3% had a blood alcohol concentration at or above the Virginia legal limit of 0.08% w/v (for driving a motor vehicle).

Of all alcohol associated accidental drowning, the great majority occurred in males. Those aged 35 to 44 years comprised 25.6%, while 61% occurred in those aged 20 to 54 years. This group may over-estimate their ability to function safely around water while under the influence of alcohol. Although the majority of these individuals had blood alcohol concentrations at or above 0.08% w/v, 38.7% did not. Preventative measures should target this potentially overlooked cohort, and emphasize abstaining from alcohol while engaging in water-related activities.

Drowning, Accidental, Alcohol

G24 Cytomegalovirus Enteritis With Profuse Gastrointestinal Bleeding Diagnosed at Autopsy: A Case Report and Review of the Literature

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The objectives of this presentation are to discuss the causes of gastrointestinal hemorrhage and gastroenteritis with specific emphasis on the diagnosis of CMV enteritis and its potentially fatal outcome.

This case report and review of the literature will impact the forensic community by helping the medical and forensic community become aware of the potentially fatal outcome of CMV enteritis.

A diverse group of pathologic factors can produce profuse gastrointestinal hemorrhage. Common causes include peptic ulcer disease, esophageal varices, arteriovenous malformations, and Mallory-Weiss tears. Aortoenteric fistulas, chemical ingestions, tumors and viruses are among the rare entities that are associated with gastrointestinal hemorrhage. Often, when gastrointestinal hemorrhage is encountered at autopsy, the causality is straight forward. However, at times, the cause of hemorrhage is more obscure and the pathologist must consider those possibilities that are less common in order to identify the etiology.

We report a case of a 74-year-old African American female who succumbed to profuse gastrointestinal bleeding secondary to cytomegalovirus (CMV) enteritis. The decedent had a history of end stage renal disease secondary to Wegener Granulomatosis. She had recently been diagnosed with inflammatory bowel disease and diabetes. She was HIV negative. Prior to her death she was hospitalized after undergoing right hip hemiarthroplasty for a right femoral fracture. Her immediate post operative hospital course was uneventful. However, while hospitalized she developed bilateral arm tremors, weakness, and decline in her mental status. She was given the preliminary diagnosis of encephalopathy and it was felt that this was due to her chronic renal failure and a metabolic derangement. In the proceeding days, her blood pressure became labile, and despite full medical treatment she died. At autopsy profuse gastrointestinal hemorrhage and multiple gastrointestinal ulcerations were found. Microscopic examination revealed transmural necrosis and mucosal erosion of the large intestine and ulceration with chronic inflammation penetrating to the muscularis propria of the small intestine. In addition, scattered intestinal epithelial cells demonstrated "smudged" nuclear chromatin suggestive of viral infection. Subsequent special staining for cytomegalovirus was positive. Causes of profuse gastrointestinal hemorrhage and cytomegalovirus enteritis are discussed.

Gastrointestinal Hemorrhage, Cytomegalovirus (CMV), Autopsy Ancillary Studies

G25 Ethyl Chloride Toxicity in a Case of Unsuspecting Abuse

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The goal of this presentation is to present a case study to increase the awareness about the compound ethyl chloride, its medicinal and industrial uses, its abuse and potential toxicity to those who choose to abuse it, and its postmortem detection in blood and tissue samples.

This presentation will impact the forensic community by emphasizing that ethyl chloride is a potentially harmful and fatal chemical when abused and can be mistaken for ethanol intoxication and may not be anticipated because of its uncommon association with death.

Ethyl chloride is a colorless gas with general anesthetic properties in humans and animals. Its use as a general anesthetic was discontinued because of its flammability, cardiotoxicity, and possible severe respiratory depression. Its major uses are for tetraethyl lead production and as a solvent, alkylating agent, refrigerant and topical anesthetic.

Ethyl chloride has gained increasing popularity since amyl nitrite and other volatile alkyl nitrite substances have been removed from the lay market because of their high abuse potential. The three most common means of inhalation of ethyl chloride are "sniffing", "huffing", and "bagging". Sniffing is perhaps the most popular means of inhalation in those who are episodic abusers. The individuals who chronically use inhalants prefer bagging because of the higher concentration of the substance being inhaled. Ethyl chloride can be purchased without prescription at underground establishments, on the internet and at places selling drug paraphernalia. It is sold as a video head cleaner, which is a legitimate use, but it is also marketed as a means of experiencing a euphoric feeling and enhancement of sexual pleasure. Many of the products containing ethyl chloride have provocative names such as Rush, Jungle Juice Plus, Maximum Impact, Black-Jac, and Macho and are

generally referred to as “poppers”. Acute exposure results in feelings of euphoria, drunkenness, ataxia, dysarthria, nystagmus, confusion, dizziness, hallucinations, impairment of short-term memory, and unconsciousness. The long term effects of ethyl chloride in humans are unknown.

The case presented is that of a 38-year-old Caucasian man found dead in an adult video store viewing room. Review of the store time records revealed that the man visited the store and returned to his vehicle six minutes later. After being at his vehicle for one minute, he returned to the store again. He was found alone in the viewing room approximately five hours later. No bottles or aerosol cans were found inside of the viewing room or on his person. Inspection of his vehicle revealed miscellaneous clothing, food containers, aerosol cans, construction equipment, and two child car seats. Several bottles of exercise supplements were in the center console of the car. It is unknown if any of the aerosol cans inside the vehicle contained ethyl chloride. There was no known prior illness or substance abuse history. His social history was unknown except the obvious visit to an adult video store.

An autopsy was performed approximately eight hours after death. His autopsy findings consisted of pulmonary congestion and edema (combined lung weight 1300 grams). The left ventricular wall of the heart was hypertrophied (1.4 – 1.5 centimeters in width). The major branches of the coronary arteries were without significant atherosclerotic change (less than 10% stenosis).

Ethanol, methanol, isopropanol and acetone were tested for by head space injection on a dual column gas chromatograph (Restek BAC-1, BAC-2). An unidentified peak with a set time of 1.156 minutes on the BAC-2 column eluted at 1.243 minutes on the BAC-1 column as an overlying peak with the same retention time as ethanol. Gas chromatographic/mass spectrometric analysis of blood and liver identified this substance as ethyl chloride. An alcohol dehydrogenase method (DRI Ethyl Alcohol Assay, Microgenics) was used for the quantitation of ethanol in the heart blood (0.09 g/dL), the urine (0.8 g/dL), and in the vitreous humor (0.07 g/dL). Cocaine metabolite(s), benzodiazepines, barbiturates, phencyclidine, amphetamine/methamphetamine, opiate(s), and methadone were not detected.

This case illustrates the importance of careful toxicological analysis and scene investigation in an instance where inhalant abuse was not suspected. Although ethyl chloride inhalation is not a common cause of death, it can be lethal when abused. The forensic community needs to be aware of its potential toxicity especially in cases such as this where there was no known history of “sniffing” or “huffing” and no obvious evidence of inhalant abuse at the scene.

Ethyl Chloride, Inhalant, Poppers

state of Vermont provides a practical example of how trends can be identified, and recommendations derived.

Motorcycle rider fatalities have been increasing nationwide since 1997, according to the National Highway Traffic Safety Administration reports. In the State of Vermont, the number of endorsed motorcycle operators increased by 7,550 from 1995-2005, and the number of motorcycle fatalities reported to the Office of the Chief Medical Examiner (OCME) doubled (8 vs. 16 cases). Through a combination of review of medical examiner reports, death certificates, hospital medical records, police reports, and Fatality Analysis Reporting System (FARS) Web-Based Encyclopedia, the OCME analyzed the 73 motorcycle fatalities who expired in Vermont from 1995-2005.

The majority of decedents (71%) held valid motorcycle licenses. None had completed the Vermont Rider Education Program (VREP)—a voluntary training program to improve motorcycle operator safety established in 1990—though one decedent had attempted, but failed the course. The state of Vermont has had a universal motorcycle helmet law since 1968, and the majority of decedents (89%) were wearing helmets. Three of these helmets, however, were not Department of Transportation (DOT) approved models. Of those with no helmets, drug and/or alcohol screens were positive forty percent of the time. Overall, thirty-eight percent of decedents had positive drug and/or alcohol screens. The average blood alcohol concentration (BAC) was 0.15%: in four cases, the BAC was less than the legal intoxication limit of 0.08%. Six decedents had a history of prior DWI convictions, and of these, five had elevated BACs at death. When examined in terms of decades, the largest group of fatalities occurred in the 20-29 year old population, though the 40-49 year olds represented the fastest growing group.

The majority of motorcycle fatalities were not attributable to poor visibility/weather, as most occurred during summer daylight hours on dry black-top roads. Neither did traffic play a major role: in 86% of motorcycle fatalities, the roadways were classified as rural rather than urban, and in greater than two-thirds of cases, the rider was lone rather than in a group. In 51% of cases, the collision was with a stationary object (e.g. guardrail, tree, bridge). In 41% of cases, the primary impact was with other motor vehicles. In 3% of cases, an animal was involved (e.g., deer, moose), and in 6% of cases the primary impact site remains unknown. Excess speed and road curvature showed a positive correlation with fatalities: per police report, 52% of decedents were driving too fast for road conditions and/or legal limits, and greater than 70% of accidents occurred at road curves. In all cases, the cause of death was blunt impact injury—usually to the head—although concurrent spinal, thoracic, abdominal, and extremity injuries were often seen.

While many factors contribute to motorcycle fatalities, those which are most important in Vermont appear to be operator-dependant. Excess speed and drug/alcohol use are two major modifiable risk factors for motorcycle fatalities in Vermont. All operators should be strongly encouraged to enroll in rider safety courses where they can receive appropriate risk education. Public safety advertising should be targeted toward the 20-29 and 40-49 year old age groups.

Motorcycle, Crash, Fatal

G26 Motorcycle Fatalities in the State of Vermont: 1995-2005

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The goals of this presentation are to: (1) investigate the etiology and demographics of motorcycle fatalities in the state of Vermont via review of Office of the Chief Medical Examiner (OCME) forensics reports and Fatality Analysis Reporting System (FARS) Web-Based Encyclopedia, (2) to provide recommendations on how to reduce motorcycle fatalities and/or serious motorcycle injuries in Vermont, and (3) to provide a model for similar analysis of motorcycle fatalities in other states.

This presentation will impact the forensic community by illustrating that nationwide motorcycle fatality trends are not necessarily the same as those seen at the state level. Analysis of motorcycle fatality data from the

G27 Progressive Isolated Hypoglossal Nerve Palsy and Sudden Asphyxial Death

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The goal of this presentation is to illustrate the direct connection between sudden asphyxial death and isolated hypoglossal nerve palsy secondary of his dissection resulting from cranial trauma.

This presentation will impact the forensic community by illustrating sudden death due to cranial nerve damage.

Unilateral hypoglossal nerve palsy is a rare clinical entity due to the lesions of the nerve in one of its segments (medullar, cisternal, of the base of the skull, carotid, sublingual). A Caucasian male who, during a struggle, received severe stab wounds to his head from a screwdriver resulting in hemorrhage of the perimesencephalic cistern and the frontal portion of the left cerebral ventricle. He was operated on to empty the cisternal hemorrhage. He had a normal postoperative course but showed considerable deglutition's incapacity and dysarthria. A few months after surgery, the man died while eating secondary to asphyxia due to sudden obstructive lingual palsy; autopsy showed a hemorrhagic dissection of the hypoglossal nerve on his bulbar brainstem. This case report appears to be unique because the unilateral hypoglossal nerve palsy is not resulting from postoperative pneumocephalus (most frequently reported in literature), but rather from progressive axonal dissection just distal to its bulbar origin, caused by a cisternal hematoma resulting from cranial trauma. The resulting ipsilateral tongue palsy caused dysarthria and deglutition incapacity and occlusion of the proximal third of larynx by alimentary bolus. Incoordination of the muscles innervated by the hypoglossal nerve resulted in fatal acute asphyxia.

Stab Wound, Isolated Hypoglossal Nerve Palsy, Sudden Death

G28 Medico-Legal Importance of Posttraumatic Hypopituitarism

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The goal of this presentation is to inform the public of existence of hypopituitarism after traumatic brain injury and possible significance for both criminal and civil cases.

This presentation will impact the forensic community by demonstrating how some form of hypopituitarism occurs in 35% of patients with moderate to severe head injury.

Recent studies have demonstrated that different forms of hypopituitarism are common among survivors of traumatic brain injury (TBI) tested several months or years following trauma.

The results of endocrine evaluation in a group of 109 patients (68 male and 41 female, mean age 37.9 ± 1.4 yrs.; body mass index (BMI) 24.8 ± 0.5 kg/m²) who had suffered moderate to severe TBI (Glasgow Coma Scale ≤ 13), at least one year prior to the assessment (mean 3.4 ± 0.5 yrs) are presented. After fasting overnight, at 08:00, serum samples were taken for T4, TSH, FSH, LH, testosterone (men), cortisol, and prolactin. GH/IGF-1 axis was evaluated by a provocative GHRH+GHRP-6 test and IGF-1 measurement, and results were compared with those from 85 healthy control subjects (59 male and 26 female, mean age 36.5 ± 1.4 yrs, BMI 24.2 ± 0.4 kg/m²).

Three groups of TBI patients were formed based on the established normal peak GH cut-off (>20 mg/L) and cut-off for severe GH deficiency (<10 mg/L). These groups are defined as *severe GH deficient* (GHD, n=16,

mean GH peak: 5.6 ± 0.7 vs. 46.1 ± 1.9 mg/L in healthy subjects; $p < 0.01$), *GH insufficient* or the so called "grey zone" group (GHI, n=17, mean GH peak: 15.9 ± 0.7 vs. 46.1 ± 1.9 mg/L; $p < 0.01$), and those with *normal GH secretory capacity* (GHS, n=76, mean GH peak: 44.4 ± 2.4 vs. 46.1 ± 1.9 mg/L; $p > 0.05$). Results show that lower GH responses during the provocative test were associated with older age ($p < 0.01$), higher BMI ($p < 0.01$), lower IGF-1 ($p < 0.01$) and the time since trauma ($p = 0.024$), but unrelated to GCS scores ($p = 0.095$), sex ($p = 0.628$) or presence of traumatic subarachnoid hemorrhage ($p = 0.615$). These results also indicate that 6.4% of TBI patients had hypogonadism, 2.8% had hypothyreosis and 2.8% had hypocortisolism; also 5.5% had hypoprolactinemia and 2.8% hyperprolactinemia.

A significant number of patients (33.9%) express some form of hypopituitarism after traumatic brain injury, which is not related to severity of injury. From medicolegal point these observations might be significant both for criminal and civil cases.

Posttraumatic, Hypopituitarism, Medico-Legal

G29 Massive Fat Pulmonary Embolization Secondary to a Liposuction Procedure With Tumescent Technique Diagnosed Postmortem in an Embalmed and Buried Body

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After attending this presentation, attendees will understand that all deaths occurred during whatever medical surgical procedure where death is not expected should undergo a medico-legal autopsy and how to avoid problems and complications produced by previously embalmed and buried bodies with marked external and internal postmortem changes that obscure the true cause and manner of death. Attendees will additionally understand that, though an autopsy initially was not performed, a thorough, methodical postmortem investigation may be able to find the true cause and manner of death in many cases.

This presentation will impact the forensic community by serving as a methodical parameter in the evaluation and investigation of cases where the deceased was previously embalmed and buried without an autopsy initially being performed.

A case of massive fat pulmonary embolization diagnosed 80 days postmortem in a previously embalmed and buried body of a 32-year-old woman who underwent an elective liposuction plastic surgery with tumescent technique is presented. The patient received a pre-surgical medical and laboratory evaluation by a cardiologist who considered that the patient was healthy enough for the elective surgery. General anesthesia was administered and the liposuction procedure was performed without complications; however, at the end of the surgery the patient developed sudden cardiac arrest. Cardiopulmonary resuscitative measures were done with no response; simple chest x-rays were performed and showed suggestive changes of a thromboembolic pulmonary process. The patient was declared dead and the surgeon erroneously signed the death certificate with the cause of death was a cardio-respiratory arrest. The body was embalmed with formaldehyde and buried the next day with no performance of an autopsy. The plastic surgeon was sued for medical malpractice and the body was exhumed and autopsied 80 days later as evidence. In spite of the deceased being embalmed and buried previously with marked external and internal postmortem changes, the macro micro pathological findings correlated well with clinical symptoms, radiological changes, and toxicological studies and revealed that the cause of death was a massive pulmonary fat embolization, an inherent risk of the surgical procedure.

Pulmonary Fat Embolism, Fat Embolism, Liposuction

G30 Lethal Inhalation of Isomers of Butylene: A Case Report

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The goal of this presentation is to clarify the pathophysiology of butylene induced damage in humans by means of histological, histochemical and immunohistochemical investigation.

This presentation will impact the forensic community by serving as an educational resource on the pathophysiology and dangers of inhaling butylene isomers.

There has been a steady increase in the number of deaths resulting from inhalation of volatile substances, which can be a suicide or an unintended consequence of "sniffing abuse". Intentional inhalation of a volatile substance indeed is an under-recognized form of substance abuse in children and adolescents with a high morbidity and mortality.

Fatal outcome of inhalant abuse has been discussed due to several mechanisms: suffocation, trauma after dangerous behaviour, vagal inhibition, respiratory depression and the "sudden-sniffing death syndrome" following cardiac arrhythmia. However, the reason of sudden death related to volatile sniffing is rarely clear even after toxicological analysis. In most cases, reported aerosol propellants, n-propane or n-butane or mixtures of n-propane, n-butane, and isobutane are involved.

Sudden death due to the inhalation of butylene isomers has not yet been described in forensic literature.

There are four isomers of butylene (α -butylene, cis- β -butylene, trans- β -butylene, isobutylene), which are all gases at room temperature and pressure, but can be liquefied by lowering the temperature or raising the pressure on them, in a manner similar to pressurized butane. These gases are colourless, but do have distinct odours, and are highly flammable. Although not naturally present in petroleum in high percentages, they can be produced from petrochemicals or by catalytic cracking of petroleum. There are few reports on the toxicology of this compounds in animals and humans; it is not clear if isomers of butylene can produce direct damage on lung endothelial cells or myocardial tissue like butane does, or if the injury is mediated by other mechanisms.

A 20-year-old male was found dead in his jail cell where a plastic bag and a portable cooking stove were present.

Forensic autopsy revealed cerebral edema, hemorrhagic edema of the lungs, and acute congestion of all inner organs. Histology (E&E) confirmed autopsy's results.

Toxicological analysis on the cooking stove gas and on biological specimens (blood and tissues) were performed. The cooking stove gas was formed by α -butylene (71%), cis- β -butylene (17%) and trans- β -butylene (12%). Lorazepam (85 ng/ml), GHB (800 ng/ml) and isomers of butylene (α -butylene = 550 ng/ml; cis- β -butylene = 130 ng/ml; trans- β -butylene = 270 ng/ml) were determined in blood samples collected during autopsy.

The histochemical (Van Gieson and Azan Mallory) and immunohistochemical (myoglobin, actin, and desmin) investigations on myocardial samples showed interstitial fibrosis with acute necrosis and myocardial contraction bands.

The immunohistochemical examination (CD-34 and VIII factor) on lung specimens did not reveal endothelial damage.

These results suggest an acute electrical myocardial death due to adrenergic overdrive as a pathophysiologic mechanism of butylene induced sudden death.

To the authors knowledge, this is the first case study of sudden death due to the inhalation of isomers of butylene described in literature. The lack of knowledge of the exact biological effects of this compounds and the steady increase in the number of deaths resulting from inhalation of volatile sub-

stances need further investigations in toxicological and pathological fields.

Isomers of Butylene, Lethal Inhalation, Toxicology

G31 Lethal Neglect: A Case of Extreme Intrafamilial Child Torture

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After attending this presentation, attendees will have an understanding of some peculiar aspects of intrafamilial child neglect ending in death from starvation.

This presentation will impact the forensic community by providing forensic evaluation of lethal child neglect as a consequence of combining forms of malnutrition, maltreatments, and psychological abuse levied by parents.

Deliberate starvation of an infant/child is a severe and rare form of child abuse, especially in industrialized countries. The goal of this presentation is to highlight the importance of forensic assessment in complex cases of child homicide.

Child neglect can be defined as the failure of a caregiver to provide a child with the necessities of life, including physical safety and protection, food, hydration, clothing, shelter and medical care. Failure to fulfil these responsibilities may constitute active or passive neglect. Forensic investigation of lethal child neglect requires complete autopsy findings, full investigation of scene and case history, past medical records, family history, and social background.

This presentation reports a case concerning a female infant aged 16 months who was brought to the Emergency Department where physicians established she was already dead. They noted the child cachectic state and multiple bruises over the whole body. The child's mother stated she had not been eating well in the last week.

Autopsy showed the child weighed 5700 grams (12.6 pounds) for a length of 76 cm (29.9 inches); she was severely dehydrated with the muscles of head, face, trunk, lower and upper extremities flaccid, redundant, wrinkled skin, and resultant prominent bones. The orbital adipose tissue was essentially absent leaving sunken appearing eyes. Examination of the head revealed multiple abrasions and ecchymoses at varying healing stages and focal alopecia.

Multiple cutting stab wounds were present on the left auricle and on the neck. There were bruises located on the chest and on the upper extremities; radiographic examination revealed fracture of left forearm overlaying an old arm contusion. Decubitus ulcers were located on the lumbar area and pelvis.

The thymus had atrophied. The stomach and large intestine were empty and exhibited some ulcerative lesions; there was a very little stool in the rectum. The weights of most of the child's organs were markedly less than normal averages.

Microscopic findings showed acute bronchopneumonia, hepatic fibrosis and no glycogen in the liver on PAS (para-amino-salicylic acid) stain.

The child lived in a reconstituted family. The mother had two children from the first marriage and another one from the present husband. The victim was conceived during a brief affair between the mother and a man who left her soon after she got pregnant.

The other children were healthy and well nourished.

Home inspection revealed the victim spent all day sitting in a stroller located in the parents' bedroom and placed in front of the wall.

The parents confessed they fed her intermittently with water and sugar,

small portions of milk occasionally adding breadcrumbs. Sometimes she ate leftover food from the other children. When the victim cried because she was hungry, the “caregivers” would beat her or throw objects (biberon, toys, etc.) from their bed at her head. The parents pled guilty and received life sentence.

In cases of malnutrition/starvation, only a complete forensic investigation may reveal that the caregivers history of the child not eating well for a few days, is hiding a case of extreme intrafamilial child abuse.

Starvation, Child Abuse, Parental Rejection

G32 Multiple Histories: A Statistically Significant Indicator of Non-Accidental Injury in Children

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After attending this presentation, attendees will be able to describe circumstances under which multiple histories are provided by caregivers and describe the validity of using multiple histories as a marker of non-accidental injuries in children.

This presentation will impact the forensic science community by allowing forensic scientists to have a scientific basis for the use of multiple histories as a marker of non-accidental injuries in children.

Forensic pathologists are increasingly being asked to state the bases for conclusions. How do we know that multiple histories are a marker of non-accidental injury in children? The early descriptive studies have shown that many shifting histories are associated with the “Battered Baby” syndrome, recently described as non-accidental or inflicted injuries in children. In individual cases, more than one history provided by the caregiver is excused as the result of a caregiver feeling “upset” at the child’s injury and death, or simply a matter of providing an initially incomplete history. The usefulness of considering the number of caregiver histories in a variety of causes of death can be assessed by reviewing a group of child death investigations.

Examining the causes and manners of death, and the number of trauma histories for a group of 169 child deaths provides additional support for suspicion raised by multiple histories. Cause and manner of death and the number of trauma histories was gathered as part of investigations of a group of 169 randomly selected child deaths examined over a seven year period. The child deaths occurred as the result of non-accidental injury as well as motor vehicle collisions, falls, drownings, various asphyxial deaths, and natural diseases. Non-accidental injury was distinguished from accidental injury, undetermined causes, and natural disease by investigation of medical and social history, and circumstances surrounding collapse as well as autopsy findings.

The causes of death included: 11 asphyxias (6.5%), 13 central nervous system diseases (7.7%), 80 head injuries (47.3%), 8 drownings (4.7%), 3 heart diseases (1.8%), 5 infections (3.0%), 2 other disease deaths (one each: volvulus and dehydration, 1.2%), 11 respiratory diseases (6.5%), 13 Sudden Infant Death Syndrome (7.7%), 13 blunt force injuries of trunk (7.7%), and 10 undetermined (5.9%).

Only two of the asphyxial deaths were non-accidental injuries and in both, one trauma history was provided. In one it was a confession, the other was unrelated to the cause of death. Most of the head injury deaths, 61, were non-accidental. In 11, no history was provided. One and two histories were given in 21 and 22 cases respectively. “Multiple histories” (more than two) were found in seven death investigations: four cases had three histories, two cases had four histories, and one case had five. The 2nd through 5th histories were closer approximations of mechanisms of sufficient magnitude to produce the injuries found at autopsy. All of the trunk injury deaths were non-accidental. Five cases had no trauma history, six cases had one trauma history which was usually inadequate to account for the injuries found, but only two provided a second history.

Most (six) of the nine accidental asphyxial deaths had one adequate

history to explain the injuries. In two cases no one knew what had happened, and in one other misinformation provided two histories. Most (sixteen) of the accidental head injury deaths had one adequate history. In three others a second history was needed to conclude that the explanation was adequate. All eight drownings had one adequate history.

Only two of forty-one natural deaths had even one trauma history. One child with a medulloblastoma had fallen off the couch a week prior to his collapse. The other child suffered a spontaneous subarachnoid hemorrhage and hit her head when she collapsed.

In this group, 31/76 (40.8%) with non-accidental deaths had two or more histories. For accidental and natural deaths (omitting the ten undetermined deaths), 4/83 (4.8%) had more than one trauma history. In a 2x2 table more than one history had a sensitivity of 40.8% for non-accidental injury deaths. The specificity of fewer than two histories and accidental or natural disease was 95.2%. The predictive value of non-accidental injury when many histories were provided was 88.6%. The predictive value of finding accidental or natural disease when fewer than two histories were provided was 64.8%. A Yates corrected Chi square is 23 with a P value of <<0.01 and odds ratio of 0.11 (with confidence interval of 0.04-0.58) for non-accidental injuries being found when fewer than two histories are provided by the caregiver.

Non-Accidental Injury, Multiple Histories, Child Abuse

G33 Recognizing Classic Metaphyseal Lesions in Child Abuse: An Autopsy Technique

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The educational objectives of this presentation are to review the difficulties associated with recognizing classic metaphyseal lesions in infants and to present a new autopsy technique which enables the visualization and documentation of these fractures.

This presentation will impact the forensic community by introducing a new autopsy technique developed to improve the recognition and documentation of injury pattern in child abuse.

Complete recognition and documentation of injury pattern is key in the diagnosis of child abuse. Classic metaphyseal lesions (CML) in infants are highly suggestive of child abuse but difficult to recognize. A CML is a planar fracture through the most immature portion of the metaphyseal primary spongiosa. It may occur as a partial or complete fracture and results in the epiphyseal cap separating from the metaphysis. In infants the primary spongiosa or newly formed trabecular bone at the chondro-osseous junction (COJ) is the weakest point of the long bone. The rapid rate at which the growing bone lengthens generates relatively thin and weak metaphyseal trabeculae. With age the growth rate decreases and the metaphyseal trabeculae become thicker and stronger. CML is typically the result of torsional and tractional forces applied in a direction perpendicular to the long axis of the bone as an infant is pulled or twisted by a limb, also by the acceleration and deceleration as an infant is shaken (Kleinman 1998).

A CML is difficult to recognize both in radiographs and at autopsy. Radiographically, a CML may appear as a radiolucency in the sub-physis region of the metaphysis. However, it may not be visible in all views or if the trabecular disruption is insufficient (Kleinman 1998). Crawford and Al-Sayyad (2003) note that most distal tibia metaphyseal fractures are diagnosed as ankle sprains or strains on initial radiographs because no definite fracture can be identified. Furthermore, CML rarely causes hemorrhage at the fracture site or in the surrounding tissue. Subperiosteal new bone formation is not prominent at a healing fracture site. Histologically, a CML appears as a series of microfractures at the mineralized regions of the distal zone of hypertrophic chondrocytes of the physis and a thin portion of the metaphyseal primary spongiosa, a difficult section to read (Kleinman 1998). In the healing bone, the CML may appear with chondrocytes deeper than

expected within the primary spongiosa or as a broad region of thickened hypertrophic zone (Kleinman 1998).

As a result of the difficulty to recognize a CML, a new autopsy technique has been developed. The first step is to expose and visually examine the COJ of the long bones by cutting the muscle from the long bone ends and reflecting the periosteum. An acute CML appears as either an open fracture or a slight line of hemorrhage. A healing fracture may appear as an oddly shaped COJ. When a fracture is suspected but not obvious, the end of the long bone is removed and processed by soaking it in a water soap bath at a steady but elevated temperature (~60C) for 24 hours. The result is a metaphysis without the epiphyseal cartilage or periosteum. Partial and complete CMLs are completely visible grossly. This technique is far more invasive and time intensive than standard flaying of the dermis but yields excellent results and eliminates any question about the presence of a CML. This technique is recommended for all infant deaths in which a non-accidental traumatic cause of death is suspected.

Classic Metaphyseal Fractures, Child Abuse, Autopsy Techniques

G34 Comprehensive Molecular Genetic Testing for the Cardiac Channelopathy Genes in 42 Cases of Sudden Infant Death and Sudden Unexplained Death in the City of New York Revealed High Mutation Rate

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The goal of this presentation is to investigate the mutation rate of the channelopathy genes in the SIDS/SUDS population.

This presentation will impact the forensic science community by highlighting the importance of implementing molecular genetic testing for the channelopathy genes in routine SIDS/SUDS investigations to assist medical examiners in the determination of cause and manner of death.

Sudden infant death syndrome (SIDS)* and sudden unexplained death syndrome (SUDS)* are vexing challenges in the field of Forensic Pathology. SIDS and SUDS are recognized as complex and multifactorial, requiring interaction between genetic and acquired risk factors during sensitive developmental stages or growth phases. It has been reported that 2-5% of apparent SIDS/SUDS cases are in fact due to a group of cardiac arrhythmia syndromes, collectively called channelopathies, where at least eight causative genes are known. Since the channelopathies affect the cardiac electric conduction system and cause arrhythmias, the diseases leave no structurally demonstrable autopsy findings. Currently, the only available means to allow postmortem diagnosis of channelopathies is through the use of molecular genetic testing to detect mutations in the causative genes.

In order to investigate the mutation rate of the channelopathy genes in the SIDS/SUDS population, our laboratory has validated methodologies in genetic mutation analysis. Presented in this study is a comprehensive mutational analysis of multiple channelopathy genes: a cardiac sodium channel gene, *SCN5A*; three cardiac potassium channel genes, *KCNE1*, *KCNE2*, and *KCNQ1*; and a cardiac ryanodine receptor gene, *RyR2*. The study population consisted of 42 cases with the cause of death certified as "SIDS" or "undetermined" by the New York City Office of Chief Medical Examiner. The methods utilized were designed to be highly sensitive, specific, reproducible, cost-effective and high throughput. This was accomplished using DNA-based PCR and cycle sequencing analysis to detect any nucleotide changes in the protein coding region. Heart, liver and spleen samples were used.

In testing the *SCN5A* gene, five cases carried a known pathogenic missense mutation, S1103Y; one case carried a known pathogenic missense mutation L619F; two cases carried an unknown, but likely pathogenic missense mutation, P656L; and one case carried an unknown, but likely pathogenic

missense mutation, I1837T. In testing the *KCNE 1&2* genes, we found that two cases carried two different known mutations, D85N (in *KCNE1*) and Q9E (in *KCNE2*). These two mutations previously have been shown to be associated with acquired Long QT syndrome. In testing the *RyR2* gene, the authors found that one case carried an unknown, but likely pathogenic missense mutation, G4471R. Genetic testing for *KCNQ1* gene is still in progress. All of the mutations identified in this study are heterozygous. Collectively, the pathogenic mutation rate is about 28% (12/42). Specifically, the mutation rate is most frequent in *SCN5A* gene 21% (9/42), while the mutation rates in other genes are less common.

This study highlights the importance of implementing molecular genetic testing for the channelopathy genes in routine SIDS/SUDS investigations to assist medical examiners in the determination of cause and manner of death.

* SIDS is defined as the sudden death of an infant under one year of age, which remains unexplained after a thorough investigation, including performance of a complete autopsy, examination of the death scene, and review of the clinical history.

* SUDS is the sudden death of an individual over one year of age and like SIDS, the death remains unexplained after a thorough case investigation, which includes performance of a complete autopsy, examination of the death scene, and review of the clinical history.

Molecular Genetic Testing, Channelopathy, SIDS/SUDS

G35 Primitive Neuroectodermal Tumor (PNET) Masquerading as Non Accidental Head Trauma in an Infant: Lessons for Multiple Disciplines

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After attending this presentation, attendees will understand the process of evaluating intracranial pathology in an infant and how to identify spontaneous as well as traumatic causes of intracranial hemorrhage, specifically, hemorrhage resulting from a supratentorial primitive neuroectodermal tumor.

The ability to discriminate not only between nonaccidental and accidental head trauma, but also between spontaneous and traumatic etiologies of intracranial hemorrhage, while keeping an open mind to all of the possibilities during the descision-making process, is among the most challenging of intellectual tasks that confront the forensic pathologist.

The appropriate recognition and accurate documentation of fatal nonaccidental craniocerebral trauma in infants and young children are among the most important contributions to be made by a forensic pathologist. Equally crucial, however, is the ability to identify both accidental causes of head trauma and spontaneous (nontraumatic) etiologies of intracranial pathology.

A rare cause of spontaneous intracerebral, subarachnoid, and subdural hemorrhage in a 3-month-old child resulted from a supratentorial primitive neuroectodermal tumor (PNET) with glial differentiation, emphasizing that not all forms of intracranial pathology are inflicted, or even traumatic. Furthermore, because the various interpretations of the imaging studies created significant controversy and disagreement regarding the assessment of the disease process findings, the potential problems that exist with neuroradiologic interpretations of lesions in this age group are emphasized.

An 11-week-old male infant presented to the MUSC Pediatric Emergency Department (ED) with a 2-day-long history of lethargy, decreased oral intake and urine output, and favoring of the left side of his face. His mother stated that his left eye had appeared "abnormal" for the past few weeks. In the ED, he was found to have a bulging fontanelle and a fixed and dilated left pupil with a minimally reactive right pupil. Of note, prenatal history was unremarkable; he was born at 39 weeks gestation with 1- and 5-minute Apgar

scores of 9 and 9. He had been essentially healthy up to his current presentation. A head CT scan demonstrated obstructive hydrocephalus and transtentorial herniation, prompting admission to the Pediatric Intensive Care Unit (PICU) with ventriculostomy placement for elevated intracranial pressure (ICP). However, he succumbed to refractory intracranial hypertension and was declared clinically brain dead on the 7th hospital day. Reports from imaging studies were notably discordant, with one interpreting the findings as "multiple trauma of varying ages", the other as a "mass". Autopsy revealed an extensively necrotic and hemorrhagic, supratentorial mass with resultant swelling, softening, and hemorrhage of the adjacent brain parenchyma bilateral thin-layered subdural hemorrhages accompanied by thin-layered subarachnoid hemorrhage, both overlying the cerebral convexities; subgaleal edema and hemorrhage confined to the ventriculostomy site; and anasarca with bilateral serous pleural effusions (15 mL each), and serous ascites (30 mL). There were no other injuries. The eyes were not examined. Microscopic examination of the subdural hemorrhage revealed predominantly red blood cells with rare fibroblasts, and sparse hemosiderin-laden macrophages, consistent with a recent origin (of ~6 days' duration). Sections of the mass demonstrated sheets of spindled to epithelioid cells with large, eccentric nuclei, punctate, "salt and pepper" chromatin, and inconspicuous nucleoli; some cells contained eosinophilic, smooth, "glassy" cytoplasm. The mass was accompanied by scattered hematoidin pigment and extensive, confluent necrosis. There was no significant nuclear atypia or vascular endothelial proliferation. An immunohistochemical battery employing antibodies to glial fibrillary acid protein (GFAP), synaptophysin, chromogranin A, vimentin, smooth muscle actin (SMA), pancytokeratin (AE1/AE3), low-molecular weight cytokeratin (CM 5.2), CD99, and epithelial membrane antigen (EMA) showed the tumor cells to express only GFAP and none of the other antigens. The collective histopathologic features and immunohistochemical profile of the tumor were most compatible with a PNET manifesting purely glial differentiation.

Sound critical thinking and an open mind on the part of the forensic pathologist when confronted with significant intracranial pathology in an infant is of great importance. Although the impressions of the imaging studies and the presence of bilateral thin-layered subdural and subarachnoid hemorrhages appropriately raised the suspicion of inflicted head trauma, the identification of a reasonable underlying etiology for the hemorrhage, the absence of injuries to suggest a pattern of repeated abuse, and the mother's description of neurologic signs entirely consistent with increasing ICP collectively provided strong evidence of a nontraumatic etiology for this baby's condition.

Primitive Neuroectodermal Tumor, Nonaccidental Head Trauma, Infants and Children

G36 Sudden Death of a 17-Year-Old Boy Due to Suspected Williams Syndrome - A Case Report

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After attending this presentation attendees will be well acquainted with the external and internal findings/characteristics of the rare genetic syndrome – Williams syndrome which can cause sudden death in young population.

The presentation will impact the forensic community by the fact that every case of sudden death must be scrutinized carefully both by revealing all the circumstances of the case with collecting relevant heteroanamnestic data and need to perform thorough examination of the body (external and inter-

nal). Finally, in order not to have only suspicion on some genetic disorder such as Williams syndrome, but to confirm it with the highest certainty, it is necessary to assign the task to develop genetic tests like FISH.

Sudden and unexpected death is one of the frequent problems in common medicolegal practice, which attracts special attention when it pertains young and previously apparently healthy individuals. One of the potential causes of such death could rarely be Williams syndrome (WS) due to specific cardiovascular abnormalities. This syndrome was initially described by Williams et al. in 1961, and Beuren et al. explained the phenotype. WS is a sporadic genetic syndrome, with an estimated incidence of 1 in 20.000 live births, caused by a deletion of elastin gene and other contiguous genes at chromosome 7, with variable phenotypic expression, associated with dysmorphic facies, neurological manifestations, idiopathic hypercalcemia, and cardiovascular features, particularly supravalvular aortic stenosis. Namely, more than 90% of the patients with WS exhibit a submicroscopic deletion spanning at least 114 kb, at 7q11.23. Hemizygosity of the elastin gene could account for all connective tissue, especially the vascular, abnormalities seen in WS.

The case concerns the 17-year-old boy who was playing with his brother in the yard of their family house during wintertime, when he suddenly fell down to the snow and died shortly after. Hetero-anamnestically, his mother stated that in his childhood, the boy suffered from abdominal pains periodically, denying however, any illness diagnosed by the physicians. In addition, she mentioned his constant problems with learning and relationship with his friends as well (slight mental retardation and nervousness). Since the boy had not been medically examined, no other clinical data could be obtained. At the autopsy, external examination revealed elfin face with short and slightly upturned nose, long filtrum and very bad dental condition – black-greenish coloration of the crowns of the front teeth. There were no signs of mechanical injuries on the body. Internal examination showed severe narrowing (the circumference 4 cm) of the ascending aorta, some 4 cm above the semilunar valves (supravalvular aortic stenosis) with mild enlargement of the heart, weighted 340 grams and significant thickening of the left ventricular myocardium, measured 2,3 cm. With exception of hypertrophy of the myocardial fibers, the histological findings disclosed no pathological abnormalities in all other organs. Toxicological screening was negative. Primarily based upon the internal findings along with case circumstances, in the autopsy record it was inferred that death of the teenager was of natural manner, the most probably due to inherited cardiovascular abnormalities (narrowing of the aorta and hypertrophy of the left ventricular myocardium). Regardless the fact that the case had been solved concerning manner and cause of death, yet the forensic pathologists posed a question to themselves – what might be the origin of such peculiar combination of external and internal autopsy findings. The attention was focused on his specific facial appearance together with the cardiovascular status and obtained heteroanamnestic data, which raised a suspicion on Williams syndrome.

Since WS is a genetic disorder, besides the above mentioned clinical manifestations and morphological findings, for definite diagnosis it is necessary to perform specific genetic analysis - the FISH test, which is a type of specialized chromosome analysis utilizing specially prepared elastin probes. Unfortunately, at the moment, neither the Institute of Forensic Medicine in Novi Sad, nor that in Belgrade is equipped for such test.

Williams Syndrome, Sudden Death, FISH Test

G37 Sudden Cardiac Death in Professional Sports Persons: Natural vs. Anabolic Steroid Induced Lesions, and Experimental Rabbit Model

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The goal of this presentation is to report the anabolic steroid-induced cardiac lesions in professional sports-persons and in experimental study (rabbit model).

This presentation will impact the forensic science community by demonstrating how controlling or banning doping in professional sports being unfeasible in the present state of affairs, however, associating apoptosis inhibitors might hold out hope of limiting the incidence of severe evolutive cardiac lesions.

Anabolic steroid-induced cardiac lesions in professional sport-persons are compared with a rabbit model. Out of 15,000 forensic autopsies performed on coroner's orders over a 24-year period (Jan 1981-Dec 2003) in the area of Lyon, France (population: 2,000,000), WHO criteria identified 2,250 cases of unexpected sudden cardiac death. Among these, 120 were found to have occurred during recreational sport and 12 in professional sports persons. In the latter category, the associated cardiac lesions were primitive: natural in 6 cases, and, according to inquest findings, induced by anabolic steroids in the other 6. To shed light on the induced lesions, animal experiments were performed, administering Norethandrolone to rabbits which were then sacrificed and subjected to pathologic examination and caspase-3 assay by fluorometry on cardiac fragments.

The natural primitive lesions were classical for such cases. The anabolic steroid-induced lesions comprised coronary thrombosis associated with left ventricle hypertrophy and lesions analogous to toxic or adrenergic myocarditis. The same lesions were found, to varying degrees, in the rabbit models, which showed significantly elevated Caspase-3 activity as compared to controls. Anabolic steroids would seem, to varying degrees, to induce lesions analogous to those found in myocardiopathy and toxic myocarditis. Their elevated Caspase-3 activity makes these lesions apoptotic in nature.

Doping, Cardiac Lesions, Apoptosis

On 3 September 2006 at 5 p.m., a car was discovered in a parking isolated area in the outskirts of Foggia, Italy, far from urban traffic. A dead man was seated in the driving seat, he had seatbelt fastened, and he lay down on the right hip. The deceased, a young adult man, was fully and tidily dressed, and was identified as a 29-year-old local resident. The car engine was turned off. The car keys were in the ignition in the "off" position, the windows were closed and the doors were locked from the inside: no damage was observed inside or outside the car. On the floor of the car near the anterior right seat, there were five empty small packages; a cigarette filter; a syringe full of 1 milliliter of brownish liquid, its needle was smeared with dried blood. Remote from the body, near his head, on the anterior right seat, there were a small metallic spoon, a needle plastic cap, and two other plastic packages full of white powder. The thanatological data recorded by the forensic pathologist called to the scene (5:30 p.m. of 3 September 2006) stated that at the time of discovery, the cadaver showed rigor mortis, and hypostasis that was partly mobile on digital pressure, but congruous with the position.

At the external examination, the left arm showed a round atrophic scar and left forearm an healing ischemic ulcer. The right antecubital fossa had pigmented pop-scars and swelling of the soft tissue with a necrotic area and two needle punctures; the upper one was surrounded by an extensive ecchymosis, the entire area measured cm 7x5.

A complete autopsy was performed 48 h after death. Internal examination revealed that the heart weighed 450 g, measured 14x13.5x5cm. The coronary arteries, the myocardium and the valvular apparatus were normal. All the other organs did not show specific alterations except for an intense vascular congestion.

Routine histological investigations, applying hematoxylin and eosin staining, were performed on all organ samples. Lung sections showed massive pulmonary oedema. Myocardium presented foci of fragmentation of entire myocytes in anomalous cross bands formed by segments of hyper-contracted sarcomeres and myofibrillar rhesis. The histological examination of the skin section, collected in right cubital fossa, showed a loss of the upper epidermal layers and accumulation of leukocytes, in particular polymorphonuclear neutrophils, and erythrocytes in deeper epidermal and dermal layers. All these skin findings suggested for typical necrotizing ulcers. The examination of other organs was unremarkable except for brain edema and generalized haemostasis.

Cocaine was detected in the subject's urine through immunoenzymatic screening. Toxicological analysis by solid-liquid extraction and gas chromatography-mass spectrometry (GC-MS), was carried out to identify and quantify the individual substances present in the biological fluids and organs. Total cocaine concentrations were as follows: blood 4.08 mcg/mL/g, liver 10.19 mcg/mL/g, brain 6.19 mcg/mL/g, urine 57.00 mcg/mL/g, and bile 17.72 mcg/mL/g. No other drugs or alcohol were detected.

The toxicological analysis of empty and full packages demonstrated that the white powder was cocaine and quinine (used as an adulterant), and the brownish liquid in the syringe, collected in the car, was positive only for cocaine. According to the crime scene data, autopsy and histological and toxicological findings, death was attributed to a fatal arrhythmia during cocaine skin inoculation.

In cocaine skin inoculation, cutaneous necrosis and necrotizing ulcers may develop as a result of several combined factors, including "skin popping", toxicity and the irritant properties of the drug and adulterants, vascular thrombosis, and infection. Quinine used as an adulterant has known caustic effects. In addition cocaine has potent vasoconstrictive and thrombotic effects. Various mechanisms such as cocaine-related increase in plasma lipids, direct and indirect increase in endothelial permeability, higher prevalence of mast-cells and other inflammatory cells in plaques may contribute to the lesions. Typical are round atrophic scars, clustered predominantly on the arms and legs, frequently seen in intravenous drug abusers, particularly cocaine abusers. These may represent healed abscesses, healed ischemic ulcers due to vasoconstrictive effect of cocaine, or the direct toxic effects on capillary endothelium.

Cocaine, Skin Popping, Necrotizing Ulcer

G39 Erroneous Diagnosis of Cadmium Poisoning Based on Postmortem Toxicology

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The goal of this presentation is to investigate the interpretation of cadmium levels in postmortem blood specimens.

This presentation will impact the forensic science community by demonstrating how the observed evaluation of elevated levels of cadmium in postmortem specimens may lead to an interpretation of accidental or intentional poisoning for what is actually a poorly described artifact of cadmium pharmacokinetics. Lack of knowledge of this artifact can lead to various effects ranging from unnecessary exhumations to civil and criminal legal cases.

In 2004, county coroner (County A) in Pennsylvania ordered a heavy metal screen on an autopsy case to investigate a case of suspected poisoning. The only analyte that was abnormal was markedly elevated cadmium. Suspicion of either accidental or intentional poisoning caused the coroner to order 26 additional postmortem heavy metal studies as well as an exhumation. A comparative population study of cadmium levels was performed on a representative living population in the same community, along with a postmortem study of a similar autopsy population. These studies confirmed that the observed elevations of cadmium were postmortem artifact.

The laboratory results of cadmium were compared for the following study groups: (1) twenty seven (27) cases of postmortem cadmium analysis performed for the Coroner of County A as part of his investigation of possible poisoning, (2) nine (9) analyses of a separate autopsy population in a nearby county (County B) that has a similar demographics and incidence of possible industrial cadmium exposure, and (3) forty seven (47) analyses of a living out-patient population at the major medical center in County A.

The average measured cadmium values were as follows:

- Coroner's cases of County A - 110 μ g/L
- Coroner's cases of County B - 66.6 μ g/L
- Control (Out patients County A) - 1.5 μ g/L

Applying a t-test to these results reveals no significant difference between the two autopsy populations. The difference between the postmortem studies in County A and the living control population of the county is significant to a p-value of 0.003.

Cadmium is a well described human toxic agent. Almost one hundred years of research based on industrial exposures has allowed precise and extensive knowledge of toxicology of the compound. Cadmium is associated with renal and pulmonary toxicity and is considered to have carcinogenic effects. Chronic environmental exposure in Japan, in the 1950's, led to the development of *itai-itai* disease. Normal ranges for cadmium are from 0.3-1.2 μ g/L in non-smokers to 0.6-3.9 μ g/L in the smoking population. The 1991 OSHA standard for cadmium defines a blood cadmium value of 5.0 μ g/L as an action limit for exposed workers. Despite its chronic toxicity, cases of acute poisoning due to cadmium are exceedingly rare and occur mostly in the context of acute fume inhalation in industry or suicidal ingestions. Even in these cases measured blood cadmium levels rarely exceed 30 μ g/L. Thus all the evidence suggests that the observed, massive elevation of postmortem cadmium was an artifact. This has been described only once before in the medical literature, in an environmental journal. It is mostly likely due to a postmortem disassociation of cadmium from its *in vivo* transport protein metallothionein.

Forensic practice relies heavily on the interpretation of postmortem chemistry values for the determination of cause and manner of death. Although this can often be a straight forward process, it requires knowledge of numerous artifacts. In the case at hand, an erroneous interpretation of these cadmium values could have easily led to considerations of either intentional or accidental poisonings.

In this particular part of the country, cadmium is still used in industrial processes and the possibility of environmental contamination was considered. A well controlled and efficient population study confirmed that the observed values were a postmortem artifact.

Cadmium, Artifact, Postmortem

* Presenting Author

G40 The Continued Role of Over the Counter Drugs in Drug Related Deaths

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After attending this presentation, attendees will better understand the epidemiological characteristics of over-the-counter (OTC) drug deaths.

This presentation will impact the forensic community and public health agencies by: (1) serving as a reminder of the continued dangers of the publicly-perceived safe OTC drugs, and (2) the epidemiological trends of who is most likely impacted by these drugs which may help in creating public health safety messages and prevention strategies.

All cases from 2001-2005 in which OTC drugs contributed to the decedents' deaths were analyzed. The OTC drugs, in order of prevalence, were diphenhydramine, acetaminophen, dextromethorphan, chlor-pheniramine, salicylate, ethylene glycol (not an OTC drug but included in analysis), ibuprofen, methanol, ephedrine, and naproxen. All 292 cases were investigated by the Virginia Office of the Chief Medical Examiner (OCME). The data extracted from the OCME database included age, sex, race, manner of death, residency, and toxicological results. OTC deaths were categorized into 5 types: OTC alone, OTC with prescription drug(s), OTC with illicit drug(s), OTC with prescription and illicit drugs, and OTC with carbon monoxide. Virginia residents were analyzed separately to obtain rates.

Considering all drug poisonings, males tend to shoulder the burden of drug-related deaths with an overall ratio of 1.8 to 1 compared to females. For accidents the ratio is 2.4:1 for males to females. Males and females have a similar amount of suicides via drug poisonings (1:1.1). These trends change when looking at the role of OTC drugs. The female/male ratio is 1.45:1 and this ratio stays very similar when examining both accidents and suicides.

Suicides accounted for 51.4% of the OTC deaths, accidents for 46.6% and undetermined for 2%. The combination of OTC with prescription drugs accounted for 66.8% of OTC deaths. Interestingly, OTC alone deaths were almost 3 times higher in suicides than accidents while OTC with illicit or OTC with prescription and illicit drugs were 5 and 4.2 times higher, respectively in accidents than in suicides. Ethanol involvement was found to contribute to death in 16.1% of cases, in 50% of the OTC with illicit drug deaths and in 17.2% of the OTC alone deaths.

Virginia residents accounted for 95.2% (N=278) of the OTC drug deaths. The rate of all OTC drug deaths is 7.5 per million Virginia residents with female rates of 8.9 per million compared to 6.1 for males. Whites carried the burden of these deaths with a rate of 9.1 per million, which was 3.4 times that of blacks and 5.2 that of Asians. The highest burden of OTC deaths was in the 35-34 and 45-54 age groups with almost 2 times the rate of any other age group. Remarkably, the rate for the infant age group (<1 year old) was 4 per million.

While most of the OTC drugs were all found in accidents, suicides, and undetermined cases, some OTCs were detected in a higher percentage of a particular manner than the others. Acetaminophen (70.9%), salicylate (77.8%) ethylene glycol (85.7%), and ibuprofen (88.9%) were found more frequently in suicides than accidents. Additionally, women were 3 and 1.8 times more likely to have used ibuprofen or acetaminophen, respectively than males as all or part of their suicidal drug poisoning. However, males were 3 times more likely to use ethylene glycol than women and also accounted for all the suicides due to diphenhydramine, alone or in combination. Chlorpheniramine (70.8% of all usage) and dextromethorphan (66.7%) were more frequently associated with accidents than suicides. Males were two times more likely to accidentally use ephedrine than females.

In conclusion, OTC drugs continue to be a source of both accidental and suicidal deaths. Women are at a higher risk than men of dying from OTC drugs either alone or in combination with other drugs. Whites also have a higher rate of using a lethal amount of OTC drugs than other races.

OTC Drugs, Drug Deaths, Virginia

G41 Exceptional Suicide by Sharp Force During Mefloquine Therapy: A Case of Drug Induced Psychosis?

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The goal of this presentation is to present a case report about a special suicide.

This presentation will impact the forensic science community by assisting in the understanding of drug-induced psychosis.

Suicide by stabbing to the head and/or driving sharp objects into the skull is of extreme rarity. This paper reports the case of a 27-year-old man, who committed suicide by multiple knife stabs and cuts to the head, torso and upper limbs.

A 27-year-old man was found dead at home, lying on his bed. Doors were locked from the inside, and there was no evidence of violence in the flat. The deceased was completely naked, with abundant bloodstains on the whole body surface. The 10-cm long handle of a kitchen knife, also stained with blood, was present near the corpse with the blade broken at *ca.* 1 cm from the guard. The rest of the blade was apparently missing. According to cadaveric signs and police findings, death was likely to have occurred the day before. Autopsy showed two superficial cuts at the lower, anterior part of the neck, two stab wounds in the right temple, one stab wound in the precordium area, one cut at the top of right shoulder near the acromion, one cut at the anterior side of right forearm, one deep complex cross-shaped incised wound at the anterior side of left forearm and wrist a perforating wound of the skull, the 10-cm long broken blade of the knife being still embedded in the right temporal lobe of the brain. The deceased had no history of psychiatric illness but was currently treated by mefloquine, a quinine derivative associated with a high rate of psychiatric side-effects. Toxicology confirmed a recent intake of mefloquine together with chloroquine, another antimalarial drug.

Acute psychiatric reactions, in particular depressive disorders, have been reported as a side-effect of a wide array of medications, including non-steroidal anti-inflammatory drugs, antihypertensive drugs, anticonvulsants, steroids, or antimalarials. Among this latter group, Mefloquine distinguishes itself by a high prevalence of various psychiatric side-effects pointed out during the early postmarketing period. In 1989, the World Health Organization commissioned an investigation that confirmed the existence of such complications, with a prevalence estimated at 4.2/1000 treatments. In 60% of reported cases, disorders appeared after the first intake of mefloquine. Serious complications were noticed only for curative treatments with doses equal to or greater than 1000 mg. To the authors knowledge, this is the first report of a completed suicide with very strong evidence of mefloquine implication. In the present observation there is a very strong presumption that mefloquine was a causative, or at least contributive, factor in the victim's suicide. This statement is supported by the extraordinary method used to commit suicide, the absence of psychiatric history in the victim, whereas most suicides par sharp force to the head have been reported in mentally disturbed patients and prison populations, the close temporal relationship between suicide and mefloquine intake, as documented by the detection of the drug in postmortem samples. In the present observation a contributive role of chloroquine coingestion is difficult to assess because psychiatric side-effects encountered with this drug are much more unfrequent than with mefloquine. However it may be noteworthy that at least one severe reaction, including paranoia, hallucinations and suicidal ideation, has been reported in a subject without psychiatric history and successively treated by mefloquine then by chloroquine. Discussion focuses upon mefloquine-induced psychiatric disorders and highlights the importance of performing toxicological investigations in cases of 'unusual' suicides.

Although such events fortunately remain quite infrequent, forensic practitioners should keep in mind the possibility of drug-induced psychoses

and depression, and toxicological analyses should be the rule in 'unusual' suicides especially in subjects with no known psychiatric history.

Mefloquine Psychosis, Suicide, Sharp Force

G42 Determination of β — Phenylethylamine Blood Levels in Carbon Monoxide Intoxicated-Related Fatalities

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The goal of this presentation is to study the β -Phenylethylamine (PEA) blood levels and its metabolic enzyme, an oxygen-dependent monoamine oxidase B (MAOB), during the hypoxic status induced by carbon monoxide intoxication cases with or without oxygen resuscitation.

PEA, a specific substrate of MAOB, is a biogenic amine that acts as a sympathomimetic amine through its release of dopamine. The rate-limiting step of the MAOB activity of monoamine deamination is a highly oxygen-dependent phenomenon. Carbon monoxide (CO) has a high affinity for hemoglobin that is about 200 times greater than oxygen. CO causes a decrease of the oxygen-carrying capacity of the blood and induces a hypoxic, irreversible status even after re-inhalation of oxygen during resuscitation. The hypothesis is that reduction of the activity of MAOB during the hypoxic status could cause an accumulation of PEA and may be associated with the duration of hypoxic and agonal status. Elevation of PEA blood levels in asphyxia-related fatalities may be related and can be reversed after additional oxygen resuscitation.

A retrospective study consisting of 67 cases of carbon monoxide poison-related fatalities and 121 control cases of CO-unrelated asphyxia and cardiogenic fatalities were collected from the Institute of Forensic Medicine, Ministry of Justice during a medicolegal investigation in Taiwan. Gas Chromatography/Mass Spectrometry was performed to determine the PEA concentrations of each victim's blood. Carboxyhemoglobin (COHb) saturation was determined by Oximeter. Data are reported as mean \pm standard error mean (SEM). The statistical analyses were carried out with ANOVA by SPSS and *p* values of less than 0.05 were considered to be statistically significant in this study.

Base on COHb saturation levels, PEA blood levels of groups of COHb 20-50%, 50-70%, and higher than 70% were 140.72 ± 41.81 (*n*= 16), 107.34 ± 25.63 (*n*= 26) and 66.36 ± 18.03 (*n*= 25) ig/ml, respectively. The PEA blood levels of asphyxia cases (including strangulation and suffocation) recognized as non-CO intoxicated-related fatalities with and without resuscitation were 1.6 ± 0.4 ig/ml (*n*= 11) and 31.7 ± 6.3 ig/ml (*n*= 48), respectively. The PEA blood levels of CO poison related fatalities with and without resuscitation were 64.75 ± 32.42 ig/ml (*n*= 9) and 105.49 ± 17.47 ig/ml (*n*= 58), respectively. The mean PEA concentrations in the blood of strangulation and suffocation cases were 83 and 98 fold higher than those of control values, respectively.

In comparison with medical rescue group with decreases in the PEA levels of non-CO intoxicated fatalities during oxygen resuscitation, the CO intoxicated cases with and without resuscitation both have significant elevations in the PEA level. These results reveal that the reversible MAOB activity during oxygen resuscitation can be blocked by the CO saturation of hemoglobin. The high affinity between CO and hemoglobin molecules and the sequential blocking of the oxygenation of hemoglobin can elevate the blood PEA of CO-intoxicated cases without reactivation of the MAOB activity after sequential oxygen re-inhalation. In conclusion, the PEA can play a crucial role of vital reaction in asphyxia-related fatalities. This study strongly supports that the pathological elevation of PEA in the blood during a hypoxic-agonal status can be reversed by oxygen resuscitation but not in CO-intoxicated fatalities.

β -Phenylethylamine, Asphyxia, Biomarker

G43 The Development of a Model to Assess the Effects of Conducted Electrical Weapons in a Stressful State

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This presentation will educate attendees on the safety of conducted electrical weapons (CEWs) that are used in a physiologically stressful state by examining their effects on swine that are hyperthermic, tachycardic, hypotensive and have elevated catecholamine levels.

The research findings presented will impact the forensic science community in guiding policy related to the use of CEWs in given operational scenarios. In addition, knowledge related to the physiological effects of CEW use in compromised individuals is useful to emergency medical personnel for determination of proper medical treatment and the development of treatment protocols.

Although the effects of CEWs on healthy, anesthetized swine appear to be transient, persons that are subjected to repeated exposures of a CEW are most likely in an agitated or combative state. This stimulation could lead to a phenomenon known as excited delirium. In order to determine whether severe physiologic stress in combination with the use of a CEW would cause a serious adverse physiological effect a controlled hemorrhage along with external warming was performed. The hemorrhage was conducted to induce tachycardia, hypotension and catecholamine release as a compensatory mechanism. These signs, along with hyperthermia, are associated with excited delirium.

Preliminary data was gathered in order to assess the effectiveness of the proposed methodology to simulate a state of excited delirium. Three male swine (44 kg +/- 0.8 kg) were included in the study and one additional "sham" (43.4 kg) to observe the effects of the stress only. Under a surgical plane of anesthesia (2%-3% isoflurane) the animals were instrumented and subjected to hemorrhage and hyperthermia. Hemorrhage was induced using the Wiggers model in which blood is removed from the pig until a predetermined mean arterial pressure (MAP) is reached. The average baseline pressure prior to hemorrhage was 70 mmHg. For the proposed effort, it was determined that a MAP of 45 mmHg was sufficient in causing a stress from the blood loss. The swine were covered in a warming blanket to bring their core temperature up to 108°F. The normal temperature for the swine is 101° - 103°F (2.4° - 4.4° higher than humans). This increase in core body temperature is consistent with the sign of hyperthermia often observed in the field and previously described. Exposures to a CEW were given 20 times (4 sets of 5 exposures) in 30 minutes. Cardiac and pulmonary parameters were continuously monitored and blood samples were collected before and after each set of exposures and at one hour intervals for four hours.

The MAP decreased from its baseline value to 39.8, 43.7 and 44.3 mmHg for each of the three animals subjected to exposures. Heart rate increased on average from 112 to 185 beats per minute after the hemorrhage for the three animals subjected to exposures while the sham increased from 100 to 168 beats per minute. As expected, the heart rate remained elevated for the entire study for all animals. The baseline pH (7.44), PCO₂ (41.4 mmHg) and lactate (0.79 mM/L) values recorded were within the normal average values previously reported for swine. The pH decreased slightly after hemorrhage for all in the exposed group to 7.38 and all three in the exposed group became acidotic during the exposures (average 7.25). Blood lactate increased above normal after the hemorrhage to 3.78 and increased further after each set of exposures to 8.93 mM/L. Compared to a previous study in which the same device was applied on healthy, anesthetized swine, these animals were more acidotic and had a greater increase in blood lactate.

This model successfully created a physiologically stressful state similar to excited delirium. The warming blanket induced an increase in core body temperature and the hemorrhage induced tachycardia, hypotension and dehydration. Epinephrine and norepinephrine were not directly measured in this preliminary study however, a compensatory mechanism of hypovolemic shock is a rise in these levels.

Electrical Weapons, Tasers, Less-Lethal Weapons

* Presenting Author

G44 Exsanguination Due to Disruption of the Left Popliteal Artery and Vein Due to Posterior Dislocation of the Left Knee Prosthesis: A Case Report and Review of the Literature

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The goal of this presentation is to report a case of a 75-year-old woman who died from an exsanguination due to disruption of the left popliteal artery and vein secondary to posterior dislocation of the left knee prosthesis.

This presentation will impact the forensic community because it is a unique case of unexpected death due to posterior dislocation of the knee prosthesis.

Dislocation after primary total knee arthroplasty is a rare but serious complication. Knee prosthesis dislocation results in disruption of soft tissue, palsy of the sciatic or common peroneal nerve and rarely disruption of the popliteal artery causing ischemia. Reported here is a case of a 75-year-old woman who received bilateral knee arthroplasty. Posterior dislocation of the left knee prosthesis occurred seven years after operation. Dislocation resulted in disruption of soft tissue and left popliteal artery and vein. She died from exsanguinations due to disruption of the left popliteal artery and vein.

Exsanguination, Total Knee Arthroplasty, Knee Prosthesis Dislocation

G45 What Lies Beneath: An Unusual Congenital Anomaly in an Assault Victim

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This goal of this presentation is to describe an unusual and unexpected cervical vertebrae anomaly in a victim of assault and discuss its significance in the setting of a homicide.

This presentation will impact the forensic community by reviewing the importance of a posterior neck dissection in blunt trauma victims and by illustrating the importance of on-site forensic anthropology services.

A 22-year-old black male was physically assaulted by another male after an incident on a roadway. The victim became unresponsive immediately after the assault in which he was struck multiple times on the head and torso by the suspect's fists. No other weapon was utilized and the fight was witnessed. The incident lasted only a few minutes and the suspect left the scene, unaware that his victim had collapsed. Emergency personnel responded to the scene within minutes and despite aggressive cardiopulmonary resuscitative measures, the victim was pronounced dead at the hospital shortly after arrival.

The victim was obese, weighing 309 pounds with a body length of 71 inches (body mass index of 43.1). External examination revealed a few facial and extremity abrasions and contusions. Internal examination revealed a 3½ inch subscalpular hemorrhage over the left parietal bone and no other traumatic injuries, specifically, no subarachnoid hemorrhage. Incidentally, the decedent was found to have a urogenital anomaly comprised of fusion of the kidneys which were located in the pelvis. The heart weighed 475 grams and was mildly dilated. The coronary arteries had a normal distribution and no atherosclerosis. A complete back dissection performed to delineate any subcutaneous hemorrhage that may have been obscured by lividity was negative. A posterior neck dissection was performed which revealed focal hemorrhage around the upper cervical spinal cord between the first and second vertebral bodies, which were abnormal due to the presence of lateral foramina at the level of the first vertebral pedicles. Further dissection ensued with the assistance and guidance of our on-site forensic anthropologist.

The first through third cervical vertebrae were completely excised in order to examine and document the course of the vertebral artery. A small

amount of adventitial hemorrhage was noted at the level of the second cervical vertebrae; however the artery wall was intact throughout. A small epidural hemorrhage was identified over the posterior aspect of the cervical spinal cord at the level of the first cervical vertebra. The vertebral arteries were removed and submitted for microscopic examination by the pathologist and the forensic anthropologist cleaned and examined the cervical vertebrae.

An atypical bilateral vertebral artery course was observed in the vertebrae. The vertebral arteries passed superiorly through the second vertebral transverse foramina, turned nearly 90 degrees and took a posterior course, doubled back at the level of the first vertebral laminae, then took a second 90 degree turn to pass through the first vertebral transverse foramina and continued superiorly into the cranium. The associated anomalous skeletal characteristics together result in an acutely angled course through which the vertebral arteries pass into the skull.

Microscopic examination of the vertebral arteries revealed fragmentation and degeneration of the elastic laminae, which was confirmed with an elastin stain.

This degeneration is felt to be a ‘wear-and-tear’ type phenomenon due to the abnormal course of the arteries through the vertebrae. Microscopic sections of the heart revealed myocyte hypertrophy and patchy interstitial fibrosis. Toxicology was negative.

Concomitant renal and cervical vertebrae anomalies are not uncommon and are seen in syndromes such as Klippel-Feil in which there are fused vertebrae and varying kidney abnormalities. The association between the urogenital system and the skeletal system occurs during the early embryonic stages of development. During the 4th and 5th weeks of development, the start of renal development occurs in the cervical region of the embryo and then extends caudally. Any interruption in this stage of development can result in anomalies involving the spine, kidneys and/or scapulae.

The vertebral artery course and microscopic appearance are quite abnormal; however are insufficient to account for the sudden death of this young man. Given the circumstances of the witnessed collapse following the physical altercation, the manner of death was ruled a homicide and the cause of death was determined to be sudden death following physical altercation.

Congenital Anomaly, Vertebral Artery, Cervical Vertebrae

G46 Forensic Pathology of the Rupture of an Enlarged Spleen

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The goal of this presentation is to demonstrate the importance of the complete autopsy examination of bodies in whom death resulted from the rupture of an enlarged spleen. The causes of the splenomegaly can be determined. The mechanism causing the rupture can be determined i.e., if the rupture was spontaneous or resulted from violence. The “thin skull” legal concept is relevant in these cases.

This presentation will impact the forensic community by drawing the attention of medical examiners to the various forensic medical aspects of deaths that can result from the rupture of enlarged spleens. The importance of complete autopsies in these cases will be clear. The autopsy will reveal the many different circumstances in which ruptures of the spleen are likely to occur.

Rupture of the spleen causes profuse intra-abdominal hemorrhage leading to hypovolemic shock, which, if undiagnosed and untreated, can be fatal. A medical examiner may occasionally be confronted by an autopsy finding of death due to complications following rupture of an enlarged spleen (splenomegaly). In such cases it is important to bear in mind that rupture of the spleen can occur spontaneously with no history or external signs of trauma to the left side of the chest or to the upper left abdomen.

It is however, vitally important to examine for signs of external injury which may have been caused by violence because, when splenomegaly is present, even light violence suffered by a victim, can be the cause of rupture

of the spleen. The nature, site and extent of the external injury will indicate the severity of the violence inflicted on the body.

There is a clear analogy to the legal concept of the “paper-thin” skull, in which injury to an abnormally vulnerable part of the body can produce disastrous consequences, disproportionate to the results that would have resulted if the violence had been inflicted on an individual who did not suffer from the particular abnormality. The name of the concept derives from the classic example of a “paper-thin” skull in which a modest blow can produce permanent brain damage.

The importance of forensic medical evaluation is evident in cases where rupture of the spleen can be connected to an act of violence inflicted on the victim. In the presence of splenomegaly the severity of the act of violence must be assessed using the results of a complete autopsy and the special investigations to be recommended in this presentation.

The presentation will discuss diagnostic procedures that will facilitate the evaluation of the etiology of the splenomegaly and the pathological changes that predispose to rupture. The causes of splenomegaly are diverse, but they may be conveniently grouped into the following categories:

- Inflammatory splenomegaly: acute or chronic enlargement of the spleen that develops in association with various infections or inflammatory processes. e.g., infectious mononucleosis.
- Hyper plastic splenomegaly: due to work hypertrophy resulting from the removal of abnormal blood cells from the circulation or as the result of extramedullary hematopoiesis e.g., leukemia.
- Congestive splenomegaly: resulting from cirrhosis with portal hypertension, splenic vein occlusion (thrombosis), or congestive heart failure (CHF) with increased venous pressure e.g., bilharzia, chronic alcoholism, cirrhosis caused by aflatoxin (from fungus *Aspergillus flavus* and *Aspergillus parasiticus*).
- infiltrative splenomegaly: caused by the engorgement of macrophages with indigestible materials (e.g., Gaucher’s disease or amyloidosis,) or by the infiltration by malignancy e.g., Lymphoma.

Splenic filtering of blood-borne pathogens, such as parasites or encapsulated organisms, may also lead to splenic enlargement (e.g., parasites causing malaria or kala azar (Leishmania).

A complete autopsy including a detailed description of the macroscopic appearance of all organs is essential. Special examinations must include:

- Histo-pathological examination of samples taken from the organs and selected soft tissue and bone.
- Toxicological examination to isolate toxic organic substances.
- Microbiological examination including isolation and identification of bacteria, viruses, or parasites.

Forensic, Splenomegaly, Rupture

G47 Clinical and Pathological Spectrum of Fatty Cardiomyopathy in Sudden Cardiac Death

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After attending this presentation, attendees will recognize the pattern of pathology findings as correlated to clinical information from cases within the spectrum of fat cardiomyopathy including arrhythmogenic right ventricular cardiomyopathy.

This presentation will impact the forensic community by reviewing clinical and pathological data for sudden cardiac death cases from the spectrum of fat cardiomyopathy. Forensic and cardiovascular pathologists, as well as

other forensic scientists, may find this information useful for comparison with observations from their home institutions and practices.

Arrhythmogenic right ventricular cardiomyopathy (ARVC) is a primary heart muscle disease characterized by fibrofatty replacement of the right ventricle (RV) that is commonly associated with sudden death. Infiltration of the RV by fat alone is also believed to be associated with sudden death. However, it is not yet fully known if both conditions are different or similar disease processes in the spectrum of fatty cardiomyopathy and to what extent fatty infiltration of the RV to contribute to sudden cardiac death. In this study, the authors set to characterize the clinical and pathological characteristics of thirteen necropsy hearts collected by the iCAPTURE Cardiovascular (CV) Biobank at St. Paul's Hospital/University of British Columbia and diagnosed with ARVC or right ventricular fatty infiltration from patients that died suddenly and unexpectedly. Each case was referred to a cardiovascular pathologist at the CV Biobank for consultation and patient data were obtained from medical records or the referring pathologist. The CV Biobank, established in 1993, is comprised of cardiovascular tissue specimens from surgery and autopsy (routine hospital and forensic) as well as accompanying annotated data which are securely stored in a database. This unique collection encompasses a wide array of cardiovascular diseases and is a powerful research and educational tool.

These thirteen cases were collected by the CV Biobank during the years 1993 to 2006 and represent approximately 14% of our sudden death cases over this time period. Each of the thirteen cases were assessed in terms of their macroscopic and microscopic features and were found to fit into one of two patterns. Nearly two-thirds demonstrated fibrofatty (six male, two female; age = 17-36 years) replacement of the right ventricular myocardium, while slightly more than 1/3 showed a pattern of predominantly fatty replacement (2 male, 3 female; age = 15-64 years). Within the fatty replacement group, 80% of individuals died following non-strenuous activity and 20% died at rest. Patient histories for this group included one individual with history of fainting and clinical intervention for arrhythmia and one patient with a history of anorexia and bulimia. Within the fibrofatty replacement group, over 57% of individuals died following non-strenuous activity; 28% during strenuous activity and 14% at rest. Patient histories for this group include one individual with documented familial ventricular tachycardia for which he received treatment; one history of dilated cardiomyopathy and mitral valve regurgitation; and one individual with sudden death of a brother due to an unspecified aneurysm. Quantitative computer-assisted morphometric analysis in a subset of seven of the thirteen cases confirmed these two patterns. Of interest, the distribution and extent of involvement differed substantially between fibrofatty and fatty patterns with changes being more extreme and widely distributed in the fibrofatty pattern and localized to the anterolateral apex and lateral base in the fatty pattern.

Thus, fibrofatty replacement of the RV, characteristic of ARVC, and fatty infiltration of the RV alone are both significant findings in cases of sudden cardiac death evaluated at a regional cardiovascular pathology referral centre. The distinctly differing extent and distribution of involvement between the two morphological patterns supports the concept that they represent two different disease processes.

Fat Cardiomyopathy/ARVC, Cardiovascular Pathology, Sudden Cardiac Death

G48 Sudden Death and Fatty Liver Disease

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The objective of this presentation is to draw attention to the alarming prevalence of non-alcoholic fatty liver disease in the obese population and to a potential increase in sudden fatty liver deaths. The need for a thorough medicolegal investigation and autopsy will be emphasized, since a better understanding of the mechanism of death in such cases may have clinical consequences for both alcoholics and non-alcoholics with fatty liver disease.

* Presenting Author

The prevalence of non-alcoholic fatty liver disease in the general population may signal an increase in the number of sudden deaths in which fatty liver disease is the sole pathologic finding at autopsy. This presentation will impact the forensic community by. The forensic pathologist should be prepared to carefully investigate these deaths, since the opportunity to better understand the mechanism of death in such cases may induce clinicians to recommend routine EKG studies in obese patients and alcohol abusers.

The sudden death of a teenager with non-alcoholic fatty liver disease (NAFLD) prompted us to question the mechanism of death in individuals whose sole pathologic observation at autopsy is fatty liver disease. From a clinical stand point, NAFLD is recognized as a leading cause of chronic liver disease, and has been associated with obesity and insulin resistance. According to recent studies, the prevalence of NAFLD in the United States now exceeds 30% and probably mirrors the prevalence of obesity in the general population. One would therefore expect forensic pathologists to see a surge of NAFLD cases at autopsy, regardless of the cause and manner of death.

A 17-year-old morbidly obese female non-drinker with an unsubstantiated history of mild mental retardation, sleep apnea, and insulin resistance died suddenly and unexpectedly. She was found face down on her futon-style bed, clad in shorts and a tee-shirt. She was 5'5" tall and weighed more than 240 lbs. The only abnormal finding at autopsy was a 2490 g pale yellow-tan liver with greasy consistency. Microscopy showed marked fatty change with focal bridging fibrosis and spotty lobular inflammation. A toxicology therapeutic and abused drug screen was negative, and vitreous glucose was less than 20 mg/dl. In the absence of any other findings of significance, the mechanism of death was assumed to be a cardiac arrhythmia, and the cause of death was certified as "Sudden Death Associated with Non-alcoholic Fatty Liver Disease and Morbid Obesity".

Forensic pathologists have long been familiar with cases of sudden, unexpected, non-violent deaths in alcoholics with autopsy findings limited solely to fatty liver. The mechanism of death in such cases is not well understood. In a review of the literature, one current theory proposes that a prolonged QT interval may be triggered by alcohol withdrawal induced hypoglycemia complicated by low potassium and magnesium concentrations.

The anatomic pathology of alcohol-related fatty liver disease and non-alcoholic fatty liver disease is the same. Absent any other factor contributing to death, the mechanism of death may also be the same.

A thorough medicolegal investigation of the circumstances of death and medical history, a careful autopsy, and of standardized histologic grading systems for fatty liver are recommended in all cases of sudden death with fatty liver disease as sole pathologic finding in order to better understand the mechanism of death. An increase in NAFLD deaths may justify the need for routine electrocardiograms in obese individuals and alcohol abusers of all ages.

Fatty Liver Disease, Prolonged QT Syndrome, Sudden Death

G49 Hypertensive Heart Disease May Compound the Risk of Death From Medication and Contrast Media-Induced Anaphylactic Shock

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After attending this presentation, attendees will understand some principles of the pathophysiology and epidemiology of lethal anaphylactic shock. Additionally, specific forensic autopsy findings related to anaphylactic shock will be reviewed.

This presentation will impact the forensic community because in this retrospective case review, all autopsied cases of individuals with medication or contrast media-induced anaphylactic shock included findings of cardiac abnormalities and, specifically, left ventricular hypertrophy was found in seven of eight cases.

The pathophysiology of anaphylactic shock is complex, involving cross-linking of IgE receptors on the surface of mast cells, causing massive

degranulation and subsequent adverse effects on the cardiovascular and respiratory systems. Circulatory collapse results from impaired venous tone and venous return, as well as decreased cardiac output. Respiratory failure results from reactive airway changes as well as upper airway swelling and obstruction and pulmonary edema.

A review of several case series in the recent literature shows that deaths from medication and contrast media-induced anaphylaxis occur more often in elderly individuals, especially those with comorbid diseases, and are more common than deaths from anaphylaxis caused by Hymenoptera stings and food allergies. Postmortem measurement of serum tryptase, a marker for mast cell activation, has been found in several studies to be a sensitive and specific test that can support a diagnosis of death from anaphylactic shock. The purpose of this study was to determine whether a retrospective review of medical examiner cases in the greater St. Louis region would corroborate the findings of previous case series reported in the literature.

A computer search was utilized to find all cases in St. Louis City and surrounding counties in the past twenty years in which the sole immediate cause of death was listed as anaphylactic shock. Twenty-two such cases were found. In eleven cases, a complete autopsy was performed at the Medical Examiner's office; in one case, a complete hospital autopsy was performed; in one case, an external examination only was performed; and in nine cases, the body was released after review of the medical investigator's report.

Among the seventeen individuals with anaphylaxis induced by medication or contrast media, thirteen were over the age of fifty. By contrast, of the five individuals with "idiopathic" anaphylaxis or anaphylaxis related to Hymenoptera stings or food allergies, four were under the age of fifty. Of the twelve cases in which a complete autopsy was performed, three cases included individuals with a swollen tongue or lips; eight included findings of laryngeal edema; ten had cardiac abnormalities; seven had pulmonary abnormalities; and two had mild cerebral edema. In the five cases in which postmortem serum tryptase levels were measured, four showed levels above the upper limit of the normal reference range (13.5 ug/ml) and all five showed levels above 10 ug/ml.

Many of the individuals who died as a result of medication or contrast media-induced anaphylactic shock suffered from comorbid diseases including obesity, diabetes, and atherosclerosis. Significantly, cardiac abnormalities were found in all of these cases in which a complete autopsy was performed. Specifically, the finding of left ventricular hypertrophy, which is strongly associated with hypertensive heart disease, was found in seven of eight cases.

The findings of this study corroborated those of previous case series, which reported that death from medication or contrast media-induced anaphylactic shock most commonly occurs in elderly individuals, many with comorbid diseases. Interestingly, in this case review, all of these autopsied cases included findings of cardiac abnormalities and, specifically, left ventricular hypertrophy was found in seven of eight cases. The association of hypertensive heart disease with death from anaphylactic shock merits further investigation and could have broad implications for the medical community if confirmed in larger studies.

Anaphylaxis, Hypertension, Hypertrophy

G50 Diffuse Axonal Injury in Medico-Legal Practice

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The goal of this presentation is to present data that will provide attendees with the important medicolegal and clinical characteristics of diffuse axonal injury in closed head trauma that may contribute ultimately to fatal outcome.

The presentation will impact the forensic community by the fact that in cases of closed head trauma, diffuse axonal injury (DAI) may contribute to overall brain damage and treatment outcome. On the other hand, these results indicate that in the cases of closed head injury, fatal outcome occurs over a shorter period if DIA is present without contusions of the brain.

Diffuse axonal injury (DAI) is a form of neural damage in close head trauma that may contribute to overall trauma severity as well as the prognosis and course. For that reason, an autopsy study was performed to analyze the extent and other important forensic and clinical characteristics of DAI.

The study was carried out prospectively during two years period when 3,012 autopsies were performed. According to defined criteria, 30 autopsy cases of closed head trauma were selected (study group), while a corresponding number of cases formed control group. Whole brain samples were fixed in formaldehyde and subsequently studied macroscopically and microscopically.

Data were obtained from medical records and autopsy findings. A contusion index (CI) was used for assessment of brain contusions. Tissue density, as a measure of myelin sheet damage, was analyzed on luxol fast blue (LFB) stained sections of corpus callosum (CC) by laser scan densitometry. The obtained results were analyzed by means of appropriate statistical methods.

Optic density of LFB stained CC slices depends on myelin quantity. Optic density of CC in controls was 1.02 ± 0.05 , while in studied subjects it was 0.96 ± 0.08 . Observed difference in optic density of CC histological slices was proved to be of statistical significance ($t=4.0035$; $p<0.05$). In cases with higher CI, i.e., where contusion injuries were more severe, optical density of CC was slightly lower in comparison to the cases of less severe contusions, and cases where brain contusions were absent. Optical density of CC is significantly lower in cases with survival period up to 24 hours.

Medico-Legal Aspects, Diffuse Axonal Injury, Trauma

G51 Placental Site Trophoblastic Tumor (PSTT) With Lung Metastases as Cause of Death in a Young Patient: Autopsy Findings and Medico-Legal Implications

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The goal of this presentation is to present the autopsy and histological findings of placental trophoblastic tumor, which are very rarely described in the literature.

This presentation will impact the forensic community by demonstrating how medico-legal implications are related to the difficulties of the doctor who faced this rare condition.

Placental site trophoblastic tumor (PSTT) is a rare form of gestational trophoblastic disease (GTD) with unpredictable biological behaviour. It arises from the transformation of intermediate trophoblastic cells that normally play a critical role in implantation. PSTT was originally termed “atypical chorioepithelioma” by Marchand in 1895. In 1976, under the title “trophoblastic pseudotumor of the uterus”, Kurman et al. recognized the entity as a form of trophoblastic disease, distinct from choriocarcinoma. Five years later, Scully and Young introduced the term “placental site trophoblastic tumor” to indicate possible malignant behaviour. Since the first report, approximately 90 cases of PSTT have been reported, formerly termed atypical choriocarcinoma, chorio-epitheliosis or syncytoma. PSTT can occur after a normal pregnancy, abortion, term delivery, ectopic pregnancy or molar pregnancy. It displays a wide clinical spectrum, and when metastatic, can be difficult to control even with surgery and chemotherapy. Unlike other forms of GTD, PSTT is characterized by low beta-hCG levels because it is a neoplastic proliferation of intermediate trophoblastic cells. Expression, however, of human placental lactogen (hPL) is increased on histologic section as well as in the serum. The most common presenting symptoms of PSTT are vaginal bleeding and amenorrhoea. Diagnosis is confirmed by dilatation and curettage and hysterectomy but meticulous evaluation of metastasis is mandatory.

A 21-year-old woman, (gravida 1, para 0) at 25 weeks of amenorrhea was admitted to the hospital for hyperemesis, hepatic problems, and important weight loss registered during the last few months. Routine laboratory tests such as liver function, haemastics and coagulations markers were abnormal, whereas all fetal parameters were unremarkable. On examination, the patient was cachectic looking. The per-abdominal examination was unremarkable. Few days after the admission the patient suddenly died before the doctors can reach a diagnosis. A forensic investigation for medical malpractice was initiated. Microscopic examination of the samples collected from uterus revealed the presence of large trophoblastic cells with eosinophilic cytoplasm. Deposition of fibrinoid material was noticed between trophoblastic cells. Tumor cells dissected through the myometrium and invaded into the vascular spaces. Specimens of the lungs revealed numerous small neoplastic emboli into the vessels.

Placental site trophoblastic tumor is an uncommon member of GTD, with less than 100 cases having been reported in the English language literature. PSTTs behave in a benign fashion, whereas approximately 10–15% were clinically malignant. Predicting which patients will develop metastases is difficult. The outcome is usually excellent after the simple hysterectomy. Unfortunately at the time of diagnosis our patient presented metastasis beyond the uterus. The management of disease with metastasis can be very difficult, for the relative insensitivity to chemotherapy. Other important adverse prognostic factors are age >40 years and mitotic count >5 mf/10 HPF. Gross autopsy and histological findings, which are very rarely described in the literature, are demonstrated. The medico-legal implications related to the great difficulties of the gynecologist who faced this rare condition in term of diagnosis and prediction of the biological behavior and outlining effective therapeutic approaches are discussed.

Placental Site Trophoblastic Tumor, Lung Metastas, Medico-Legal Implications

G52 Identification of Human Body Fluids: Comparison Between Two Commercial Kits for Detection of Semen

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The aim of our presentation is to show the results making a parallel study to detect human semen on old and recent traces with these two different commercial kits.

This presentation will impact the forensic science community by showing how it is possible to improve the knowledge about identification methods using new approach to detect traces.

The examination of living victims of sexual assaults is very important; the necessity to have markers to detect the presence of semen on clothes or body fluids could be helpful in forensic science. Semen is the most common form of body fluid evidence encountered in these cases; in screening or examining sexual assault evidence, semen or other body fluids can be present on a variety of surfaces including sample collection swabs, pieces of clothes, bed sheets, towel, flooring, condoms, and feminine products. The samples can also be stored for many years: testing for body fluid identification and DNA profiling should be able to reliably, and with high sensitivity detect semen from a variety of sources. In countries with sophisticated forensic science or laboratories, the pathologist will not be called upon to carry out actual techniques for detection of seminal fluids: he has to be a careful collector of samples and to be able to make an interpretation of the results, but sometimes even the pathologist has to be well informed and has to be able to make these tests by himself. The detection of semen depends upon many different methods as naked-eye and lens recognition; examination under ultraviolet light, enzyme reactions (acid phosphatase activity), immunological methods, FISH method.

Particularly the immunological methods are recently used in many laboratories and they detect the presence of some antigens that normally can be found also in seminal fluid: for example PSA and Semenogelin.

PSA or prostate-specific antigen is a glycoprotein produced by the prostatic gland and it is found in seminal plasma, male urine, and blood, it could be present also in tissue or fluid of the female body but the concentrations are very low. A positive PSA test is a reliable indicator of semen regardless the presence of spermatozoa or elevated acid phosphatase level.

The other test detect a different protein that is present on semen, Semenogelin: it is the major component of human semen and together with fibronectin, gives rise to the gel-like coagulum of newly ejaculated semen.

Both of them are immunochromatographic assay tests that use monoclonal antibodies specific for the antigen and they use a strip test that can be manipulate easily.

The aim of our presentation is to show the results we had in our Laboratory making a parallel study to detect human semen on old and recent traces with these two different commercial kits. This study has the purpose to test also the sensitivity of these new methods because of the importance they could have in forensic cases.

Identification, Human Semen, Immunological Kits

G53 A Brush With Death: Suicidal Ingestion of Toothpaste

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The goal of this presentation is to describe the gross findings and the physiologic derangement resulting in death in toothpaste/flouride toxicity.

This presentation will impact the forensic community by making medical examiners aware of the potential acute toxicity of [widely-available] fluoridated toothpaste, its recognition and the high national incidence of non-fatal toothpaste poisonings.

This poster presentation will permit the attendee to brush up on the toxic effects that accompany the ingestion of toothpaste with fluoride, an extremely common, if rarely fatal, poisoning event. After attending this presentation, the attendee will be able to describe the gross findings in acute fluoride poisoning, the circumstances in which toothpaste poisoning may occur and the physiologic derangement that results in injury or death.

A 51-year-old man was found unresponsive on his bed, by his wife, when she came home from work. The bedroom door was locked from the inside. There was a history of domestic abuse, and reportedly the wife had assaulted him three days earlier, resulting in visible contusions on the right eye and upper arm. Resuscitative attempts were unsuccessful and he was pronounced dead at the scene. There was no investigative evidence of acute trauma or foul play.

Past medical history was significant for bipolar disorder, hypertension and chronic back pain. The decedent was known to abuse cocaine and multiple burnt copper pad fragments were identified throughout the house.

Two weeks earlier, the decedent, who was noted by his wife to be depressed for several months, had uttered an isolated suicidal statement to the effect that when his medications arrived by mail he should "take them all". His medications (Depakote, bupropion and olanzapine) were irregularly out of count and some were in a pile on the bedside table, along with a Thermos. No note was found.

Autopsy revealed an overweight male (BMI 28.5 kg/m²) with cardiomegaly (600 grams), organized anterior infarct, marked concentric left ventricular hypertrophy and chronic lung disease with pulmonary hypertension. There was florid hemorrhagic necrosis of the entire gastric mucosa. The stomach contained frank blood (300 ml) and a 230-gram conglomerate of translucent blue-green paste (with a minty odor).

Follow-up investigation located an almost empty 119-gram tube of toothpaste as well as multiple partially full tubes of toothpaste in the outdoor trash. The wife indicated that the decedent had some level of sophistication regarding medications, had a sibling who was a pharmacist, and would be aware of the dangers of toothpaste ingestion, especially with the warning on the package.

Toxicological evaluation revealed the presence of cocaine and benzoylcegonine as well as bupropion and citalopram. A biochemical vitreous screen was unremarkable. Fluoride was not detected in femoral blood.

The cause of death was: gastrointestinal hemorrhage due to massive ingestion of fluoridated toothpaste, hypertensive heart disease, and cocaine intoxication were significant contributing factors.

Given the history of suicidal intent, the concealment of the toothpaste tubes and the noxiousness of ingestion, the manner of death was certified as suicide.

Gastrointestinal signs and symptoms usually predominate upon ingestion of toothpaste. Other observed effects have included headache, numbness, and electrolyte disturbances, especially hypocalcemia. Hypotension and dysrhythmias are evident in severe poisonings. Toothpaste often contains up to 5 mg of fluoride per teaspoon. The fluoride is the component of toothpaste associated with toxicity. In many cases, 3 to 5 milligrams per kilogram of elemental fluoride is a toxic dose. The mechanism for toxicity following the ingestion fluoride-containing substances is thought to be a reaction between the sodium fluoride in the toothpaste gastric acid, resulting in the production of highly corrosive

hydrogen fluoride (HF). The HF causes adverse effects reported in large ingestions, including nausea, vomiting, diarrhea, abdominal pain, and acute hemorrhagic gastroenteritis.

According to Annual Reports of the American Association of Poison Control Centers, over 118 thousand poisoning exposures were reported to poison centers nationally during the five-year period ending in 2005. Of these, 91 percent were unintentional exposures; roughly 90 percent involved children less than six years old. This case is unique in the respect that it was the sole fatality attributed to toothpaste ingestion during this period.

Toothpaste, Fluoride, Poisoning

G54 Toxicological Implications in Heat Related Deaths in Phoenix, Arizona: Case Reports From the Office of the Medical Examiner

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After attending this presentation, attendees will be afforded a three year review of the statistics, toxicology, and pertinent scene findings associated with heat related deaths in the metropolitan Phoenix area.

This presentation will impact the forensic community by raising awareness of this public health issue.

The diagnosis of a heat related death rests on the importance of considering all factors involved for certifying the death when a person is found dead in a hot environment that can routinely be greater than 105 degrees during summer months. In recent years, media scrutiny of the number of deaths related to hyperthermia has reached headline proportions in our area, which has prompted much public awareness and activism. Although these headlines are accurate in reporting deaths have occurred, they do not typically reflect the true circumstances surrounding the deaths. This paper will discuss the headlines versus factual findings, retrospectively demonstrate the statistics, and discuss an algorithmic approach to unify the certification for more accurate compilation of county health statistics. Data was collected from May 1st to September 30th for years 2005 and 2006 (2007 data is still being collected). During this 2 year period, 168 deaths were certified as heat related. Of these deaths, 52% (87) had negative toxicology findings and were attributed to heat only. Of the remaining 48% (81 cases): 14% (24) had positive toxicology screens for ethanol, 16% (25) had positive screens for stimulants (cocaine or methamphetamine), 5% (8) were positive for psychotropic drugs, and 14% (24) had positive results for more than one of these categories. Toxicology also plays a vital role in electrolyte determinations. The levels of sodium, creatinine, and urea nitrogen must be considered, if possible, when evaluating potential heat related deaths. In conclusion, vitreous analysis, scene variables, and decomposition all affect the ability to evaluate results. The relevance of these findings in conjunction with other variables used to make the diagnosis will be discussed. The proposed algorithm will assist with the information gathering process and aid the forensic investigation by promoting categories for the deaths to be cataloged, so more accurate statistical, epidemiological and community prevention measures can be instituted. This retrospective analysis will demonstrate the multiple factors used to make a diagnosis of a heat related death and elicit common problems encountered in evaluating a decomposed body in a potentially hot environment. From these findings, an algorithmic approach will be proposed to further define the cause and manner of death in future investigations and improve public health reporting. It is hypothesized that the cause and manner of death could be more definitively diagnosed by using a more uniform information gathering process at the scene, during the autopsy examination and from the toxicology findings. Specific case findings and circumstances will be discussed.

Hyperthermia, Toxicology, Death

G55 Firearm Deaths by Law Enforcement in New York City

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Upon completion of this presentation, participants should obtain an overview of the circumstances and injury patterns seen with 42 police shootings.

This presentation will impact the forensic science community by demonstrating how although police shootings in which the decedent was unarmed and/or sustained numerous gunshot wounds are widely reported by the lay press, these types of shootings were not typical in our study.

The use of deadly force during law enforcement is a matter that compels public scrutiny. There were 42 gunshot deaths caused by police over a 4-year period in New York City. The decedents' average age was 31 years and ranged from 17 to 64 years. There were 41 males and 1 female; and 26 Black, 9 Hispanic, and 7 White decedents. The majority (90%) of the decedents possessed a weapon. There were 26 handguns, 6 knives, 1 axe, 1 metal pipe, and 1 toy gun (carried by an adult impersonating a police officer). Vehicles were used as weapons in two incidents. Ethanol and/or drugs of abuse were detected in 78% (31/40) of the decedents. The detected drugs of abuse included: 15 cannabinoids, 14 ethanol, 10 cocaine/BE, and 1 amphetamine. Seven decedents had a history of psychiatric illness.

The most common reason for the police presence was a response to a crime and for the shooting was the decedent's possession/use of a weapon. All but one of the decedents had injuries caused by handguns (one involved a handgun and rifle). A total of 177 bullets struck the 42 decedents. Fourteen decedents sustained single gunshot wounds, and the remainder had multiple gunshot wounds ranging from 2 to 21. In the majority of the cases in this study, the number of gunshot wounds of the body was 3 or fewer. There were 112 penetrating, 55 perforating, and 8 graze wounds. Thirteen decedents had at least one gunshot wound of the back or buttocks, accounting for 25 of the total 177 wounds, and four of the twelve had gunshot wounds of *only* the back. With the exception of the upper extremities, gunshot wounds of all locations were more likely to penetrate than perforate.

The location of the entrance wound is sometimes used as evidence to support or dispute the justification for the use of force. A shooting is a dynamic process with split second decisions and movements. It has been demonstrated that a person can turn the torso completely in the milliseconds that it takes for one to decide to fire a gun and pull the trigger. Our data show a wide range of entrance wound locations which would reflect this dynamic process.

Although these deaths may be high profile, the certification is typically straight forward and the cause (i.e., gunshot wound) and manner of death (homicide) are readily apparent. Since the medicolegal definition of homicide is death at the hand of another, the forensic pathologist is absolved of considering intent or the appropriateness of the use of force. Typically, those issues are left to the legal investigation (e.g., grand jury investigation). During this time, the medical examiner may play an important role in the corroboration of witness statements and other evidence by providing information on the direction of the wound tracks, range of fire, and opining on how the injuries may have affected the victim during the course of the event.

Although police shootings in which the decedent was unarmed and/or sustained numerous gunshot wounds are widely reported by the lay press, these types of shootings were not typical in our study. The vast majority of police-shootings occurred with the police responding to a crime in which the decedent was armed. In addition, most of the decedents had 3 or fewer gunshot wounds.

Forensic Pathology, Firearm, Police

G56 Postmortem Genital Examinations With Colposcopy in the Evaluation of Fatal Sexual Violence Against Women

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The goals of this presentation are: to help attendees better understand the nature and appearance of the anogenital tissues at various postmortem intervals; to compare the results from photocolposcopy at various magnifications vs. single lens reflex (SLR) photography; and to determine if toluidine blue dye is a reliable and/or useful adjunct in the postmortem genital examination.

This presentation will impact the forensic science community by improving the diagnostic acumen of the forensic examiner; avoiding ambiguity of interpretation of clinical findings in postmortem genital examinations; and providing a framework for the medical evaluation of fatal sexual violence against women.

This paper proposes to describe ongoing research on postmortem genital anatomy. These cases comprise a significant portion of a baseline study of postmortem genital examinations, to better study fatal sexual violence against women. To this end, a detailed analysis of anogenital anatomy at various postmortem intervals is being conducted.

The focus of the present discussion is to describe the initial results of cases drawn from the Donated Body Program, at University of California, Davis, California. A total of 30 cases will come from this population and will form a subset of the final, larger project sample. Analysis of results from these baseline studies will allow eventual comparison to genital injuries sustained by both sexual homicide victims and living sexual assault victims. Data accumulated during this project will provide the core information for a *Sexual Homicide Database* (Crowley, AAFS/1998;2000; JFS/2004).

The operations base of the Donated Body Program at the University of California, Davis, California, is at the Sacramento County Coroner's Office Morgue. Most donors are received by the Program \leq 24 hours of death. All cases selected for this baseline study are fresh, or fresh-frozen, vs. embalmed. Cases are examined based upon availability, i.e., female gender, and received by the Program in a time frame compatible with examination by the primary investigator.

A paucity of data exists on the "normal" appearance of the genital anatomy during the postmortem interval. We lack data from scrutiny and photodocumentation of the postmortem anogenital tissues. In living sexual assault victims, specific anogenital sites have been well-studied (Slaughter, Brown, Crowley, and Peck, 1997). The use of colposcopy is well established for both adult and child *living* victims. During the autopsy, gross visualization alone may not allow the detection of the more subtle findings that usually constitute genital trauma in sexual assault. Crowley described a mobile system for postmortem genital examinations with colposcopy (JFS, 2004).

Previously, the use of 1% toluidine blue as an adjunctive tool in fatal abuse cases was limited to select case examples. This nuclear stain has been incorporated as a practice standard by many programs, for the medical legal evaluation of living sexual assault victims. A review of the original methodologies was presented earlier (Crowley, AAFS/2005; 2007). Toluidine blue is specific for zones of parakeratosis and results can be due to inflammatory, benign, or malignant vulvovaginal diseases. Following application of toluidine blue dye *in vivo*, false positive results may be caused by 23 benign vulvovaginal conditions, in addition to cervical mucous. In nongenital sites, toluidine blue dye has been shown to yield positive results in granulation tissue (Crowley, 2007).

Using Crowley's mobile system of technology, the clinical phase of this research project began in March, 2007, at the Donated Body Program at the University of California, Davis, California. The research project is an observational study, with a cross-sectional design. The examination methodology employs photocolposcopy at 7.5X, 15X magnification, or both, plus 35 mm photography via the colposcope. Additional photographs are taken with a 35mm single lens reflex (SLR) digital camera, for comparison. Inspection and photodocumentation of specific anogenital sites is employed, prior to manipulation of the genital tissues. On select cases, concomitant application

of a 1% solution of toluidine blue dye has also been incorporated, in order to evaluate the reliability of this general nuclear stain as an adjunct to the postmortem examination.

Available demographic data is collected on each case, which is assigned a unique identifier, for entry into a modified version of the *Sexual Homicide Database*. Eleven anatomic sites are routinely evaluated and documented on the postmortem worksheet. Inspection, labial separation, and labial traction are used to maximize visualization, in addition to speculum insertion and anoscopy. The nature and pattern of postmortem genital findings are described in a manner consistent with the proposed taxonomy for postmortem anatomy previously described by Crowley and Peterson (AAFS/2004).

Currently, a wide variation exists in the methodology for the examination of antemortem sexual assault victims. Protocols and procedures vary, especially with regards to adjunctive methods, e.g., application, timing, and interpretation of toluidine blue dye. Postmortem challenges are multifaceted; they may pose even greater significance than in living victims. Postmortem deposition of the victim's remains usually precludes the opportunity for a follow-up examination/re-evaluation. Moreover, when experts whose sole expertise is with the antemortem victim are asked to collaborate in a sexual homicide case, even greater challenges arise. The expert *must* consider working as a team member, not in a vacuum; their frame of reference cannot solely reside in the antemortem arena.

The higher magnification potential of the colposcope affords greater opportunity for careful scrutiny and photodocumentation. This improves both the diagnostic acumen of the examiner and the quality of the postmortem genital examination. Colposcopy facilitates peer review, salient to the scientific process and eventual applicability of the research endeavor.

It is certainly true that in equivocal cases, the Forensic Pathologist can simply remove en bloc, for dissection and microscopic evaluation, the tissues germane to genital findings. However, it may prove to be beneficial to have an initial *in situ* examination of the anogenital anatomy via colposcopy.

The ultimate goal is to better visualize, in order to improve our understanding of what is normal in the anogenital anatomy during the postmortem interval.

Forensic Clinical Nurse Specialist, Colposcopy, Donated Body Program

G57 The Serial Killer of Elderly Women: Analysis of a Multi-Victim Homicide Investigation

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After attending this presentation, the participants will learn: (1) the practical issues involved in investigating and analyzing the actions of a serial murderer, and (2) the motives, methods of operation, victim selection, injuries and body disposal scenarios highlighted through case examples never presented before.

This presentation will impact the forensic community by showing a little-known but noteworthy case of a serial killer murder of an elderly women occurring in Southern Italy ten years ago.

Ben Mohamed Ezzedine Sebai, is a convicted Italian serial killer. Originally from Kairouan (Tunisia), he immigrated illegally to Italy in 1990. In 1991 he was charged of attempted murder and rape and the police headquarters of Bolzano issued an expulsion order. He fled and took refuge in the province of Foggia (Southern Italy), where he worked as farm laborer. He begged for money and relied on voluntary organizations managed by religious institutions for food and shelter. Between 1994 and 1997, in the territories of Southern Italy, fifteen women aged over 70 were murdered. One victim in 1994, two victims in 1995, three in 1996, nine in 1997, but not

all attributed to Sebai. Most of the victims were stabbed multiple times on the neck (min. 1, max. 20) with the exception of three cases in which the cause of death was manual strangulation. The assailant had sex with only one victim and sperm traces were recovered on the body. All the victims were found in their own apartments with no sign of break-in. However, the murders were connected to the theft of money and/or jewelry. The press alerted the public to the inability of the local police to seize the guilty party. In the meantime a criminal profiling was requested to aid the local police in refining their suspect list. The results showed that the murder pattern was completely inconsistent with the local criminal patterns, suggesting that the perpetrator could be an illegal immigrant sexually motivated or prior arrested for sex-related incidents. On the 15th of September, 1997, Sebai was arrested while attempting to catch a train after his last murder. Sebai was recognized by an 8-year-old child next-door neighbor of the victim while he was casting off his blood-stained clothing. He was convicted of four murders and given life sentence.

For the remaining homicides, other people were convicted; in most cases they were relatives of the victims spurred by economical reasons. In 2006, after nine years, Sebai admitted responsibility for the murders of four more elderly women, for which nine other people had already been convicted, among whom one had committed suicide in jail in 2005. The reasons of this posthumous confession are to be found in his willingness to clear these people of a groundless charge and hand over the crime weapon never found before. One year later, in 2007, he confessed to seven more murders,,with all 15 deaths occurring between 1994 and 1997. After first interviews with Sebai, a story of difficulty during childhood involving his grandmother; apparently she allowed his uncles to abuse him. His father was violent too. He hit Sebai on his feet after hanging him face down. Sebai's techniques were quite simple; once he studied the elderly women's habits, he made sure that nobody was in and he intruded under the pretext of a salesman of holy pictures then burst into the house. He deliberately chose the victims, having no prior personal connection with them at all. The neck was his favourite target because there the stab wounds can produce rapid death by exsanguination. With profuse bleeding, physical activity of the victim is also limited or lost rapidly preventing victims from screaming. He also confessed that at the end of each murder he used to ejaculate confirming the previous hypothesis of homicides sexually motivated. Sebai's criminal profiling is still going on and further developments of this case cannot be excluded.

Serial Killer, Multi-Victim Homicide Investigation, Criminal Profiling

G58 One Entrance Wound, Three Bullets, and Four Pulls of the Trigger: An Unusual Case of a Suicidal Gunshot Wound of the Head

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The goal of this presentation is to illustrate an unusual case of suicide with a revolver and multiple squib bullets.

This presentation will impact the forensic community by illustrating the need for close collaboration between the forensic pathologist and the firearm examiner when dealing with cases of unusual gunshot wounds.

Suicide is one of the most important public health issues in the United States. Suicide represents the eleventh leading cause of death in the United States. Suicides comprise approximately 12% of the caseload of the Allegheny County Medical Examiner's Office in Pittsburgh, Pennsylvania. Suicide rates for this country have been relatively stable over the past decade averaging approximately 10 per 100,000 populations. The most common method of suicide in the United States is the use of a firearm.

An elderly Caucasian male with a history of prostate cancer recently

* Presenting Author

learned that his prostate cancer had metastasized to his pancreas. Family members relayed that he made comments that he did not want to go through radiation and chemotherapy treatment again. On the morning of his demise, the decedent told his wife that "It just ain't worth it anymore." Later that morning his elderly wife heard a thump in the adjacent room. The decedent was found in the fetal position on top of his overturned walker. The wife called her brother-in-law to help, at which time they found blood coming from his head and a revolver in his right hand.

The external examination revealed an elderly Caucasian male with a single contact penetrating gunshot wound of entrance to the right temple region of the head. Dense soot deposits were present on the skin and within the wound track. A faint muzzle abrasion was identified surrounding the entrance wound. Gunpowder residue was grossly visible on the left index finger. Radiographs of the head revealed three separate bullets. Autopsy revealed a single entrance with internal beveling of the right temple bone. The path of the bullets was leftward through the bilateral temporal lobes of the brain. One .38 caliber slug was recovered from the left temporal lobe and the other two slugs were recovered from the subcutaneous tissue of the left temporal scalp.

The firearms report found the Colt .38 special caliber revolver to be in good working order. The six shot cylinder of the revolver contained three spent cartridges and three live cartridges. Interestingly, the three spent cartridges were in positions 1, 2, and 4. In position 3 was a live round with its primer struck. The three slugs recovered from the decedent's head were .38 caliber lead wad cutter-type bullets that were found to be fired by the above Colt revolver.

Collaboration between the pathologist and firearms examiner concluded that the decedent used his right thumb to pull the trigger four times and his left hand was used to steady the revolver. The first two cartridges were squibs that lodged in the barrel of the revolver. The third cartridge was a dud; the primer was struck with the revolver's firing pin but it did not discharge. The fourth cartridge was live and when struck by the firing pin discharged forcing itself and the two lodged squib bullets out of the barrel of the revolver and through the skull and brain of the decedent creating one classic entrance wound and bullet path. The bases of the two squib bullets confirm this scenario along with the deformation of the nose of the first squib slug and the relative pristine nature of the fourth live round.

Suicide, Handgun, Squib Bullets

G59 Suicidal Shotgun Wound Using a Shotgun Barrel, a Shotgun Shell, and a BB

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After viewing this presentation individuals will be better able to recognize unusual patterns of suicide. These patterns include: homemade or improvised firearms, unusual firing positions, and disguise of the suicide as a murder.

This presentation will impact the forensic science community by providing another unusual example of the use of a firearm for suicidal purposes. It also stresses the importance of good investigative technique as well as maintaining an open mind throughout the duration of an investigation.

Suicidal gunshot wounds are common in the United States. Many of these cases involve handguns; however, the use of long guns such as rifles or shotguns is also prevalent. Occasionally, an individual will employ the use of a homemade firearm or 'zip gun'. Creative or elaborate mechanisms for pulling the trigger are sometimes devised. Some individuals go to great lengths to conceal the weapon, confusing the issue and making the suicide appear as a homicide. In this report, we describe an unusual suicidal shotgun wound, in which the victim used a shotgun barrel (without the rest of the gun), a shotgun shell, and a BB.

A 54-year-old man was found dead in the basement of his home by

* Presenting Author

friends who were helping him move out of his home. He was lying on the concrete floor with an obvious wound to his lower left chest. Emergency medical personnel responded, as did police. He was pronounced dead at the scene. The coroner was notified. The police and coroner believed that the chest wound was the probable cause of death, and their initial impression was that it represented some sort of impaling wound. The basement was relatively empty, as the man and his friends had been moving his belongings out of the home. An old shotgun barrel was seen lying on the floor near the body, but it was not initially considered significant. Examination of the body at autopsy revealed the true nature of the wound: a non-contact shotgun wound with wad-petal abrasions and stippling. Close inspection of the shotgun barrel and scene disclosed a spent shotgun shell within the barrel, multiple small indentations on the base of the shell, including one on the primer, and a BB pellet on the floor near where the man and the shotgun barrel were discovered. It was surmised that the man, while bending at the waist and leaning over, held the barrel in a vertical position, with the muzzle end directed upward toward his chest and the opposite end, containing a loaded shell, toward the floor. By slamming the base of the shotgun shell on a BB on the floor, the man eventually hit the BB with the primer, causing the weapon to discharge.

The present case serves to remind death investigators of the importance of a thorough scene investigation as well as the importance of maintaining an open mind regarding the cause and manner of death. In this case, the initial concern was for a homicide with an impaling wound. Autopsy and subsequent investigation revealed the truth—a suicide employing a shotgun fired in a very unique manner. The case provides another example of how suicidal individuals can be very creative when it comes to discharging a weapon.

Suicide, Shotgun, Barrel

G60 Characteristics of Suicidal Gunshot Wounds to the Mouth in Women

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After attending this presentation, attendees will become familiar with the characteristics of suicidal gunshot wounds to the mouth in women, particularly relating to the circumstances in which the decedent shot herself.

This presentation will impact the forensic community by drawing attention to an unusual case and reviewing factors which may be used to distinguish homicide from suicide in female victims of oral gunshot wounds.

In 2003, an unusual case occurred in which the decedent, a 40-year-old woman, sustained a gunshot wound of the mouth in another person's residence, and in his presence. Her skirt had been removed and folded in her purse, and the crowns of her central incisors were chipped. An important forensic issue in this case was whether the mode of death was homicide or suicide.

In calendar years 2004-2006, the Los Angeles County Department of Coroner examined 755 victims of suicidal gunshot wounds. Of these, 80 (11%) were female. Of the female victims, 72 (90%) used handguns and 8 (10%) used rifles or shotguns.

The gunshot entry wound was located in the mouth in 24 individuals. The ages of these 24 victims ranged from 34 to 90. A suicide note or equivalent (telephone call, estate documents left out) was present in 14 cases (58%).

In virtually every case, the decedent was fully clothed (23/23 cases; one case where amount of clothing was unknown) and the gunshot wound was inflicted at the decedent's home (21/24 cases, 88%). The shooting was unwitnessed in 22 cases (92%).

In 20 cases, the decedent did not sustain chip fractures of the tips of the incisors by x-ray. In two cases the decedent was edentulous, and in two cases the presence of fractures could not be ascertained because of extensive destruction of the mouth by the firearm wound.

The caliber of the gun varied widely. There were two injuries with .22

caliber weapons, one with a .25 caliber weapon, one with a .32 caliber weapon, three with 9 mm weapons, five with .357 caliber weapons, nine with .38 caliber weapons, and one with a .45 caliber weapon. One decedent used a 12 gauge shotgun, and one used a 20 gauge shotgun.

Suicidal gunshot wounds of the mouth are unusual in women, occurring in 24/755 of our suicidal gunshot wounds in this series (3%). In the large majority of cases, the female victims of suicidal gunshot wounds to the mouth were fully clothed and committed suicide unobserved in their own residences. Chip fractures of the tips of the incisors were not seen in our cases. Most victims in this case used handguns rather than rifles or shotguns. On the other hand, presence of a suicide note and caliber of the gun were not distinctive features of this group of cases.

In determining the mode of death in a gunshot wound of the mouth in a female victim, it may be valuable to note the circumstances in which the injury occurred; particularly whether the decedent was clothed, whether the injury was observed, and whether the decedent was in her own residence.

Gunshot Wound, Suicide, Female

G61 Victimization of Children, Adolescents, and Young Adults by Physical and/or Sexual Abuse in Northwestern Greece: A Three Year Study

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After attending this presentation, attendees will become familiar with the epidemiologic, demographic, social and medical features of child, adolescent and young adult victims of physical and/or sexual abuse in Northwestern Greece.

This presentation will impact the forensic community by demonstrating the value of data collection and interdisciplinary research work as an important initial step in facing child abuse (either physical or sexual) effectively.

Child abuse is a worldwide problem, although its manifestations and extent in specific regions may vary. It is far more prevalent and detrimental than is generally recognized, having both short and long-term physical, psychological, and social consequences. In Greece mild physical punishment of children is considered to be a normal aspect of child rearing. Compared to other countries (e.g., USA, United Kingdom or Japan) the reported incidence of child abuse in Greece is minimal. It is probable, however, that the rate is underestimated because of the lack of mandatory reporting of child abuse, and also because of inadequate awareness among health care providers. *A priori*, these circumstances make any effort of estimating the true extent of child abuse in Greece even harder.

The incidence, gravity and the social and medical characteristics of the reported cases of child, adolescent and young adult abuse in Northwestern Greece were the parameters chosen to be investigated. A comparison was also done to the characteristics found in other areas of Greece and foreign countries. Data survey was performed through the retrospective analysis of child, adolescent and young adult abuse cases, for the period November 2004 to December 2006, based on the archive files (forensic reports) of the Patras Medical Examiner Office, which serves the entire region of North-western Greece.

Twenty-six (26) cases of child, adolescent and young adult abuse were reported. The age of the victims ranged between 1 and 20 years old for both sexes. From these 26 cases, 18 were identified as physical and/or sexual abuse. At the rest 8 cases neither physical nor sexual abuse findings were established. Six (6) cases concerned rape or sexual abuse, and the victims' age ranged between 5 and 15 years old. Four (4) victims were males and 4 were females respectively. The 18 established cases of physical and/or sexual abuse included 4 victims of rape (3 were females), and 14 children and adolescents physically abused. The significance of the injuries (see table 2)

of 3 out of the 14 physically abused victims was characterized as dangerous (2 females, 1 male) and 11 as simple or light (9 females, 2 males). The families of 15 victims resided in urban centres and the rest 3 in the country, respectively. As far as the nationality of the victims is concerned, one family was Eastern European while the rest (17 families) were Greek. The above categorization of physical and sexual abuse was performed according to the Greek legal system (Greek Criminal Law).

Demographic and social characteristics of the victims included:

- Delay in Seeking Help: 38 (70%)
- "Difficult Child": 24 (44.4%)
- Unwanted Pregnancy: 21 (39%)
- Illegitimate Child: 7 (13%)
- Difficult Pregnancy and Delivery: 19 (35%)
- Premature Child: 8 (14%)
- Problem during the Neonatal Period: 15 (28%)
- Illness during the first months of life: 12 (22%)

Summarized medical findings in 18 cases of abused children, adolescents and young adults included:

- Blunt Force Injuries: 23 (42.5%)
- Craniocerebral Injuries (including fractures): 19 (35.2%)
- Fractures of Long Bones: 8 (15%)
- Burns and Scalds: 7 (13%)
- Sharp Force Injuries: 5 (9.2%)
- Developmental Disorders: 15 (28%)
- Psychomotor Retardation: 7 (13%)
- Congenital Malformations: 1 (1.8%)
- Other: 4 (7.4%)

* Several victims were diagnosed with more than one finding.

There is no doubt that child abuse and neglect is manifested in Northwestern Greece with characteristics similar to those described in other areas of Greece and in foreign countries. Nevertheless, in our study there was a high prevalence of females among the victims, an argument that comes in controversy with the standing esteem medical examiners have in Greece. The relatively low number of reported cases (26 cases, less than 9 per year) is primarily a result of lack of the Greek National Health System's organization, but may be also attributed to the nature of the Greek family which precludes the maltreatment of children. Indisputably, there is wide denial of a child abuse problem among professionals in Greece, especially in the medical profession. Notwithstanding, Greece is just making its initial steps in identifying and facing the phenomenon of child abuse and neglect, and we are very optimistic that the situation will be ameliorated in the near future.

Forensic Medicine, Child Abuse, Northwestern Greece

G62 Aneurysms and Old Lace: A Ruptured Splenic Artery Mycotic Aneurysm Masquerading as Arsenic Poisoning

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After attending this presentation, attendees will gain a better understanding of the clinical presentations of patients with abdominal mycotic aneurysm and understand the usual clinical findings associated with arsenic poisoning and its differential diagnosis.

This case study discussion will impact the forensic community and the general medical community by highlighting the clinical signs and symptoms of a patient with a fatal ruptured splenic artery mycotic aneurysm, expanding clinicians' and investigators' knowledge bases to heighten pre-mortem suspicion of such cases, thus decreasing the mortality of mycotic aneurysms and decreasing unfounded accusations of poisoning.

The term *mycotic aneurysm* is often used to describe infected aneurysms within the vascular system. These lesions are classically caused by bacterial endocarditis when multiple downstream vessels are showered with and

seeded by bacterial emboli. In recent times, these aneurysms are seldom attributed to fungal organisms, and may also be referred to as infected aneurysms.

A high level of clinical suspicion is often required, augmented by blood cultures, echocardiograms to identify endocardial vegetations, and additional imaging studies such as MRI or CT scans to identify specific emboli, aneurysms, or downstream infarcts. Treatment includes antibiotic therapy, and often surgical removal of the aneurysm. Symptoms vary, depending on the vessels or organs involved by the aneurysm. Mycotic aneurysms in the splenic or mesenteric arteries may present with nonspecific abdominal pain, or no pain at all. Due to the usual concurrent bacteremia, these patients often complain of headaches, and demonstrate confusion or drowsiness.

Similarly, victims of arsenic poisoning can have varying levels of clinical symptoms, depending on the amount of arsenic ingested. The baseline health status of the patient will also affect his or her reaction to the poison. Low levels of arsenic can cause headaches and confusion. Diarrhea, vomiting, and stomach pain are more common with higher levels of poison. Because arsenic is a frequent component of daily household cleaning products and some food items, a low level of arsenic may be detected in many individuals. Individuals who are poisoned, either through accidental exposure/ingestion or due to purposeful poisoning by another person usually exhibit higher levels of detectable arsenic. Arsenic levels are generally detected by chemical analysis of hair or urine. Hair samples may show falsely elevated levels of arsenic, due to environmental accumulation of arsenic on the hair. However, hair follicles retain arsenic for much longer periods than it can be detected in the urine. Nails and skin can also harbor arsenic for long periods of time.

An elderly gentleman lived in a nursing home and was the suspected victim of arsenic poisoning at the hands of one of his children with whom there had been a recent property dispute. The patient initially complained of nondescript but at times severe abdominal pain. Clinical specimens (hair samples) taken shortly before his death revealed no toxic levels of arsenic. Shortly thereafter, he died secondary to a ruptured splenic artery mycotic aneurysm.

At autopsy, the gentleman was found to have a hemoperitoneum and a large retroperitoneal hematoma in the area of the splenic artery, due to an apparent ruptured aneurysm. No endocardial vegetations were identified. There was evidence of pyelonephritis in the kidneys. Pre-mortem arsenic levels were measured clinically via hair analysis, and were found to be within normal limits.

Further discussion will outline the incidence and various clinical presentations of mycotic aneurysms, methods by which these aneurysms have been detected in other cases, and ensuing successful clinical interventions. For the purposes of comparison, the typical findings of arsenic poisoning and their overlap with this case will be discussed.

Aneurysm, Mycotic, Arsenic

G63 Lymphocytic Hypophysitis Associated With Sudden Unexpected Death in a Young Woman

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The goals of this presentation are to recognize clinical setting and pathological changes in lymphocytic hypophysitis, and to recognize importance of sampling the pituitary for histopathology in young women with sudden unexpected death.

Lymphocytic hypophysitis causes endocrine dysfunction that could

potentially lead to sudden unexpected death. Moreover, the definitive diagnosis requires histopathological examination of the pituitary gland. Given the inconsistent practice of pituitary sampling, this presentation will impact the forensic science community by presenting how lymphocytic hypophysitis may be an underrecognized cause of sudden death.

Lymphocytic hypophysitis is an unusual inflammatory condition of the pituitary gland, classically seen in females during the peripartum periods. The clinical presentation is varied and depends on hormonal deficiencies and pathophysiological effects on the target organs. While involvement of the neurohypophysis and secondary diabetes insipidus are rare, progression to multiple organ endocrinopathies is common. Pathologically the condition is characterized by lymphocytic infiltration of the hypophysis with occasional involvement of the thyroid and adrenal glands. In this report, we present the case of a 23-year-old woman diagnosed at autopsy with lymphocytic hypophysitis, with concomitant infiltrates in the thyroid gland and adrenal medulla, who died suddenly and unexpectedly, with no other apparent cause of death. While the precise mechanism of death is unclear, this case raises the possibility of endocrine dysfunction as a contributing factor to sudden death and emphasizes the need for greater awareness of the entity and routinely sampling the pituitary gland in cases of sudden unexpected death.

Lymphocytic Hypophysitis, Pituitary, Sudden Death

G64 Medico-Legal Aspects of Posttraumatic Gastroduodenal Ulcers

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On the basis of presented data attendees will be well acquainted with the important medicolegal and clinical characteristics of posttraumatic gastroduodenal ulcers that can be very serious and even fatal complications of various types of injuries.

The presentation will impact the forensic community by the fact that in cases with development of posttraumatic stress ulcers medicolegal expertise of injuries may be very complicated, especially if fatal complications of stress ulcers occur (hemorrhage, perforation), since in such cases the causative relationship between the primary injuries and fatal outcome should be explained. On the other hand, the important influence on humanity may have data that indicate the most risky injuries concerning development of stress ulcers, as well as the importance of their adequate prevention during the treatment of injured individuals.

The posttraumatic gastroduodenal ulcers (PGDU), so called stress ulcers, represent very important, sometimes life threatening or even fatal complication of various types of injuries. Therefore, a broad autopsy study was performed in order to analyze frequency and other important forensic and clinical characteristics of PGDU.

The study was divided in a retrospective part (period 1996-2000, 5197 autopsies), and a prospective part (period 2004-2005, 2356 autopsies). In the retrospective part of the study 157 autopsy cases with posttraumatic gastroduodenal ulcers were observed (experimental group), and 730 cases without posttraumatic ulcers (control group). In the prospective part of the study 45 autopsy cases with posttraumatic ulcers were analyzed (experimental group), and 212 cases without posttraumatic ulcers (control group).

Data were obtained from autopsy protocols, anamnestic data from the deceased's family members and accessible medical records. Degree of the injury severity was presented by ISS value. Furthermore, in the prospective

part of the study histological examination of small vessels of the abdominal organs was performed in order to investigate influence of atherosclerosis on development of PGDU. The obtained results were analyzed by means of appropriate statistical methods.

In both retrospective and prospective part of the study, the percentage of occurrence of PGDU was approximately 17% among all cases with potentially risky injuries. Posttraumatic ulcers are more common in males (around 77% of all individuals with stress ulcers), as well as in older age (over 50 years). The outliving period ranged between 24 hours and 25 days, but it was often no longer than 12 days (76%). From the preventive point of view, it is important to point out that 16.5% out of all PGDU in the retrospective part, and 15.5% in the prospective part of the study, was found at autopsy in the injured individuals who outlived trauma less than 48 hours.

The manner of trauma was mostly accidental with the vast majority of traffic accidents (66%), and with the highest absolute number of pedestrians (66). The main causes of death in the experimental group were as following: damage to the vital brain centers (64%), chest injuries (13%), spinal cord injuries (6%), burns (6%) and complications of injuries. The most of injured persons with posttraumatic ulcers sustained multiple injuries, that is polytrauma. Isolated craniocerebral injury was found in 25% cases with posttraumatic ulcers. In majority of cases with mechanical injuries, the calculated ISS value was ≥ 16 .

The most risky injuries for development of PGDU appeared to be isolated spinal cord injuries. Namely, among all cases with isolated spinal cord injuries, PGDU were diagnosed in 50% in the retrospective part, and in 25% in the prospective part of this study. The other types of injuries with high risk for development of PGDU were burns and scalds, isolated mechanical craniocerebral trauma, and mechanical polytrauma. This investigation shows that small vessels changes of the stomach and other abdominal organs are not very important factor in pathogenesis of posttraumatic ulcers, while the most important suppose to be functional disturbances of microcirculation caused by the primary injuries.

The stomach was the most frequent localization of PGDU, mostly with numerous lesions (so called erosive gastritis). Duodenum was the most frequent site of solitary ulcers, as well as exacerbated chronic peptic ulcers.

Complications of PGDU were found at autopsy in 40% of all cases with stress ulcers, mostly in form of hemorrhage, and rarely as perforation, and penetration. In 20% out of all 157 cases with PGDU in the retrospective part of the study, the postmortem diagnosed complications of PGDU were proclaimed to be a cause of violent death in the autopsy protocols (mostly mutually with primary injuries).

In the medicolegal expertise of cases with PGDU, three main problems usually appear: (1) estimation of severity of primary injuries, (2) establishing of causative relationship between the primary injuries and lethal outcome in cases with fatal complications of PGDU (mostly hemorrhage with resultant exsanguination), and (3) possible accusation of treating physicians for medical negligence.

Medico-Legal Aspects, Stress Ulcer, Trauma

G65 Death Caused by Cardioinhibitory Reflex: Myth or Reality?

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The goal of this presentation is to inform the medicolegal community about the different practices in using the cardioinhibitory reflex.

This presentation will impact the forensic science community by informing the medicolegal community about the mainstream opinion.

It has been known for hundreds years that pressure applied to the carotid sinus region may result in unconsciousness and convulsions. Hering and Heymans demonstrated that stimulation of the carotid sinus region results in a number of reflexes, with effects on the cardiac rhythm, vascular tonus, and respiratory function. Ever since, a number of reports dealing with cases of

death after mechanical pressure (such as strangulation, short-termed neck trauma and/or other traumatic injuries) against the carotid sinus region were published in the literature. The autopsy signs were the lack of local vital signs (such as absence of congestion, cyanosis, petechiae), indicating a very short agony possibly due a reflex mechanism.

In recent times, there has been an observed increase in numbers of clinical forensic cases in which the victim have suffered neck compression. Some victims show suggestive signs (e.g., petechiae, bruises). Other victims do not show any objective signs but anamnestic subjective symptoms are consistent with neck compression. The role of the forensic expert is to evaluate if there was life endangerment subsequent to compression based on objective and subjective findings.

The question whether ‘violence against the neck may cause life endangerment by cardio-inhibitory reflex’ is often the subject of discussion in medicolegal practice. The answer to this question may have important consequences in penal jurisprudence, particularly in cases in clinical forensic medicine.

In order to evaluate this question we mailed six questions in the framework of a qualitative and quantitative study to the members of different organisations of legal medicine: IALM, AAFS (International listing), NAME, French Society of Legal Medicine, German Society of Legal Medicine, and the Swiss Society of Legal Medicine.

The survey was conducted by E-Questionnaire based on the opinion, experience, and collaboration of several experts from about thirty countries.

The two principle questions were: (1) can cardioinhibitory reflex subsequent to neck injury cause death (forensic pathology)? And (2) can cardioinhibitory reflex subsequent to neck injury cause life endangerment (clinical forensic medicine)?

The questions required the participants to specify how often they made this kind of diagnosis and on which criteria they based their conclusions. Criteria for forensic pathology included the following: provided information, postmortem examination (macroscopic), histological examination, complementary investigations (such as medical imaging), or by elimination.

Criteria for clinical forensic medicine included the following: provided information, subjective findings (such as spots before the eyes, loss of consciousness), objective findings on the victim, complementary investigations (such as medical imaging), or by elimination. Other variables concerning the forensic experts were the following: active - emeritus, years of experience in forensic pathology and/or clinical forensic medicine, principal discipline of activity: forensic pathology, clinical forensic medicine, genetics, and toxicology.

The preliminary analysis indicates that over two-thirds of the participants believe that neck injury can induce a cardioinhibitory reflex and therefore life endangerment is possible. About a third of the experts use the cardioinhibitory reflex in their medicolegal opinions to confirm life endangerment in clinical forensic medicine or as a cause of death. They base their diagnosis on different criteria.

Cardioinhibitory Reflex, Neck Compression, Life Endangerment

G66 Ehlers-Danlos Syndrome Type IV (Vascular): An Atypical Presentation and Unexpected Diagnosis in a Medical Examiner Setting

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After attending this presentation, attendees will have a basic knowledge of the pathophysiology of the Ehlers-Danlos Syndrome, particularly the most severe form, Ehlers-Danlos Syndrome Type IV. They will also learn some of the basics of the genetic testing performed and be made aware of resources available should this diagnosis be suspected.

Because Ehlers-Danlos Syndrome can result in premature death, which

* Presenting Author

may be related to trauma or even mistakenly thought to be due to trauma, this presentation will impact the forensic science community by demonstrating how it is important for medical examiners and forensic investigators to be aware of this clinical entity and have a basic understanding of the pathophysiology.

Ehlers-Danlos Syndrome is a group of genetically inherited defects in collagen synthesis characterized by a wide array of clinical manifestations and with diverse clinical presentations. Because Ehlers-Danlos Syndrome can result in premature death, which may be related to trauma or even mistakenly thought to be due to trauma, it is important for medical examiners and forensic investigators to be aware of this clinical entity and have a basic understanding of the pathophysiology. This presentation will accomplish those goals using a recent case as an example.

There are six recognized major types of Ehlers-Danlos Syndrome, all of which vary somewhat in biosynthetic defect, mode of inheritance, and clinical presentation. The common feature among the subtypes is decreased tissue tensile strength, particularly tissues rich in collagen. Ehlers-Danlos Syndrome type IV is the most severe form because the defect involves type III collagen and may result in the rupture of large blood vessels or organs. Complications include arterial and bowel rupture and, in pregnancy, rupture of the uterus at delivery.

A recent case at the Office of the Armed Forces Medical Examiner-Pacific Region demonstrated the importance of considering diseases like Ehlers-Danlos Syndrome in the differential diagnosis. An adolescent female developed right flank pain and was treated presumptively for a urinary tract infection. After a week of both outpatient and inpatient management her condition did not improve. The patient collapsed while getting out of a vehicle and sustained a large scalp laceration. She subsequently went into cardiac arrest in the Emergency Department and died in the operating room of the local medical treatment facility.

During the autopsy the medical examiner was struck by the friability of the patient's connective tissue, particularly the mesentery. Multiple vascular defects and complete avulsion of one kidney with partial avulsion of the vascular pedicle of the other kidney were noted. A connective tissue abnormality, such as Ehlers-Danlos Syndrome, was suspected based on the gross anatomic findings. A microscopic examination demonstrated organizing hemorrhage outside of the adventitia of the right renal artery, indicating that the rupture had evolved over a period of time.

The medical examiner consulted with a research laboratory that specializes in the Ehlers-Danlos Syndromes. Frozen tissue specimens were provided and spleen was used to extract DNA for analysis. The researchers identified a mutation in one allele of the COL3A1 gene that is located on chromosome two. The effect on the gene product was deletion of 18 amino acids from the protein, accounting for the clinical presentation and autopsy findings.

In retrospect the family related that their daughter had always bruised easily and sustained unusually severe lacerations for seemingly minor trauma as a child. She also had some of the characteristic facial and skin features of Ehlers-Danlos Syndrome as well as the classic finding of joint laxity. Routine laboratory studies performed years earlier to evaluate the problem of easy bruising were all within normal limits.

An accurate diagnosis was extremely important to provide closure for a family that was attempting to understand how their daughter could be diagnosed with a urinary tract infection and die one week later. Establishing a diagnosis was critical for the clinicians who took care of this patient, all of whom were initially left wondering if there was anything they could have done to change the outcome. It was also essential to recommend genetic counseling for the parents and siblings of the deceased, particularly since Ehlers-Danlos Syndrome Type IV is typically inherited in an autosomal dominant mode.

Special acknowledgement to Peter Byers, MD, Ulrike Schwartz, MD, and Melanie Pipin, MS, in the Department of Pathology, University of Washington, Seattle, Washington, for performing the genetic testing and providing technical information and support.

Collagen, Vascular, Genetic

* Presenting Author

G67 Mechanisms of Delayed Splenic Rupture: A New Hypothesis

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After attending this presentation, attendees will understand a new hypothesis which describes a potential mechanism of delayed splenic rupture.

This presentation will impact the forensic community by introducing a new mechanism of delayed splenic rupture. Also it impacts the medical and surgical communities as it guides to reduce the high mortality rate in delayed splenic rupture.

A 46-year-old man was assaulted with a club to the face and chest and sustained multiple contusions. On admission there were no signs of circulatory shock. The abdominal examination was unremarkable. During his stay in hospital he had light diets due to pain and loss of appetite. He was managed symptomatically and discharged five days after the incident.

Two hours after discharge he was admitted again with a complain of severe abdominal pain. He claimed that soon after his return to home, he ate two full plates of rice and curry, three mangos, and drank two glasses of water as he was so hungry and developed appetite for home made food. Immediately after the diet he experienced this abdominal pain.

On admission, he was pale with a pulse rate of 116 beats per minute and a blood pressure of 60/30 mmHg. There was a marked tenderness with rigidity and guarding on abdominal palpation. Bowel sounds were attenuated. Hemoglobin level had dropped to 7.2 g/ dl from a level of 10.5 g/dl within five hours. Two pints of blood were transfused. Although it was planned to do an ultrasound scan of abdomen the patient was pronounced dead thirteen hours after admission.

Autopsy revealed a generalized pallor. The abdomen was distended. A contusion of 8x3.5 cm was seen on left lower chest laterally. There were no rib fractures. A hemoperitoneum of 2300 ml was noted. The spleen was within the normal range. A hematoma of 2.5x3x1.5 cm was seen overlying a splenic laceration on the gastric area of the visceral surface. The laceration was 1.25 cm in length with a depth of 0.25 cm, involving splenic capsule and parenchyma. The body of the empty stomach was in contact with this hematoma. Histological examination confirmed the perisplenic haematoma of otherwise normal spleen.

The mechanism of this serious and possible life threatening complication is still not fully understood. There are a number of potential mechanisms for delayed splenic rupture.

Intrasplenic hematomas, pseudoaneurysms of intraparenchymal splenic artery branches, and asymptomatic splenic pseudocysts all of which develop following abdominal trauma and rupture, possibly days, months or years later are three mechanisms suggested in this context. Also bleeding from a splenic rupture could be tamponaded by surrounding organs and /or peri-splenic haematoma formed at the time of injury, delaying its rupture at a later date.

The visceral surface of the spleen consists of gastric, colic and renal surfaces. The gastric surface is directly in contact with the body of the stomach. Therefore a perisplenic hematoma which plugs the splenic laceration on the gastric surface temporarily, may easily be dislodged by the mechanical forces exerted by distending stomach, causing fatal intraperitoneal hemorrhage. Such risk is imminent during the early period of regeneration of splenic laceration where wound breaking strength is relatively low.

In this case, the laceration occurred at the time of assault was plugged temporarily by the hematoma. On day five, pressure exerted by full stomach after the heavy solid meal, dislodged the hematoma causing hemorrhage from the site of laceration.

The pressure exerted by full stomach after heavy solid meals may disturb perisplenic hematoma overlying a laceration on the gastric surface of the spleen causing delayed splenic rupture leading to sudden fatal intraperitoneal hemorrhage.

It is advisable to maintain a light liquid/ semisolid diet instead of a

heavy solid meal during the period of recovery of the patients who are having perisplenic haematomas due to lacerations on the gastric surface of the site of laceration.

Delayed Rupture, Spleen, Mechanisms

G68 Death of a Vampire?: Case of Exhumation and Mutilation of a Corpse in Rural Romania

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After attending this presentation, attendees will have a better understanding on how the mis-interpretation of decompositional artifacts have contributed to beliefs, superstitions and the myth about the existence of vampires. Attendees will be shown a video clip of the actual forensic grave side examination of a reported "vampire" who was put to his final death by family members.

Even before the famous classic tale of horror "Dracula", written by Bram Stoker in 1897, the belief of vampires can be traced back as far as the fifteenth century to various parts of Europe. Of all the various countries and regions steeped in the belief of vampires and the undead, none run so deep as in the country of Romania. The belief in vampires is rooted in many cultural beliefs regarding the after life such as the acknowledgement of Satan and his monstrous minions. Another important aspect of the belief in vampires is based on the mis-understanding of the changes that occur to the body as the result of the decompositional process. Misunderstood changes include the postmortem purging of bloody fluids from mouth and nose which were thought to be evidence of recent feeding, and the appearance that the hair and nails continue to grow after death. Other examples of mis-conception include the presence of guttural sounds from the deceased as the result of expelled post mortem gases, and the postmortem pink and reddish discolorization of the skin which gave the appearance that a corpse had returned to life.

A prime example of the deep seated cultural belief in vampires in parts of rural Romania is demonstrated in a recent case which involves the exhumation, and mutilation of a corpse. In December of 2003 a seventy-six year old retired school teacher in the rural Romanian village of Marotinul de Sus died. At his death, the elderly male was placed in a simple wooden coffin, which was then buried in a shallow grave located below a make shift stone vault. Later in time various relatives of the deceased begin to fall ill and claimed to have had dreams in which the deceased had risen from the dead as a vampire to drink their blood. As a result of the unexplained illnesses, and terrifying dreams, several family members made the decision to follow the ancient cultural tradition, and destroy their now believed undead family member.

In July of 2005 six family members traveled to the cemetery under darkness, and exhumed the body of their deceased relative. Waiting to the stroke of midnight a member of the group drove a pitchfork into the chest of the corpse, and then opened the chest cavity with a large knife, and removed the heart. The corpse was then repeatedly stabbed in various locations with wooden stakes, and garlic sprinkled over the body. The group departed the cemetery with the heart impaled on the pitchfork, and proceeded to a near by crossroads. At the crossroads, the family members burned the heart, then mixed the ashes with peppermint schnapps, and drank the concoction. As a result of their actions, they no longer felt ill, and their terrible dreams of their vampire relative were no repeated.

Later in time, word of this macabre ritualistic act made its way to the daughter of the deceased, and local authorities. A second exhumation of the corpse was ordered by authorities investigating the horrific act, in which a grave side forensic examination was conducted by a forensic pathology team. The grave side examination by the forensic pathology team corroborated the story of the mutilation, including the removal of the heart. A video clip of the actual grave side examination will be presented.

As a result of the seemingly indignant and horrid act, the six family

members who had participated in the mutilation of the corpse were arrested and sentenced to six months in jail. The arrest of the family members, greatly angered local villagers who indicated that this was a practice that been conducted by locals for many centuries. Many villagers praised the action carried out by the six, noting that it was a great thing to take out his heart as the people were in danger. Other villagers confessed to have taken the hearts from the dead many times before, and to have drunk a solution containing the ashes of the heart. In their own defense, the leader of the six family members pleaded innocent, having done nothing wrong. The leader informed the police that when they exhumed the corpse he had blood surrounding his mouth, and that he moaned when they stabbed him with the pitch fork. Pleading with authorities the head family member stated that if he hadn't conducted the ritual, that his son, wife, and daughter-in-law would have died.

Decomposition, Postmortem Mutilation, Ritual

G69 Sickle Cell Disease and Sudden Death

Michelle A. Jorden, MD*, Jennifer A. McReynolds, PhD, and Adrienne E. Segovia, MD, Cook County Medical Examiner, 2121 West Harrison Street, Chicago, IL 60612

The goal of this presentation is to educate and alert the forensic community to the common causes of death in sickle cell patients.

This presentation will impact the forensic community by demonstrating the importance of recognizing pulmonary complications at autopsy that are frequently seen in the sickle cell population and which are responsible for causing sudden death. Lastly, the possibility of sickle cell disease should be entertained in any young African-American person who dies suddenly and unexpectedly without a known history of sickle cell disease.

Sickle cell disease afflicts one of every 650 African Americans and an estimated 8% of African Americans are heterozygous for the sickle cell gene. Sickle cell anemia is attributed to profound morbidity as well as mortality to those afflicted with the disease. In the clinical setting, sickle cell anemia can present as recurrent infection especially in the younger population and as sickle cell pain crisis, stroke, and sudden death in the adult population. In 1949, the discovery that sickle hemoglobin exhibited an abnormal electrophoretic mobility has pioneered our current understanding that sickle cell disease is a molecular disease/diagnosis. With the advent of immunizations and vaccinations, antibiotic therapy and the implementation of newborn screening programs, the mortality rate of individuals with sickle cell disease has declined.

Although morbidity and mortality from sickle cell disease has declined in recent years, a subset of patients die from sudden and unexpected deaths. The most common causes of sudden death in individuals succumbing to sickle cell disease are acute and chronic pulmonary complications that encompass pulmonary edema, pulmonary thromboembolism/thrombosis, and pulmonary hypertension. Although the literature comments on the presence of pulmonary thromboembolism as a frequent autopsy finding, the literature is unclear as to whether these patients also exhibited deep venous thrombosis. Therefore, sickle cell patients may not share the same risk factors for development of pulmonary thromboembolism as the rest of the population (i.e., recent surgery, obesity, and immobilization). Instead, sickle cell patients may undergo pulmonary thrombosis as a consequence of in-situ sickling of red blood cells within blood vessels during hypoxic episodes. For forensic pathologists who perform autopsies on all cases of sudden death, the history of sickle cell disease may be absent or may never have been diagnosed, especially in athletic adolescents. Therefore, in those individuals who are of African American race, younger age, and presenting with pulmonary thromboembolism/thrombosis in the absence of known associated risk factors, the importance of a thorough autopsy examination including a detailed gross and microscopic examination of the heart and lungs, and dissection of the lower extremity veins, in conjunction with postmortem hemoglobin solubility/electrophoresis tests are underscored.

During the past year at the Cook County Medical Examiner's Office in Chicago, IL the authors have encountered two (2) cases of young African

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American individuals (one female at 31 years old and one male at 38 years old) who carried a diagnosis of sickle cell disease and who were found unresponsive with no known antecedent symptoms. After a complete autopsy, the cause of death in both cases was pulmonary thromboembolism/thrombosis in the absence of deep venous thrombosis. In both cases, the microscopic sections displayed acute and organizing pulmonary thrombi. In addition, both cases displayed severe pulmonary hypertensive changes characterized by thickened pulmonary arterioles and plexiform arteriopathy.

Given these findings, the decision was made to pull all cases of young African American individuals who died suddenly from pulmonary thromboembolism/thrombosis without a known history of sickle cell disease over a two year period. Three (3) additional cases were identified and consisted of two females and one male (ages 20-40s). Hemoglobin solubility tests were performed on the postmortem blood of these individuals. The hemoglobin solubility tests were negative in all three cases. Although the tests were negative, we eliminated the possibility of sickle cell disease as a contributory factor and upon further review of these cases, all these cases demonstrated deep venous thrombosis, and an identifiable risk factor was observed in one case.

Sickle cell disease is a common disease that afflicts the African American population. For forensic pathologists, the findings of pulmonary thrombosis in the absence of deep venous thrombosis and associated risk factors in the young African American population should alert the forensic pathologist to the possibility of sickle cell disease and further laboratory testing of postmortem blood for hemoglobin solubility.

Sickle Cell Disease, Sudden Death, Pulmonary Complications

G70 The Biochemical Alteration of Soil by Decomposition Products

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After attending this presentation, attendees will understand the importance of soil analysis in cases involving decomposed remains, and the correlation of soil composition changes with the decomposition period.

This presentation will impact the forensic community by serving as a potential tool for estimating the postmortem period and may have implications for both forensic and human rights investigations.

Decomposition chemistry refers to the chemical degradation processes which occur in soft tissue as decomposition proceeds. These processes involve the breakdown of the body's main constituents including proteins, carbohydrates and lipids. Lipids represent an important biomarker of decomposition as they are not easily degraded and can be retained in the soil environment for extended periods. Currently, there are few techniques which can provide an accurate estimation of the postmortem period. When a body decomposes in a soil environment the currently available techniques become even less accurate.

The aim of this study was to investigate the relationship between the release of decomposition fluids into a soil environment and their potential correlation with the decomposition period. The study was conducted in the southern region of Ontario, Canada during the summer months of July and August. Pig carcasses were used as acceptable models for human decomposition and were allowed to decompose on the surface of the soil until skeletonization occurred after approximately 100 days. Soil samples were collected from the region directly beneath the carcass at varying decomposition intervals. The total microbial biomass was determined by measuring the extractable lipid phosphate and the fatty acid content. Samples were analyzed by chromatography and spectroscopy techniques. The soils were characterized using particle size analysis and variations in total carbon, nitrogen, phosphorous, pH and moisture content were also investigated.

The study identified a significant increase in the amount of total nitrogen and soil extractable phosphorous released into the soil. However, the total available carbon did not increase significantly with time. Lipid-phosphate and fatty acid concentrations also increased with time confirming that there was a flux in the microbial biomass present in the soil. The pilot study was able to highlight the forensic potential of these techniques for estimating the postmortem period and promoted ongoing studies in this area. The results have the potential to be used in a forensic investigation involving remains which have decomposed for an extended period in a soil environment.

Decomposition, Soil, Postmortem Period

G71 A Cadaver Encased Within Concrete: A Case Report

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The goal of this presentation is to present an amazing case report on a cadaver encased within concrete.

This presentation will impact the forensic science community by showing the particularities of the crime scene and the autopsy of this deceased person.

Encasings within concrete are relatively rare forms of hiding or disposing of a body. At first, these cases are often treated as "matters involving a missing person". In this case report, the circumstances and findings are described in which a body was encased within concrete. It is of importance to note that the body may be preserved quite well in concrete, which allows not only the identification of the victim but also the determination of the cause of death, even after a prolonged postmortem interval.

A male cadaver aged 65 is discovered in reinforced concrete in a cellar. Circumstances of his death, circumstances of his burial, identification, autopsy findings, and the perpetrator's behavior are described. In March 2003, Mr P's brother goes to the Police Department and says he hasn't seen his brother for five years. The police investigations lead to his wife. She says her husband was very violent physically with herself and their son. Five years ago, during summer, her husband fell on the floor in their house. Because she was afraid of his reactions, she went away from the house, came back three weeks later and discovered her husband dead, still at the same place. She decided alone to remove the body. With the help of her son, she put her husband in her car, enveloped in several layers of tissues, and deposited him in a cellar of another house. She said she built a wall alone and placed the body under 70 centimeters of reinforced concrete.

Crime scene and autopsy findings are described. The body was found dressed like on the day of his death. His wife had put a plastic bag on his head and pins on his nose. She said it was to avoid a putrid flow. She wrapped the body into several blankets. The body was putrefied (three weeks of putrefaction) and conserved in the same state. Identification was easy, rapid, and completed odontologically. No traumatic lesions were discovered during the autopsy. Several hypotheses were proposed for the manner of the death: toxic, natural or asphyxia by plastic bag. Anthropological analysis is detailed to determine the origin of the lesions. On the body, in the blankets, *Calliphora vicinae* larvae and *Calliphora vomitoria* pupae were discovered. An entomologist expert tried to precisely determine the postmortem delay since it was crucial for the investigations to conclude the delay between the death and the encasing in the cellar. These findings are compared to police investigations. These findings are compared to literature on bodies disposed in reinforced concrete, on the behavior of this woman. The body conservation is detailed according to different methods of burial. Moreover, after denunciation, selenium intoxication was suspected. The investigation and findings on selenium are described.

This case is amazing, and has required a multidisciplinary approach to be elucidated. The authors underline, one more time, the importance of the description of the death scene associated with the autopsy findings to

understand and to conclude on the cause and the manner of death.

Anthropology, Concrete, Entomology

G72 A Degloving Experiment to Suggest Postmortem Interval: Give the Anthropologist Some Hands From Freshwater

Turhon A. Murad, PhD, California State University, Department of Anthropology, 400 West First Street, Chico, CA 95929-0400*

Following the presentation, the attendee will know the results of a unique experiment to determine the minimum length of time necessary for a pair of human hands to be degloved after being submerged in freshwater at 21°C.

This presentation will impact the forensic science community by using the degloving of human hands to suggest the postmortem interval.

A unique experiment was performed during spring 2007 in response to an unusual request from a defense attorney. In late March 2007 an attorney inquired if human hands could be "degloved" after being submerged in freshwater for a period of 36 hours at a water temperature of approximately 70°F. Of particular interest was the minimum length of time necessary for human hands to be "degloved" under the specified conditions. "Degloving," or the removal of the entire epidermal skin surface of human hands has been well documented as resulting from both: (1) some types of accident, and (2) natural phenomena occurring after hands have been submerged for an extended period.

In this particular instance specific aqueous parameters needed to be addressed, such as the type of water (freshwater over that of a marine environment), complete submergence of the hands, and a water temperature of approximately 21°C (70°F). Following a preliminary literature review it was determined that most information on degloving was anecdotal (Aggrawa 2005, Anderson and Hobischak 2004, Boyle, Galloway and Mason 1997, Kovarik, Stewart and Cockerell 2005, Rodriguez, 1997). Therefore, a unique experiment was proposed, and ultimately agreed upon.

Over the next few weeks the University of California Davis Donated Body Program (UCD-DBP) in central California was contacted. Specifically, arrangements were made to acquire two freshly harvested human forearms with the intent of soaking them in freshwater, and to the best degree possible, emulating the conditions of a canal described by the attorney and documented by the relevant county's Water Quality Control Board. It seems the canal, which is used for agricultural irrigation and thus well monitored, passes through a county in which a decedent had previously been recovered. At issue was the postmortem interval and thereby a possible alibi for the attorney's client. Water temperature and speed of water flow for the central California canal were recorded throughout the period relevant to the investigation.

Thus, to determine the length of time necessary for degloving to occur a controlled degloving experiment was initiated. By May 18, 2007 arrangements had been made to pick-up two forearms on that date from the UCD-DBP. A left (UCD-07-048-UL-FL) and a right (UCD-07-048-UL-FR) forearm was acquired from an 89 year-old female who had died from cardiopulmonary arrest shortly before becoming a part of the experiment. Both forearms had been removed from the decedent during the morning of their acquisition. They had been refrigerated until approximately 1400 hours when they were then transported to the CSU, Chico Human Identification Laboratory for the experiment. By 1800 hours on May 18, both the forearms had been prepared for being submerged in a stainless steel water bath maintained at a near constant water temperature of 21°C (70° F) for the next ten days. Preparation included: initial photographs of both the arms and hands, sealing the disarticulated proximal ends with rubber seals and additionally covered with waxed polyseal, preparing the stainless water bath with a thermometer, and filling the bath with un-chlorinated, room temperature, fresh water. The proximal ends of both arms were sealed to prevent water from entering beneath the skin from the disarticulated ends. Additionally, both

arms were submerged to slightly below the seals for the same reason.

The arms were then monitored every six (6) to twelve (12) hours for changes in color, odor, and general appearance, including the degree of skin-slippage. Additionally, the water temperature was carefully monitored on each occasion the forearms and hands were checked. The observational process was maintained throughout the first 42 hours of the experiment, after which the arms and hands were checked only twice a day, in the early morning and early evening (i.e., at 600 and 1800 hrs.).

During the entire experimental period the highest and lowest water bath temperature achieved was 24°C and 18°C, (75.2°F and 64.4°F, respectively) while the average water temperature was 20.5°C (68.9°F). Periodically water was removed from the bath and replaced with fresh, unchlorinated water of an appropriate temperature to more accurately reflect the conditions described by the Water Quality Control Board for the canal's condition. Thus, every day from three to four liters, or approximately three to four quarts, of water were removed and replaced.

Both hands acquired the classic "washer women's appearance" during the first six hours and continued to worsen over the first 36 hour period. By the end of the second day (i.e., 42 to 48 hours) deep wrinkles appeared and very minor skin-slippage began to appear. Photos were taken, and neither hand was capable of being "degloved" at the end of 36 hours, nor at the end of 48 hours. By day four both hands had begun to become discolored (dark pink), as gases and odor became apparent. During the fifth day (96-120 hrs.) marbling of black and blue colors was acquired, odor increased, and marked bloat of gases was found at the proximal ends beneath the rubber seals (i.e., the ends where the disarticulation had occurred). During day six (by 141 hrs.) both hands had become increasing marbled black and blue as skin-slippage also increased. During the seventh day (between 160 and 168 hrs.) an attempt to deglove the right hand failed but resulted in tearing the skin on the dorsal surface. The left hand had developed a large blister at the anterior wrist where putrid fluid had accumulated. Gases continued to be produced at the proximal ends of both arms but to a greater extent on the right than the left. Simply, the skin on the left hand was generally more firmly attached than that of the right. Photos were taken of the tear and the blister as well as the general deteriorating condition of both hands. On day eight (182 to 190 hrs.) the degree of skin-slippage increased on the dorsal and anterior surfaces but the skin of all the fingers remained moderately attached. There was a marked difference between slippage on the right versus the left hand, with the right hand proceeding more rapidly. During day nine (at 204 hrs. into the experiment) the right hand was "degloved," although the skin of some of the fingers and all the fingernails remained attached. The left hand was still not ready to be "degloved" on day ten. However, at 256 hours into the experiment, or after 10.5 days, the left hand was "degloved," although once again, the skin of some of the fingers and all the fingernails remained attached.

It was concluded that freshly acquired fleshed human hands submerged in freshwater at a temperature of 20.5°C could be "degloved" after a minimum period of nearly 200 hours. However, additionally, it was concluded that because the skin of the fingers as well as the nails never became completely detach during the experiment (as they had in the questioned case) it would very likely take much longer for such degloving to occur. Since all chemical and decomposition processes are temperature dependant the temperature of the water can be expected to play a critical role in the length of time necessary degloving to occur. Also of note, because the experimental hands were acquired from an 89-year-old decedent (i.e., one much older than the decedent prompting the experiment) a decedent's age or health status needs be considered in affecting the experimental result – the attachment and elasticity of connective tissue between the epidermis and dermas in younger versus older persons could be expected to play a role. If that were the case the length of time for degloving to occur in a young healthy male should be expected well after the 36 hour period in question.

Degloving, Postmortem Interval, Freshwater Death

G73 Parasitic Wasps: Succession, Development, and Forensic Importance as PMI Indicators

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After attending this presentation, attendees will understand the potential forensic value of parasitic wasps associated with decomposing remains in determining time since death. Aspects of parasitoid biology and behavior in regard to carcass attendance and insect development will also be discussed for use in the estimation of a postmortem interval (PMI).

This presentation will impact the forensic science community by. These results provide biological and developmental data for forensically relevant species of parasitic wasp for use in determining time since death in forensic investigations. Data gathered will improve the accuracy of PMI estimations in cases where decomposition has advanced beyond the life cycle of flies, the traditional indicators of time since death. Discussion of the relevance of the results presented here to forensic cases will establish the importance of parasitic wasps as forensic indicators of time since death and our findings provide reference data required for accurate PMI estimation.

Knowledge of the predictable pattern of insect succession onto a carcass and the relationship between temperature and larval development has proved invaluable in estimating PMI. To date forensic entomologists have focused on the use of synanthropic flies, particularly Calliphorids as forensic indicators of time since death. However, where time since death extends beyond the larval development time of these commonly used species, only a minimum PMI can be estimated. For instance, where only empty fly pupae cases are recovered from a crime scene the time lapse between the emergence of adult flies from the pupae cases and the discovery of the body is unknown. In such cases, the presence of parasitic wasp larvae within insect hosts such as fly pupae can be used to estimate an extended PMI.

The order Hymenoptera contains an extremely diverse range of insects, including numerous parasitic wasps or more accurately “parasitoids.” The term “parasitoid” encompasses those arthropod species whose larvae feed exclusively on the body of an arthropod host, eventually killing it. Parasitoids use a broad spectrum of hosts including necrophagous insects found in association with decomposing remains (Archer & Elgar, 2003).

Use of parasitoids as tools in criminal investigations requires; baseline data on the temperature-dependant development of both the host and parasitoid species; knowledge of the development stage at which the female wasp parasitizes the host; and an understanding of the factors involved in host location within a decomposition habitat. Currently, there is a paucity of relevant reference data and the research that is available is either geographically specific or is focused on parasitoid species used as biological control agents of filth flies rather than in a forensic context.

In this study, the species and biology of parasitic wasps associated with decomposing remains in Western Australia and their relevant host species were investigated. A monthly survey of relevant insect fauna frequenting decomposing remains was conducted. Domestic guinea pig carcasses (*Cavia porcellus*) were used as an attractant. The stage of decomposition at which the observed parasitoid species attended carcasses, species seasonality and rates of parasitization in the field were identified. Predominant species identified included *Tachinaephagus zealandicus* Ashmead (Hymenoptera, Encyrtidae) and *Nasonia vitripennis* Walker (Hymenoptera, Pteromalidae). Base-line reference data on the temperature-dependant development of both of these parasitoid species were also established under laboratory conditions.

These results provide biological and developmental data for forensically relevant species of parasitic wasp for use in determining time since death in forensic investigations. Data gathered will improve the accuracy of PMI estimations in cases where decomposition has advanced beyond the life cycle of flies, the traditional indicators of time since death. Discussion of the relevance of the results presented here to forensic cases will establish the importance of parasitic wasps as forensic indicators of time since death and our findings provide reference data required for accurate PMI estimation.

Entomology, Parasitic Wasp, Postmortem Interval

G74 Difficulties in Determining Sex From the Skull: Considering Conflicting Lines of Evidence

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The goal of this presentation is to demonstrate that forensic scientists should understand and employ all available scientific techniques when analyzing human remains, as well as to emphasize that individuals performing forensic osteological analysis must possess a firm understanding both of modern human variation and of the theoretical subtleties of the methods employed to study such variation.

This presentation will impact the forensic community by emphasizing the importance of: (1) a firm foundation in patterns of modern human biological variation, (2) an equally firm understanding of the theoretical and practical strengths and limitations of the methods employed in sex determination, (3) an education in statistics in order to realize that misclassification is not random and can usually be traced to some morphological idiosyncrasy of the remains in question, and (4) a demonstration of the value of using all available scientific methods to determine biological sex from the human skeleton.

A common misconception held by non-anthropologists is that the determination of biological sex from human skeletal remains is relatively easy and/or straightforward because there is a 50% chance of just “guessing” the correct sex assignment. While it is true that forensic anthropologists are extremely accurate at sex determination, they are also aware of the potential sources of error within their assessments, as well as the potential error associated with the external interpretation of their analyses.

Determining sex from gross skeletal morphology can be accomplished via both non-metric and metric techniques. Non-metric techniques examine sexually-dimorphic patterns of discrete skeletal trait expression to distinguish between males and females. Metric techniques rely on the quantification of size and shape differences between males and females, as measured from several diagnostic skeletal elements. The determination of sex using metric methods is most frequently accomplished via the discriminant functions calculated by the FORDISC software (Ousley and Jantz, 1996). Both non-metric and metric approaches to sex determination rely heavily on the os coxa and cranium, which are the two most reliably-diagnostic skeletal elements. Though the os coxa is the preferred element for sex assessment, unfortunately this element is not always present in the remains available to forensic anthropologists for analysis. Indeed, many forensic anthropology cases consist solely of isolated skulls or crania. Not surprisingly, accurate sex determination becomes increasingly difficult in instances of heavily fragmented or largely incomplete skeletons.

Regardless of the techniques or skeletal elements used in the analysis, the forensic anthropologist’s ability to accurately assess the sex of unidentified skeletal remains may be stymied by individuals who are atypically skeletally robust or gracile, or by individuals who originate from populations which are outside the forensic anthropologist’s sphere of experience. The possibility of encountering such individuals therefore places several critical demands on the forensic anthropologist, including: 1) a firm foundation in patterns of modern human biological variation, and 2) an equally firm understanding of the theoretical and practical strengths and limitations of the methods employed in sex determination. Additionally, the forensic anthropologist should be well educated in statistics in order to realize that misclassification is not random, and can usually be traced to some morphological idiosyncrasy of the remains in question. Collectively, these considerations caution against the hasty interpretation of the results of anthropological analyses, as they may not always be as clear-cut as a cursory examination of the conclusions may suggest.

This presentation will impact the forensic community by demonstra-

ting the value of using all available scientific methods to determine biological sex from the human skeleton. Two cases will be presented in which the only skeletal element available for analysis was the skull. In the first example the non-metric analysis was suggestive of a female and was supported by FORDISC's sex-only function; however, when ancestry was considered, the specimen was classified as a male. In the second example, both the metric and non-metric analyses suggested female. However, the individual's ancestry was questionable and the skull may have represented a male from a population of small, gracile individuals. The atypicality of both specimens alerted the forensic anthropologist to possible interpretational issues which warranted further investigation. In order to supplement the osteological analysis, samples from each individual were sent for genetic sex determination. While it is understood that there are also errors associated with genetic sex determination, this reemphasizes the forensic anthropologist's need to understand modern human variation and the available scientific methods to study variation. Each case will be discussed with an emphasis on sex determination by both osteological and genetic means, as well as a critical assessment of the interpretational error associated with each.

Sex Determination, FORDISC, DNA

G75 Molecular Genetic Testing in 323 Cases of Fatal Pulmonary Thromboembolism in the City of New York Revealed Racial Stratification

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The goal of this presentation is to investigate the frequency of these genetic risk factors in fatal PE and to understand the genotype and phenotype correlation.

This presentation will impact the forensic science community by presenting detailed characterization of the mutation spectrum in fatal PE is vital for providing accurate diagnosis of cause of death and efficient preventative treatment to the high-risk family members.

Fatal pulmonary thromboembolism (PE) is a common cause of death encountered in the forensic pathology setting and usually presents as a complication of deep venous thrombosis (DVT). The pathogenesis of venous thrombosis is multifactorial and requires interaction between both inherited and acquired risk factors. Heterozygous or homozygous Factor V Leiden (G1691A) or prothrombin (G20210A) mutations, and homozygous MTHFR (C677T) variant have been recognized as common independent genetic risk factors in DVT. In order to investigate the frequency of these genetic risk factors in fatal PE and to understand the genotype and phenotype correlation, we have validated a genetic testing method to detect the three common mutations.

Testing was conducted using multiplex PCR-SNaPshot technologies on postmortem tissue and blood samples. Between March 2005 and May 2007, we tested 323 fatal PE cases from the New York City Office of Chief Medical Examiner. The authors found that 48 of the 323 cases were positive for at least one mutation. The genetic testing results were categorized by the demographic data and acquired contributing factors. The overall frequency of three mutations in PE cases was found highest in Whites (34.15 %), followed by Hispanics (28%), very low in Blacks (3%), and zero in Asians. In contrast, the number of fatal PE instances in our study is highest in Blacks (54.8%), followed by Whites (25.4%), and Hispanics (15.5%), and very rare in Asians (1.5%). Blacks were also associated with a high percentage of idiopathic PE with unknown acquired contributing factors. This study suggests that there are racial disparities in genetic risks contributing to fatal PE. In addition, comparing the incidences of PE in different races to the racial composition in New York City residents (44.7% Whites, 26.6% Blacks, and

9.8% of Asians), Blacks showed the highest incidences of fatal PE. Further research focused on delineating the genetic risks in black populations is warranted. Detailed characterization of the mutation spectrum in fatal PE is vital for providing accurate diagnosis of cause of death and efficient preventative treatment to the high-risk family members.

Molecular Genetic Testing, Fatal Pulmonary Thromboembolism, Racial Stratification

G76 The Pathologist's Role in Preserving Implanted Pacemakers and Cardiac Defibrillators or How Not to Get Shocked!

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After attending this presentation, attendees will understand the standardization of techniques for safe and effective explantation of implanted electric cardiac devices such as pacemakers, defibrillators, and leadwire systems.

This presentation will impact the forensic science community by demonstrating how careful adherence to recommended procedures by medical examiners will minimize damage to retrieved implanted cardiac devices (pacemaker, ICD, CRT-D and leads), and will facilitate postmortem device analysis and cause of death determination. In addition, appropriate pre-extraction planning of methods for removing implanted defibrillator leads will reduce risk of electrical shock for personnel.

Permanent implantable electrical cardiac devices such as Pacemakers, Implanted Cardiac Defibrillators (ICDs), and Cardiac Resynchronization Therapy-Defibrillators (CRT-D) are common therapies. On occasion, the function or malfunction of such devices has been suspected in patient deaths, especially in view of recent large recalls. It is possible to determine what role, if any, an implanted cardiac device could have played in a patient's death from postmortem examination of a retrieved device, interrogation of stored memory, and additional testing even several years after death. It is very important that implanted electrical devices and associated leads be considered for retrieval as a system. The goals for removal of pacemakers/ICDs/CRT-Ds are: (1) keep as much of the total system together and intact as possible, (2) identify the components for the device and how it was implanted before retrieval, (3) document throughout the retrieval process, and (4) keep explanting personnel safe.

Before attempting removal of any implanted electrical device system, it is advisable to familiarize yourself with how it is implanted, and possible risks. Whenever possible, review any x-ray or imaging that shows the device and lead(s). Pacemakers, ICDs and CRT-Ds are surgically implanted in a similar manner, in a prominent palpable subcutaneous pocket located usually on the left chest or abdomen. Electrical leadwires (leads) are attached to a pacemaker, ICD, CRT-D by screws in a "header." Leads are usually tunneled together upwards through the left chest and into the medial left subclavian vein and then to the appropriate areas of the atrium and ventricles.

The lead carries electric current to the electrode attached to the patient's heart and carries sensed electrical information to the pacemaker/ICD/CRT-D. These signals are processed by an on-board computer and software for interpretation and delivered therapy. The treating physician has prescribed desired device performance by programming the device. An electrical lead is made of an outer layer of plastic insulation, an often intricate inner metal wire core for carrying current, a terminal electrode attached to the heart's surface, and an attachment to the device's header. Lead failures are known to account for approximately 50% or more of implanted electrical system failures. Therefore, it is vital that we attempt to optimize lead retrieval during postmortem examinations. Also of note, additional unattached leads may be found because when leads are replaced in patients often times original leads are simply abandoned—and often it is the abandoned leads that are of interest. Therefore, whenever possible both the pacemaker/ICD/CRT-D

and the attached lead should be extracted as a single device system, along with careful extraction of any abandoned leads.

The pacemaker/ICD/CRT-D subcutaneous pouch should be documented by sketches or photographs looking for pre-mortem burns or charring of the walls, type and amount of fluid present, or evidence of fluid ingress into the plastic header or metal pacemaker/ICD/CRT-D case. All findings and clinical impressions about explanted lead(s) and attachment to pacemaker/ICD/CRT-D header should be documented for the record and photographed.

ICDs and CRT-Ds are about the same size as pacemakers and are implanted in a similar manner, but because defibrillators use high energy, they represent a significant safety issue. ICD/CRT-D leads have a special terminal electrode attachment for defibrillation. For retrieval of ICD or CRT-Ds which remain switched on, personnel must be aware to avoid inadvertent contact with the lead's terminal defibrillation electrode. The ICD/CRT-D terminal electrodes resemble springs or coils and are attached to the end of the lead attached to the heart, and must be assumed to be "hot" even after a patient's death. Retrieval procedures can induce electrical signals in to the ICD/CRT-D that, while artifact, may set the device up to deliver a shock. If an ICD/CRT-D is known to be implanted in a patient, prior to starting an autopsy or retrieval, identification of the make and model of the device and consultation with a cardiologist can help ensure the unit is switched to "off" to reduce the risk of shock. A patient's chart can also be examined to determine if the unit was switched to "off" prior to death. However, it is always best to handle a retrieved terminal electrode from a defibrillator as if it is still "hot" and capable of delivering an electrical shock.

Brief background information on pacemakers and ICDs with appropriate references will be presented, along with a detailed suggested extraction protocol.

Implantable Cardioverter Defibrillator, Cardiac Resynchronization Therapy Defibrillator, Pacemaker

G77 Postmortem Angiography in Support of Radiologic Assisted Autopsy

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Upon completion of this presentation, participants will be able to recognize the usefulness of digital radiography and computed tomography in the assessment of vascular injury. Postmortem studies may be performed with antegrade or retrograde injection of contrast medium into the vessels under investigation, in conjunction with the standard forensic autopsy.

This presentation will impact the forensic science community by demonstrating the value of Radiologic Assisted Autopsy.

Radiologic Assisted Autopsy (RAA) performed with digital radiographs (DR) and multidetector computed tomography (MDCT) is limited in its ability to assess vascular integrity. Postmortem angiography has been proposed as a technique to overcome this limitation, a variety of contrast agents and techniques are being evaluated. This report outlines a method for performing postmortem peripheral vascular assessment in conjunction with the standard forensic autopsy.

During autopsy the vessel of interest was isolated at its source or a convenient location distal to the area of interest. Lower extremity arteries were cannulated with embalming trocars where they exited the open abdominal cavity. Vertebral arteries were isolated in the posterior fossa after brain removal and cannulated with a 5F angiocatheter. Hand injection of contrast was performed during MDCT imaging of the area of interest. Satisfactory visualization of peripheral arteries was achieved with a mixture of embalming fluid and radiographic contrast [Omnipaque 320]; undiluted contrast was injected retrograde into the vertebral arteries. Arteries can be injected postmortem in either antegrade or retrograde direction.

Successful demonstration of a lacerated femoral artery (2 cases), lacerated iliac artery and vein (1 case), intact vertebral artery (2 cases) and a lacerated vertebral artery (1 case) were accomplished. When performed in conjunction with RAA postmortem angiography has the potential to: (1) allow the investigator to avoid unwanted dissections, and (2) optimization of autopsy resources.

Angiography, Radiologic Assisted Autopsy, MDCT Virtual Autopsy

G78 CSI Halifax in Miami: The Importance of Practical Courses in the Forensic Sciences

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Upon completion of this workshop, participants will gain insight into the importance of providing practical experiential learning opportunities for students in the forensic sciences and gain a better understanding of the collaborative effort involved with forensic investigations.

This presentation will impact the forensic science community by illustrating the need to develop hands-on courses as students, who want to pursue careers in forensic science, need to understand the realities of the training required and the job tasks as well as illustrating the desire for students to experience practical hands-on courses in the forensic sciences and therefore the importance for educators and practitioners to create such courses. In addition, this presentation will illustrate the importance and need for international collaboration in the forensic sciences – students were unable to gain this experience in Nova Scotia but were able to experience it in Miami-Dade County.

Student interest in forensic science has grown tremendously over the past few years; however, a practical approach to the topic is very rare. Within North America and Europe, forensic cases are highly guarded and treated as 'top secret' by police departments and coroner's offices; only a select few individuals receive security clearance to examine and analyse human remains, therefore making it almost impossible for a novice to gain this very necessary 'realistic' forensic experience.

However, in May 2007, a unique and groundbreaking practical hands-on internship was created by the collaboration of Saint Mary's University and the Miami-Dade County Medical Examiner's Office. During this course, students gained a rare and comprehensive knowledge of applied forensics; they were exposed to the multidisciplinary nature of forensic investigation and mentored by experts in the field of forensic science.

Education, Experiential Learning, International Collaboration

G79 Can Renal Acute Tubular Necrosis Be Differentiated From Autolysis at Autopsy?

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After attending this presentation, attendees will have an understanding of the morphological characteristics used to define acute tubular necrosis (ATN) and how certain characteristics may be used to differentiate between ischemic ATN and autolysis in postmortem samples.

This presentation will impact on the forensic community by providing morphological characteristics to be used in the microscopic examination of postmortem renal tissue to determine and/or confirm analyses of ATN as contributing to cause of death. The use of diagnostic criteria will augment the identification of ischemic ATN as distinct from the process of autolysis.

Acute tubular necrosis is the most common cause of acute renal failure and accounts for 50% of all cases of acute renal failure in hospitalised patients and greater than 75% of critical care/intensive care unit cases. Acute renal

failure affects about 5% of hospitalized patients and has a high mortality rate of 50%. It is a commonly held view amongst autopsy pathologists that it is generally not possible to diagnose ATN at autopsy because of the presence of autolysis, and that the only way the condition can be diagnosed is by identifying mitotic figures in the tubular epithelium. This belief may lead to the under-reporting of the condition as a finding upon microscopic analysis of renal tissue.

The Department of Forensic Medicine, Glebe, Sydney autopsy database was queried for cases where an antemortem diagnosis of ATN was made. Antemortem hospital medical charts for each case were searched for a diagnosis of ATN based on clinical and biochemical parameters. A total of 57 cases over a 5 year period were found. These cases were compared to a similar number of age and sex matched controls, who died suddenly as a result of self-inflicted hanging but were otherwise healthy.

A total of 114 deidentified and randomized kidney sections were examined. Serial tissue sections from each case were stained with H&E, Martius Scarlet Blue (MSB), Masson's Trichrome and anti-human Ki-67 immunoperoxidase. Morphological characteristics compared were proliferating epithelial cells (as visualized by Ki-67 positivity); fibrin thrombi in glomeruli; tubular epithelial whorls; mitoses in tubular epithelium; presence of tubular casts; degree of autolysis; tubulorrhexis; tubular epithelial flattening; interstitial inflammation, and interstitial edema.

All results were expressed as mean \pm standard deviation. Differences between groups were determined by two sample t-test. A *p* value < 0.05 was considered to be statistically significant.

Statistically significant differences were between the cases exhibiting ATN and the controls in the following morphological characteristics: number of tubular epithelial whorls, proliferating cells, tubulorrhexis, and interstitial edema. The mean number of tubular epithelial whorls in ATN cases was 1.93 ± 5.15 ; no whorls were found in any control cases (*p* < 0.001). The mean number of proliferating cells in ATN cases was 19.5 ± 29 and in control cases was 5 ± 9.2 (*p* = 0.0001). The mean number of tubules exhibiting tubulorrhexis in ATN cases was 0.0309 ± 0.0826 and in control cases was 0.007 ± 0.0258 (*p* = 0.041). The mean degree of interstitial edema (as determined by proportion of fields exhibiting the condition) in ATN cases was 0.533 ± 0.412 and in control cases was 0.195 ± 0.312 (*p* < 0.001).

The remaining morphological characteristics (fibrin thrombi, tubular casts, degree of autolysis, mitotic figures, tubular epithelial flattening and interstitial inflammation) were analysed and showed no statistically significant differences between the two groups.

Acute tubular necrosis can be reliably differentiated from autolysis at autopsy. The presence of characteristic tubular epithelial whorls is highly diagnostic of ATN. When taken together with tubulorrhexis, interstitial edema and epithelial proliferation, a diagnosis of ATN can be reliably made at autopsy.

Autopsy, Acute Tubular Necrosis, Renal Pathology

G80 The Effects of a New Level 1 Trauma Center on the Local Medical Examiner Office

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The goal of this presentation is to describe the changes in the medical examiner non-natural case load in relation to the establishment of a level 1 trauma center.

This presentation will impact the forensic community and humanity by providing insight into the effects of a level 1 trauma center on regional medical examiner, which in turn affects law enforcement, families, funeral homes and regional funding.

The goal of this study is to look at the change, if any, to the medical examiner case load and distribution following the opening of a new level 1 trauma center. Factors evaluated included the increase or decrease in the total number of medical examiner cases per year, the medical examiner districts from which these cases are originating and what types of cases the trauma center is bringing into the district.

On October 1, 2004, the University of Florida & Shands Hospital in Gainesville, Florida became a Level 1 Trauma Center. For a patient to be given trauma alert status, they must meet very specific criteria, such as two or more long bone fractures, ventilation beyond passive oxygen administration, or 15% or more of body involved in second or third degree burns.

This new trauma center covers nine whole counties and seven partial counties. The counties with partial coverage are relatively equidistant between two level 1 trauma centers, such that patients in these counties may go to one of two trauma centers for treatment. Of these sixteen counties covered by the new trauma center, only seven are within the District 8 Medical Examiner's jurisdiction. Even though the injury(s) may have occurred outside the jurisdiction of District 8 Medical Examiner Office, when a trauma patient dies at the trauma center, the time and place of death is in Alachua County. Because medical examiner jurisdiction in Florida is defined by place of death, not place of injury, such cases fall under the auspices of the District 8 Medical Examiner Office.

The District 8 Medical Examiner Office case files were retrospectively reviewed from January 1, 2002 to June 30, 2007. Only non-natural deaths were included in the study population as natural deaths would not be affected by the presence or absence of a level 1 trauma center. The trauma center began operating at level 1 status October 1, 2004, and this is the date used to demarcate "before" and "after" data sets. During this time, 3156 total cases were investigated by the MEO and 2388 were autopsied. The annual case load has been steadily increasing, with the largest increase in 2005 (a 10% increase in total cases and a 22% increase in autopsies). Since October 1, 2004, 312 cases have been investigated that came through the trauma center as a trauma alert, with 275 investigated by the District 8 MEO. Roughly 58% of the deaths coming through the trauma center were a result of motor vehicle crashes, by far the largest mechanism, followed by falls of all types (20%). Only 33% of the trauma center deaths had their corresponding injuries within the District 8 medical examiner jurisdiction. Before the trauma center opened, approximately 15% of all non-natural investigations were outside of the District 8 MEO, whereas afterwards, 26% were outside the jurisdiction.

This study has found that a much larger percent of the District 8 Medical Examiners case load is now coming from outside of the current jurisdiction since the opening of the trauma center, which is associated with an increase in the over all number of cases each year and an increase in the complexity of the cases. Patients from the trauma center tend to have more complex injuries resulting in longer autopsies and more time spent determining causes of death. Additionally, a large percentage of the trauma cases are coming from surrounding districts, cases that originally would have gone to that outside district or a different one with a level 1 trauma center, such that trauma deaths are being redistributed throughout the region. The larger implication being that the opening of a Level 1 Trauma Center not only affects the medical examiner district in which it resides, but also the surrounding medical examiner offices by reducing their case load.

Medical Examiner, Trauma, Non-Natural Death

G81 Mapping the Literature in Forensic Pathology and Legal Medicine: A Bibliometric Study of North-American Journals From 1980 to 2005

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The goal of this presentation is to describe the evolution of the literature in forensic pathology and legal medicine for North-American journals over more than twenty-five years. More precisely, it will draw a picture of our literature and describe developments and trends regarding numbers of author(s) per article, represented countries and international collaborations, types of articles and use of the scientific method.

This presentation will impact the forensic community by providing new insight in the forensic pathology literature. A better knowledge of this body of literature could help us assess our strengths and weaknesses, and better position ourselves on literature ethical issues.

Bibliometric studies have increasingly been used over the last years. Those studies are useful to understand the evolution of literature or trends in particular fields or within a geographical area. However, in forensic sciences, bibliometry has barely been used yet and the few studies that have been performed mainly focused on most highly cited articles, most prolific authors and impact factors. Thus, the present study specifically aims at mapping the literature in the field of forensic pathology and legal medicine.

The two North-American leading journals in forensic sciences were selected: the Journal of Forensic Sciences and the American Journal of Forensic Medicine and Pathology. All articles in the field of forensic pathology and legal medicine published in those journals in 1980, 1985, 1990, 1995, 2000, and 2005 were retrospectively analysed, excluding editorials, guest editorials, tributes, and book reviews. For each article, the following features were compiled: number of author(s), author's country and international collaboration and type of article. Furthermore, it was assessed if the article was using or not the scientific method, with testing of hypotheses by statistical analysis. A total of 522 articles were examined from 1980 to 2005 at a 5-year interval: 215 articles from the Journal of Forensic Sciences and 307 articles from the American Journal of Forensic Medicine and Pathology. The SPSS 15.0 software was used to perform statistical analyses at a threshold of significance of 5%. Mean values were compared using analysis of variance, while proportions were compared through Chi-square tests.

Overall, the number of articles per year has passed from 55 articles in 1980 to 89 in 2005. Meanwhile, the average number of author(s) per article has significantly increased ($p=0.000$, $p<0.05$), passing from 1.8 to 3.5. The relative contribution of other countries in comparison to the United States has significantly increased from 9.3% to 57.3% ($p=0.000$, $p<0.05$). Articles from international collaboration were absent in 1980, passing to 5.62% of articles in 2005. As for the types of articles, the review article was the only type of article significantly decreasing ($p<0.05$). No significant differences was revealed for the remaining types of articles, although letters to the editor showed a tendency to decrease ($p=0.069$), while original studies showed a tendency to increase ($p=0.088$). Finally, the number of studies using the scientific method did not significantly progressed from 1980 to 2005 ($p=0.416$, $p>0.05$), passing from 10.9% to 15.7%.

The literature in forensic pathology and legal medicine in North-American journals has expanded in number of articles per year from 1980 to 2005. However, the relative proportion of pathology and legal medicine in the forensic literature as a whole has stayed about the same. The significant increase in the average number of author(s) per article follows a similar trend in the forensic literature. Finally, it is surprising to see that while the use of the scientific method has significantly progressed in the forensic literature over the last twenty-five years, pathology and legal medicine literature has stayed behind on this aspect. This observation is a warning sign that researchers and authors in our field should notice.

G82 Purtscher Retinopathy Detected by Postmortem Monocular Indirect Ophthalmoscopy

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The goals of this presentation are to: (1) describe the retinal features of the Purtscher retinopathy, (2) list conditions and disorders associated with Purtscher retinopathy, and (3) describe the histological features of Purtscher-flecken.

After attending this presentation, attendees will gain insight into the value of postmortem monocular indirect ophthalmoscopy (PMIO) in detecting Purtscher retinopathy and subsequent histopathological description of the observed retinal lesions. This presentation will impact the forensic community by providing an introduction to non-hemorrhagic retinopathies detectable by PMIO and consequent histopathological characterization.

In 1910, Dr. Otmar Purtscher described a patient with severe head trauma who had a hemorrhagic and vaso-occlusive retinopathy characterized by multiple variably sized cotton-wool spots (Purtscher-flecken) plus retinal hemorrhages around the optic nerve head. Two years later he designated the condition angiopathia retinae traumatica. Since then the term Purtscher retinopathy has been used to describe a clinical picture of angiopathia retinae traumatica even in the absence of known head trauma. Purtscher-like retinopathy has been observed in a variety of conditions including compressive chest injuries, long bone fractures, retrobulbar anesthesia, connective tissue and vasculitic diseases, orthopedic surgery, acute pancreatitis, strenuous childbirth, and battered child syndrome. The exact pathophysiological mechanism causing Purtscher or Purtscher-like retinopathy remains controversial and published supportive histological descriptions are rare. Two cases are described of Purtscher retinopathy detected by postmortem monocular indirect ophthalmoscopy plus the histological features and immunohistochemical staining for β -amyloid precursor protein of observed Purtscher-flecken.

Case 1: A 36-year-old man sustained a traumatic brain injury with immediate loss of consciousness following an assault in a parking lot. Cranial computed tomography revealed subdural and subarachnoid hemorrhages. He remained comatose and died thirteen days after the injury. Neuropathological examination revealed traumatic axonal injury, a cerebral contre-coup contusion plus organizing subdural and subarachnoid hemorrhages. Prior to autopsy PMIO identified retinal hemorrhages and multiple posterior, peri-papillary, polygonal foci of retinal whitening (Purtscher-flecken) distributed between retinal arterioles and veins. Histologically, these areas were collections of swollen, contracted axons (cytoid bodies) in the nerve fiber layer highlighted by immunohistochemical staining for β -amyloid precursor protein.

Case 2: A 27-year-old man had experienced nausea and vomiting for a number of days. While at his girlfriend's residence he collapsed following an episode of vomiting. Resuscitative efforts were unsuccessful and he was pronounced dead in the emergency department. Hepatosplenomegaly was present at autopsy and his hypercellular bone marrow contained > 20% myeloid blasts with Auer rods. The leukemic cells stained positively for CD68 and myeloperoxidase. Prior to autopsy PMIO revealed multiple bilateral retinal hemorrhages, many white-centered, plus posterior foci of small Purtscher-flecken. Histologically, these foci were cytoid bodies in the nerve fiber layer that stained positively for β -amyloid precursor protein.

No published reports of Purtscher retinopathy detected initially at autopsy are in the medical and scientific literature. Previous articles on the histopathology of Purtscher retinopathy have been two case reports from patients with acute pancreatitis who died 6 and 23 days after the onset of their illness. Both had focal areas of retinal edema and loss of architecture

in the inner retinal layers with abrupt transition to normal retina. In the author's reported cases the detected Purtscher-flecken were cytid bodies that stained positively for β -amyloid precursor protein. These inner retinal collections of swollen, contracted axons are relatively nonspecific and histopathologically similar to retinal cotton-wool spots and foci of axonal injury observed throughout the nervous system commonly associated with a variety of traumatic and non-traumatic conditions.

Purtscher Retinopathy, Traumatic Brain Injury, β -Amyloid Precursor Protein

G83 Sudden Death Due to a Cardiac Sarcoidosis: Histopathological Helping Evidences

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The goal of this presentation is to present an uncommon case of sudden cardiac death in a 34-year-old. A complete methodological forensic approach by means of autopsy, histological, and immunohistochemical examinations led us to conclusion of a systemic sarcoidosis with massive cardiac involvement.

This presentation will impact the forensic science community by demonstrating how the rarity of cardiac sarcoidosis makes the case peculiar; in addition to clinical and lab tests, a complete forensic methodological approach by means of autopsy, histopathological examination and immunohistochemical stain led us to confirm the diagnosis of cardiac sarcoidosis as the cause of death.

Sarcoidosis is a multisystem disorder of unknown aetiology, characterized by noncaseating epithelioid cell granulomas. The aetiology and pathogenesis are unclear, although many infectious, environmental and genetic factors have been implicated. Prognosis and clinical manifestations are dependent on the location and extend of granulomatous infiltrates. The cardiac involvement is uncommon (at autopsy, cardiac involvement has been reported in 20-30% of patients with sarcoidosis, although most studies indicate that <5% of patients with sarcoidosis have symptoms related to cardiac involvement) and has a wide range of clinical manifestations (conduction disorder, ventricular arrhythmias, atrial arrhythmias, pericarditis, valvular dysfunction, congestive heart failure). It is unusual for sarcoidosis to present with isolated cardiac involvement. In autopsy study, cardiac involvement proved to be the cause of death in 37% of the patients with sarcoidosis. Cardiac involvement associated with poorer prognosis and the mortality rate may exceed 40% at 5 years and 55% within 10 years. The presence of pulmonary involvement was associated with better survival. Sudden death due ventricular tachyarrhythmia or conduction block accounts for 25 to 65% of the deaths due to cardiac sarcoidosis.

A 34-year-old woman was found lifeless at home from by her parents. Death scene investigation was unremarkable. The extended family hadn't a history of sudden death. In her history a visit to the Emergency Room three months before death was recorded. She complained chest pain, non-sustained ventricular tachycardia and loss of consciousness. Body temperature was normal. Subsequent cardiological evaluation with ECG showed sinus rhythm with ventricular premature beat and intraventricular conduction abnormalities. Echocardiography showed normal chamber dimensions, no wall motion abnormalities. The research for viruses was negative. The laboratory findings were normal. During hospitalization she presented some episodes of supraventricular paroxysmal tachycardia (160 bpm) and non-sustained ventricular tachycardia. No other symptoms or apparatus failure were present. Family history was reportedly negative for cardiac disease. An anti-arrhythmic treatment was prescribed.

A complete postmortem examination was performed two days after death. External examination was unremarkable. The internal examination revealed only a polivisceral congestion and pulmonary edema. All internal organs were macroscopically normal. The heart had a normal shape and was

normal in size and weight. The left and right coronary arteries arose normally. No significant stenosis or thrombotic occlusion of the coronary segment were detected. The atrio-ventricular and semilunar valves were normal. The myocardium showed an extensive fibrotic scarring, particularly in the supero-anterior wall of the LV and the posteroseptal wall. The histological examination of the heart, performed with routine haematoxylin-eosin revealed diffuse and extensive fibrosis with non-caseating granulomas composed mainly of an aggregate of epithelioid cells and multinucleated giant cells in the centre surrounded by lymphocytes, plasmacells and mastcells. The lungs and kidneys also showed the same non-caseating granulomas. An immunohistochemical examination of heart samples was performed to confirm diagnosis. Mycobacterium tuberculosis and fungal infections were excluded on special stains. The remainder of the histological examination was unremarkable. The diagnosis of sarcoidosis with massive and extensive cardiac involvement was established as cause of death.

Cardiac Sarcoidosis, Sudden Death, Ventricular Arrhythmias

G84 A Diagnosis of Chagas Disease at Autopsy

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The goal of this presentation is to become familiar with Chagas disease and to consider it as a diagnosis in the setting of chronic myocarditis and sudden death.

The forensic community will be presented with an interesting case of chronic myocarditis related to Chagas disease, raising awareness of the presence of this disease in the United States, and its relation to sudden death.

Chagas disease is caused by the parasite *Trypanosoma cruzi*, which is a blood-dwelling and tissue-dwelling protozoan. The disease occurs in the Americas, primarily in Central and South America. It is transmitted to humans through the bite of the reduviid bug. The disease is commonly seen in children younger than five years who develop a skin lesion known as a chagoma at the site of infection where the organisms proliferate in the skin. The trypomastigotes (flagellate forms) may then spread via hematogenous or lymphatic routes and cause an acute illness characterized by lymphadenopathy, fever, anorexia, and fatigue. After the acute phase, recovery may occur, or the disease may progress into a chronic phase, which is usually seen in adults and older children. Chronic carriers of *Trypanosoma cruzi* may develop chronic myocarditis and a cardiomyopathy or dilatation of the digestive tract, characterized by dysphagia and megacolon.

Chagas disease is diagnosed at autopsy in a 66-year-old Hispanic male originally from El Salvador who died in Houston while at work in the construction of a residential apartment complex. He was found dead by his employer who had arrived at the job site to supervise him. He was found on the floor inside of an apartment that was being renovated, and it appeared he had collapsed as he was preparing to perform some caulking. Per his family, he had no known medical or social history but had been complaining of dizziness and palpitations over the past two weeks. At autopsy, he had an enlarged, 515-gram heart with left ventricular hypertrophy and focal thinning of the left ventricular wall toward the apex. A 1.5-centimeter mural thrombus was in the apex of the left ventricle, and the surrounding myocardium had diffuse scarring. Extensive myocardial fibrosis extended into the lateral and posterior left ventricle towards the base of the heart. The coronary arteries showed mild atherosclerosis with 10% to 20% stenosis in the left anterior descending and right coronary arteries. He also had remote embolic infarcts in the kidneys and brain with 9-centimeter and 3-centimeter cortical scars in the kidneys and a 2-centimeter area of cortical encephalomalacia in the left occipital lobe. Microscopically, sections of the heart showed chronic interstitial inflammation with lymphocytes and eosinophils associated with patches of myocardial fibrosis. Toxicology was negative for drugs and alcohol. Chagas disease was considered in the differential diagnosis of chronic myo-

carditis in an adult male from Central America; therefore, serologic testing was requested through the Centers for Disease Control. An indirect fluorescent assay showed an IgG antibody titer of 1:512, which was positive for Chagas disease.

There are many different causes of myocarditis including infections, immune reactions, drug hypersensitivity, poststreptococcal, giant cell myocarditis, and sarcoidosis. Common infectious causes are typically viral such as coxsackieviruses, echoviruses, influenza, and adenovirus. Additionally, other protozoa such as toxoplasma and helminths can also affect the heart and cause myocarditis. Although typically prevalent in South and Central America, Chagas disease should be considered in individuals in the United States who present with cardiac arrhythmias, congestive heart failure, and sudden death, especially in Texas, California, and throughout the South given the large immigrant population in these states. *Trypanosoma cruzi* can also be transmitted through blood transfusions, organ transplantation, transplacentally, and through breast milk. In 2006, the FDA approved a screening test for Chagas disease in the blood donation population, which is currently being used for screening the donated blood in the Gulf Coast region of Texas.

Chagas Disease, Chronic Myocarditis, Autopsy

G85 Dysplasia of the Atrioventricular Nodal Artery: A Case Report and Review of the Literature

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After reviewing this presentation, attendees will understand the pathophysiology and epidemiology of conduction system arterial dysplasia, a rarely reported condition. Autopsy findings and the correlation between histopathologic abnormalities and sudden death will be emphasized via a case presentation and a review of the literature on this topic.

It is important that the forensic community be aware of this process, its characteristic histopathology, the distribution and clinical consequences of similar lesions throughout the body, and its implications as a cause of sudden death. Pathologic processes involving the conduction system are often considered in the investigation of otherwise healthy persons, and this presentation will impact the forensic science community by presenting evidence for the systematic examination of conduction system histology.

A case of the investigation of the sudden death of a previously healthy 15-year-old male will be presented. The patient had a history of being overweight (BMI 28.4), mild well-controlled asthma, and Attention Deficit and Hyperactivity Disorder treated in the past with stimulants. Examination revealed an essentially negative autopsy, a negative skeletal survey by radiography, and normal histopathology of the usual microscopic sections taken at autopsy. Postmortem toxicology was significant for the presence of a moderate amount of caffeine. Viral and bacterial cultures grew a likely postmortem contaminant only, and vitreous chemistries were normal. Further examination of the conduction system revealed significant dysplasia of the atrioventricular nodal artery, characterized by irregular fibrointimal thickening of the vessel wall with marked disruption of the elastic lamina, highlighted by special stains.

Dysplasia of the atrioventricular nodal artery is a rare entity, described only in small case reports and series. The morphologic changes are the same as those found with fibromuscular dysplasia, which is most commonly seen in the renal and internal carotid arteries but has been reported in numerous arterial beds and may even be a generalized condition. Fibromuscular dysplasia is a nonatherosclerotic, noninflammatory disease of the arterial wall, the exact cause of which is unknown. The lesions may predominantly alter the intima, media, or the adventitia, and the sequelae are dependent upon the degree of vascular wall thickening or destruction and the location of the affected vessels.

Within the forensic literature, there are scattered case reports of dy-

splasia within the vasculature supplying the conduction system, but the majority of the literature linking fibromuscular dysplasia to a cause of death focuses on the disease process within the small coronary arteries. In fact, some controversy exists as to the presence of apparent dysplasia within the nodal arteries in control subjects dying of other causes and whether the use of special stains can highlight specific alterations of the vessel wall that may lead to an increased association with sudden death.

An example of atrioventricular nodal dysplasia is the cause of sudden death in a relatively healthy adolescent. It is important that the forensic community be aware of this process, its characteristic histopathology, the distribution and clinical consequences of similar lesions throughout the body, and its implications as a cause of sudden death. Pathologic processes involving the conduction system are often considered in the investigation of otherwise healthy persons, and this presentation will present evidence for the systematic examination of conduction system histology.

Atrioventricular Node, Dysplasia, Sudden Death

G86 Subaortic Aneurysm of the Left Ventricle Complicating Staphylococcal Endocarditis

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After attending this presentation, the audience will learn about an unusual complication of endocarditis, which could lead to sudden death of young people.

This presentation will impact the forensic science community by demonstrating how subaortic aneurysms can complicate staphylococcal aortic valve endocarditis and cause sudden unexpected deaths in young people.

Subaortic aortic aneurysms are rare. Initially thought to be of congenital origin, they may occur as a complication of aortic valve endocarditis. This report describes a subaortic aneurysm in a 21-year-old patient who had a recent history of staphylococcal endocarditis.

A 20-year-old Vietnamese male who worked as a machinist presented to the Emergency Room of a local hospital with a 4-6 days history of fever, chills, and headache. A cardiology evaluation was requested due to a systolic murmur on examination. A transesophageal echocardiography revealed abnormal vegetation of the aortic valve and mild aortic, tricuspid and mitral regurgitation. Blood cultures drawn at the time of the admission grew *Staphylococcus aureus*. *Staphylococcus aureus* endocarditis was diagnosed. The patient was treated with Gentamycin for 14 days, and Nafcillin for seven weeks. The patient was followed by a cardiologist for eight months. The patient refused aortic valve replacement surgery. Ten months after the onset of the first episode the patient was found down at home with shortness of breath and an altered level of consciousness. He was transported to the hospital, but suffered cardiac arrest and was pronounced in the Emergency Room. At autopsy, the patient weighed 149 pounds and measured 67 inches. The external examination showed evidence of therapeutic intervention and no external trauma was noted. The pericardial cavity was filled with 200 mL of clotted blood. The heart weighed 430 grams. There was aneurysmal enlargement at the base of the left ventricle, between the aorta and the left atrium, measuring 3.0 cm in diameter. A ruptured snout measuring 1 cm was located on the superior aspect of the aneurysm. The aortic valve was bicuspid. The aneurysm communicated with the left ventricle just below the right commissure of the two cusps by a triangular opening measuring 1.5 x 1.0 cm. Death was attributed to cardiac tamponade from spontaneous rupture

of a subaortic aneurysm.

Subaortic aneurysms can be congenital, infective or traumatic. Congenital weakness of the fibrous annuli could predispose to the development of such aneurysms. A bicuspid aortic valve is another contributing condition. The role of aortic regurgitation as a consequence of infective endocarditis in the aneurysmal formation needs to be considered in our case. It is probable that rupture of the aneurysm resulted from weakness and increased tension of the aneurysmal wall.

Forensic Pathology, Sudden Death, Subaortic Aneurysm

G87 A Rare Case of Cardiac Failure Due to Hypertensive Crisis in Pheochromocytoma: A Methodological Approach for Diagnosis

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The goal of this presentation is to present a rare case of cardiac failure due to hypertensive crisis in pheochromocytoma in an asymptomatic 25-year-old young man is presented. The rarity of pheochromocytoma makes the case peculiar and the complete pathologic investigation adopted (autopsy performing, immunoistochemical staining, and biochemical screening) is strongly recommended to pathologists to confirm diagnosis.

This presentation will impact the forensic science community by demonstrating how the rarity of pheochromocytoma makes the case peculiar. It is strongly suggest, in these cases, the relevance for pathologists of a complete methodological approach, integrating clinical data by means of autopsy findings, immunoistochemical staining and biochemical screening to confirm diagnosis.

Pheochromocytomas are rare but clinically important tumours of chromaffin cells that produce, store, release and metabolize catecholamines. Pheochromocytomas usually manifest clinically as hypertension which can be sustained or paroxysmal. The diagnosis of pheochromocytoma is based on measuring excessive amounts of catecholamines and their metabolites on blood and urine; more than 90% of patients with pheochromocytoma have elevated levels of catecholamines, metanephrine, and vanillyl-mandelic acid. Sensitivity and specificity of these measurements are 91%. Failure to diagnose the tumours can result in sudden, unexpected and potentially lethal complications; cause of death in these cases is generally a consequence of paroxysmal hypertension as well as cerebral vascular accidents, abrupt haemorrhage into the tumour or acute left ventricular failure.

A 25-year-old man, with a past medical history significant for recurrent episodes of cephalgia, was transported to the local Hospital at 11:44 p.m. complaining of vomiting and headache. A prescription for symptomatic treatment was issued unsuccessfully. He had high blood pressure (180/80) and tachycardia (110 bpm). Neurological examination was unremarkable, abdomen showed no rigidity, peristaltic sounds were normal. Initial laboratory findings showed hyperglycaemia (177 mg/dl) and high level of amylase (125 U/L); further findings showed high levels of myoglobin (153 ng/ml). A 12 lead electrocardiogram on admission was performed showing sinus tachycardia, with right bundle branch block and ventricular bigeminy extra systoles; non specific repolarization change were also described. Few hours later, 8:15 a.m. the patient appeared pale and sweating; blood pressure was unappreciable and hypocontractility of left ventricle with low ejection fraction was observed on echocardiography (EF 25-30%). A state of haemodynamic shock was declared (FC 170, blood pressure was unappreciable). Pulmonary edema was observed on chest Rx examination and oro-tracheal intubation was performed substaining ventilation in intensive care unit. At 9:15 a.m. ECG monitor showed cardiac arrest; resuscitation manoeuvres were attempted unsuccessfully.

A complete postmortem examination was performed two days after death. External examination was unremarkable except for food residuals in the mouth. Internal examination showed cerebral oedema; food residuals were recorded at oesophagus exploration; heavy lungs presenting white foam

on the main bronchi was also detected. Heart was fixed in formalin, cardiac size was normal, with conical shape. Macroscopic study (cut in cross-section 3 mm intervals) of coronary arteries was unremarkable. A well circumscribed encapsulated lobulated reddish and brownish suspected lump measuring 3.5x3x3 was attached to the medial aspect of the left kidney; it was soft on section and presented aspect of necrosis and haemorrhage. Adrenal tissue was attenuated over the upper part of the mass; aspect of minimal haemorrhage was observed on pancreas examination.

Histological examination revealed polyvisceral stasis, mild cerebral edema: massive pulmonary edema was recorded. Cardiac myofibers varied considerably in size with many large fibers and aspect of fibrosis suggesting for hypertension; the pathological myocardial picture included fragmentation of the whole myocyte (pancellular lesion) which ranged from early breakdown in pathological band (intense hyperosinophilia of the hypercontracted myocardial cells with rexis of the myofibrillar apparatus into cross-fiber, anomalous and irregular) to a total granular disruption (myofibrillar degeneration). Histological examination of the suspected lump addressed diagnosis for a benign pheochromocytoma with the presence of well-defined nests (Zellballen) bound by a delicate fibrovascular stroma, which contain amyloid. The cells varied considerably in size and shape and had purely granular basophilic cytoplasm; the nuclei were round with prominent nucleoli.

An immunoistochemical study was performed and it showed a positive reaction for chromogranin and synaptophysin.

Dosage of catecholamines and their metabolites on a blood and urine samples was performed showing high levels of catecholamines, metanephrine and vanillyl-mandelic acid.

Clinical data, autopsy findings, data collected from immunoistochemical staining and biochemical analysis led us to conclude that cardiac failure due to hypertensive crisis in adrenal pheochromocytoma was the cause of death.

In conclusion, the rarity of pheochromocytoma makes the case peculiar. The authors strongly suggest, in these cases, the relevance for pathologists of a complete methodological approach, integrating clinical data by means of autopsy findings, immunoistochemical staining and biochemical screening to confirm diagnosis.

Pheochromocytoma, Cardiac Failure, Hypertensive Crisis

G88 Arrhythmogenic Right Ventricular Dysplasia (ARVD): A Not So Rare Cause of Sudden Death in Young Adults

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The goal of this presentation is to make the forensic community aware of this entity (ARVD) as a sudden cause of death in the young adult population.

This presentation will impact the forensic science community by demonstrating how routine full autopsies may not detect the subtle pathologic changes that cause Arrhythmogenic Right Ventricular Dysplasia.

Ten (10) cases of ARVD/Arrhythmogenic Right Ventricular Cardiomyopathy (ARVC) autopsied at Danbury Hospital, CT, from June 2002 until June 2007 were reviewed. This number represents 3.75% of the total adult full autopsies performed in our institution during the same period.

Age, sex, and ethnic background were noted. Associated cardiac and non cardiac related diseases were reviewed.

Medications, social and family history (sudden death of a sibling) as well as body habitus (obesity) were tabulated.

Prior symptoms (syncope episodes, palpitations) and pre-terminal circumstances (place of death, physical activity) were examined. Autopsy findings (both cardiovascular and systemic) were correlated.

The ten patients' ages ranged from 34 to 65. Sex ratio was 1:1. 8/10

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were obese, 5/10 used alcohol frequently, 10/10 were at rest at time of pre-final event, 1/10 had family history of sibling (brother) sudden death, 10/10 had some degree of Coronary Artery Disease (CAD), 7/10 had cardiomegaly (450g to 650g), 1/10 had coexisting myocarditis, 10/10 were Caucasian (only 1 with an Italian background), 4/10 had suffered a significant traumatic injury and 3/10 used medications for depression or anxiety. In patients with ARVD, the most common findings were obesity, CAD. The authors also concluded that Caucasian ethnicity is prevalent, the pre-terminal episode happens at rest, the age group is between 4th and 7th decades, and M:F ratio is ~1.

This report helps to increase awareness regarding this congenital cardiac disease. It is relevant to the forensic community, because of its high incidence in children, and young adults, and it is a frequent cause of (sudden death) in the North East (New England).

Arrhythmogenic right ventricular dysplasia (ARVD, also known as arrhythmogenic right ventricular cardiomyopathy or ARVC) is a type of non-ischemic cardiomyopathy that involves primarily the right ventricle of the heart. It is characterized by hypokinetic areas involving the free wall of the right ventricle, with fibrofatty replacement of the right ventricular myocardium, with associated arrhythmias originating in the right ventricle.

ARVD is an important cause of ventricular arrhythmias in children and young adults. It is seen predominantly in males, and 30-50% of cases have a familial distribution. It is usually inherited in an autosomal dominant pattern, with variable expression. The penetrance is 20-35% in general, but significantly higher in Italy. Seven gene loci have been implicated in ARVD. The incidence of ARVD is about 1/10,000 in the general American population, although some studies have suggested that it may be as common as 1/1,000. It accounts for up to 17% of all sudden cardiac deaths in the young. In Italy, the incidence is 40/10,000, making it the most common cause of sudden cardiac death in the young.

Up to 80% of individuals with ARVD present with syncope or sudden cardiac death. The remainder frequently present with palpitations or other symptoms due to right ventricular outflow tract (RVOT) tachycardia.

Apoptosis (programmed cell death) appears to play a large role in the pathogenesis. It is unclear why the right ventricle is predominantly involved. The disease process starts in the subepicardial region and works its way towards the endocardial surface, leading to transmural involvement. The left ventricle is involved in 50-67% of individuals. If the left ventricle is involved, it is usually late in the course of disease, and confers a poor prognosis.

90% of individuals with ARVD have some EKG abnormality. The most common one seen in ARVD is T wave inversion in leads V1 to V3.

Transvenous biopsy of the right ventricle can be highly specific for ARVD, but it has low sensitivity. A biopsy sample that is consistent with ARVD is found to have > 3% fat, >40% fibrous tissue, and <45% myocytes.

A postmortem histological demonstration of full thickness substitution of the RV myocardium by fatty or fibro-fatty tissue is consistent with ARVD.

There is no pathognomonic feature of ARVD. The diagnosis is based on a combination of major and minor criteria. The diagnosis is based on a combination of major and minor criteria, and requires either 2 major criteria or 1 major plus 2 minor, or 4 minor criteria.

Many of these patients have symptoms associated with ventricular tachycardia, such as palpitations, light-headedness, or syncope. Others may have symptoms and signs related to right ventricular failure, such as lower extremity edema, or liver congestion with elevated hepatic enzymes. Unfortunately, sudden death may be the first and sole manifestation of disease.

The goal of management of ARVD is to decrease the incidence of sudden cardiac death. This raises a clinical dilemma: How to prophylactically treat the asymptomatic patient who was diagnosed during family screening.

Sotalol, a beta blocker and also a class III antiarrhythmic agent, is the most effective antiarrhythmic agent in ARVD. Other antiarrhythmic agents used include Amiodarone and conventional beta blockers (i.e., Metoprolol). If antiarrhythmic agents are used, their efficacy should be guided by series ambulatory Holter monitoring, to show a reduction in arrhythmic events.

Individuals with decreased RV ejection fraction and dyskinetic portions of the right ventricle, may also benefit from long term anticoagulation with

warfarin to prevent thrombus formation and subsequent pulmonary embolism.

Implantable cardioverter-defibrillator devices (ICD's) are the most effective prevention against sudden cardiac death.

Cardiac transplant surgery is only rarely performed in ARVD. It may be indicated if the arrhythmias associated with the disease are uncontrollable or if there is severe bi-ventricular heart failure that is not manageable with routine pharmacological therapy.

All first degree family members of the affected individual should be screened for ARVD. This is used to establish the pattern of inheritance. Screening should begin during the teenage years unless otherwise indicated. Screening tests include: Echocardiogram, EKG, holter monitoring, cardiac MRI, and exercise stress test.

ARVD, Sudden Death, Pre and Postmortem Diagnosis

G89 Cardiac Death in Anabolic Steroid Abuse: A Pathological and Toxicological Study

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After this presentation, participants will understand the proposed methodological approach in analysis of cases of doping-related death. The presentation will cover reports in the scientific literature of doping-related deaths due exclusively to the use of anabolic androgenic steroids (AAS).

This presentation will impact the forensic science community by highlighting the importance of a correct methodological approach in such cases, and the possible cause-effect relation between AAS intake and cardiac death.

The true extent of doping is underestimated. The absence of chemico-toxicological findings in biological samples is a limitation in epidemiological studies, conducted as surveys on the living or case histories of the dead. Literature reports of doping-related deaths due exclusively to AAS confirm that the phenomenon is underestimated and that epidemiological data from postmortem and intra vitam studies are contradictory.

The present work describes two cases of the death of young athletes who had taken AAS; cardiopathological evidence is discussed in relation to studies in the relative literature.

The methodological approach is based on the following steps: (1) assessment of circumstances, (2) analysis of medical documentation, (3) external examination and autopsy, (4) microbiological analysis, (5) chemico-toxicological analysis, and (6) interpretation of results.

Case 1 - A body-builder aged 32 was found dead in his home. Medical history: Subject had taken AAS for years. He had recently stopped taking them, due to unidentified side-effects. Postmortem findings: External examination, excessive muscular development. Cadaveric section: cardiomegaly, with concentric hypertrophy of the left ventricle (LV). Histology: focal lymphocytic myocarditis and adipose dystrophy in disarray at the apex of the right ventricle. Microbiological analysis: Molecular study by Polymerase Chain Reaction (PCR): negative for cardiotropic viruses. Toxicological analysis: Screening and confirmatory chromatographic techniques to search for xenobiotics were negative.

Case 2 - A body-builder aged 31, accustomed to practicing martial arts, unexpectedly lost consciousness during training. Hospitalized in intensive care, he died 72 hours later of cardiac failure and acute hepatorenal failure.

The medical history included astenia, dyspnea, and perimalleolar edema. The clinical picture had worsened ten days before death. Also was reported long-term intake of AAS (boldenone, dromostanolone, enanthate methenolone, stanozolol, trenbolone). Postmortem external examination: Excessive muscular development. Cadaveric section, dilatative cardiomyopathy, with endocardial thrombosis. Histology: Marked dysmetria of hypertrophic myocytes, with diameter up to 30 μ ; dyschromic and

dysmetric nuclei, evident interstitial fibrosis, and rare inflammatory infiltrates. The subendocardial trabeculae, especially of the right ventricle (RV), showed extensive areas of colliquative myocytolysis in repair phase. Microbiological analysis: Molecular study by PCR positive for Epstein-Barr Virus (EBV). Toxicological analysis: Screening (GC-MS) and chromatographic (GC-MS/MS) confirmatory techniques to reveal xenobiotics in hair were positive for AAS (stanazolol).

A cause-effect relation between AAS and cardiac death can only be demonstrated by applying rigorous methods of investigation. Further clinical and experimental studies are needed for further in-depth knowledge of the pathogenetic and physiopathological role played by AAS in causing cardiac death. In particular, clarification is needed on the possible effects of AAS on sympathetic control of the cardiac function, related to myocardial contractility and vascularization.

Anabolic Androgenic Steroids, Cardiac Death, Doping

G90 A “Café Coronary” in a 2-Year-Old: Case Report

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After attending this presentation, attendees will understand the history of the term “café coronary” and the mechanisms, genetics, presenting signs and symptoms, and pathologic findings of abnormal cholesterol metabolism involved in familial hypercholesterolemia.

This presentation will impact the forensic community by reviewing the role genetic diseases play in fatal, premature pediatric coronary artery disease. During café coronary events, myocardial ischemia should be considered as a cause of death, even in the pediatric population, and especially if there is a family history of premature coronary artery disease or familial dyslipidemia.

“Café coronary” is a term used to describe a sudden attack resulting in death that occurs during or shortly after eating, often in the elderly, and is secondary to choking; however, the death is erroneously attributed to coronary artery disease. In children and adolescents, the opposite scenario, death in a suspected choking victim having a final diagnosis of myocardial ischemia secondary to coronary artery disease, is extremely rare.

Childhood is a critical period in which dietary and lifestyle patterns have long-term implications for coronary heart disease risk in adult life. Smoking, high intake of dietary total fat and saturated fat, low exercise level, and excessive alcohol consumption are correlated with elevated serum cholesterol, obesity, and hypertension in children, as well as a predisposition to premature death from coronary heart disease.

Children and adolescents can be at an even higher risk of cardiovascular disease if there is a family history of premature coronary artery disease or familial dyslipidemia. Of the primary hyperlipidemias, familial hypercholesterolemia (FH) is the most common and the most documented to have important cardiovascular consequences beginning in childhood. FH is an inherited dominant condition due to a defect in the LDL receptor gene and is usually discovered when there are increases in plasma total and LDL cholesterol in the child and in at least one of the parents. More than 600 different LDL-receptor mutations have been described. Mutations of the LDL-receptor cause significantly elevated LDL levels. This inability for cholesterol uptake leads to premature atherosclerosis and a very high risk of early cardiovascular disease and myocardial infarction. Patients with homozygous FH manifest cardiovascular disease within the first two decades of life, and may present within the first decade of life with physical findings related to cholesterol deposition, such as tendon xanthomata, cutaneous xanthelasma, or corneal arcus. FH heterozygotes usually present with problems in early to mid-adulthood.

A 2-year-old Hispanic male appeared to be suffering from a “café coronary” while eating, but was actually suffering from acute myocardial

ischemia secondary to >90% stenosis of multiple coronary arteries. Initial responders and emergency department personnel proceeded with resuscitative procedures/protocols in response to a presumed choking/asphyxia event. Autopsy revealed extensive cholesterol deposition in the coronary arteries with additional deposits found throughout the aorta and within the skin (xanthomas). The decedent’s family history was significant for a father and 12-year-old sister with hypercholesterolemia. A recent visit to the pediatrician revealed fasting plasma total cholesterol >400 mg/dl. It is recommended that medicolegal death investigators become familiar with the possibility of an acute cardiac death in young children with a family history of abnormal cholesterol metabolism.

Café Coronary, Children, Familial Hypercholesterolemia

G91 Identification of Twenty Charred Victims of a Helicopter Accident, Africa

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This presentation offers a paradigm for the identification of multiple charred bodies in situations where there is no existing medicolegal infrastructure.

This presentation will impact the forensic science community by demonstrating how a rush to immediate autopsy is not always the best first step. A first triage including sex, size, and personal effects allowed quick matching with antemortem data.

Since each mass disaster presents unique challenges, the medicolegal response must be tailored to the circumstances at hand. Scientific standards for identification vary from country to country, often in proportion to the urgency of identification and the country’s scientific capabilities.

On June 11 2007, a helicopter transporting twenty supporters of a soccer squad, among them two French nationals, ignited a couple of feet off the ground at an airport in Africa; investigation revealed that the private helicopter company was not certified to fly. The bodies, unnumbered, had been simply repatriated to local morgue. No forensic investigation were performed locally. The French embassy asked the french government to send a team to Africa in order to identify the french bodies and to help local government to identify their bodies. As the bodies were charred, the identification procedure might include all the victims.

A seven member team of French forensic experts, including two pathologists and an odontologist, were dispatched to the scene, accompanied by half a ton of equipment; a one week mission was planned.

The first step was to petition the local judiciary to confer official status on the mission. Next, a unit of the team worked with families to organize intake of antemortem data (medical and dental history, descriptions of personal effects) and exemplars for possible DNA comparison.

A second unit worked on analyzing the bodies. A decision was made to do an intake exam to assign the bodies case numbers, determine the sex and size, then describe any personal effects. This preliminary triage facilitated more exacting processing with regards to comparison with available antemortem data (scars, prostheses, dental irregularities). With that goal, an autopsy (minimal autopsy following the Interpol procedure) with odontologic evaluation was conducted on each body, and a segment of femur retained for possible DNA testing.

On-site identification was possible for fourteen of the twenty bodies as follows: dental charting – eight bodies; radiographic comparison – two

* Presenting Author

bodies; confirmation of a hip prosthesis - one body; anthropological identification of an old fracture – one body; identification by highly specific ritual scars – two bodies; fingerprints – one body. Some bodies were identified by multiple modalities. Finally, for six bodies, genetic testing was the only possible option, and was accomplished through mitochondrial DNA extracted from bone specimens sent to France packed in dry ice. Location work took one week, with DNA identification of the final six bodies completed in three weeks.

All site work was done by the specially french trained team, equipped to perform postmortem examinations without relying on local infrastructure (with the exception of access to water). This team includes police officers, crime scene investigators, forensic odontologists, and forensic pathologists, all trained in identification methods and technics.

The authors experience demonstrates that a rush to immediate autopsy is not always the best first step. In this case, preliminary triage on the basis of sex, size and personal effects allowed quick matching. Time for identification was reduced, and the bodies were rapidly released to families as identifications progressed, easing the political pressure.

Forensic, Mass Disaster, Identification

G92 Risk Factors for Pedestrian Deaths

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After attending this presentation, attendees will understand some of the pertinent risk factors associated with pedestrian deaths.

This presentation will impact the forensic community and public health agencies by documenting and highlighting factors which can help focus injury prevention strategies.

All pedestrian deaths investigated by the Central Virginia District Office of the Chief Medical Examiner in the years 2002 through 2006 were reviewed using police reports, death certificates, and medical examiner investigation and autopsy reports. The decedent information and circumstances of the death were extracted to analyze factors such as age, sex, race, manner of death, intoxication, time of day, season, location of death, activity of decedent, and vehicles involved.

Approximately 70% of all deaths were adults (21 to 65 years old) and 70% of all deaths were males. The rate of pedestrian deaths (per million) was 21 for males compared with 8.7 for females. Rates were highest for Hispanics (24.2) followed by African Americans (19.3) then non-Hispanic Caucasians (12.1).

Considering individual risk factors in adult pedestrian deaths, the leading factor was darkness with approximately 76% of deaths occurring at night. The second most prominent factor was alcohol intoxication (Blood Alcohol $\geq 0.08\%$ by weight by volume) present in 44% of pedestrian deaths. The next most common factors were crossing a road (41%) or walking along or in a road (25%). Almost 8% of the pedestrian deaths were associated with a domestic dispute and 88% of the victims were male. Nearly 7% of the pedestrian deaths occurred in victims of or responders to a previous motor vehicle accident.

Most of the pedestrian deaths were certified as accidents (94%). Only 4% of the pedestrian deaths were certified as suicides but in an additional 6% of the deaths there were circumstances which were suspicious for but not diagnostic of suicide.

Education and enforcement focusing of risks of darkness, alcohol use and pedestrians crossing or walking on roads are focus areas for prevention. Pedestrians and responders on roads after motor vehicle collisions are at great risk. Domestic disputes are associated with a surprising number of pedestrian deaths. Pedestrian deaths require careful investigation to correctly establish manner of death.

Pedestrian, Motor Vehicle, Death

G93 Cervical Spine Injuries in Fatal Traffic Crash Victims: Microscopy and Diagnostic Imaging Findings

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The objective of this presentation is to familiarize the attendees with the presence of discrete lesions in the cervical spine facet joints in fatal traffic crash victims based on a large case-control forensic autopsy study utilizing advanced diagnostic imaging procedures and histological methods.

This presentation should encourage forensic specialists and researchers to include detailed examination of the posterior elements of the spinal column in the evaluation of trauma victims. Furthermore, clinical sciences should consider these findings as potentially relevant in cases of cervical spine symptomatology after severe road traffic crashes despite negative diagnostic imaging evaluation.

Occult lesions have previously been identified in the cervical spine in case studies on autopsy material using diagnostic imaging procedures and microscopy; very few case-control studies have, however, been performed.

The lower cervical spine facet joints from 42 subjects (20 fatalities from passenger car traffic crashes (cases) and 22 decedents due to non-traumatic causes (controls)) were removed *en bloc* during autopsy. The specimens were examined with: (1) advanced diagnostic imaging procedures (conventional x-rays, computed tomography and magnetic resonance imaging), (2) stereomicroscopy of 3-mm thick anatomical slices, and (3) microscopy of 10 μ m thick stained histological sections. Each facet joint was examined and described systematically with each of the three methods. The diagnostic imaging examination included evaluation of fractures and bleeding, the stereomicroscopy included evaluation of fractures, bleeding and damage to the synovial folds, and the microscopy included evaluation of fractures, bleeding in and disruption of the folds and haemarthrosis. Furthermore, age-related changes were evaluated microscopically with regard to cartilage fibrillation and fissures, vascular invasion of the tidemark and semi-quantitative histomorphometric measurements of the cartilage thickness, subchondral bone thickness, cartilage length, and percentage overlap of the anterior and posterior folds. Results from the diagnostic imaging procedures and the stereomicroscopy were compared to the microscopical findings.

Lesions in the lower cervical spine facet joints were common, particularly in the soft tissues, including bleeding in the joints spaces and the synovial folds. Among the diagnostic imaging procedures, computed tomography was the most sensitive towards identifying facet fractures, whereas soft tissue lesions could not be identified reliably in any of the diagnostic imaging procedures. None of the stereomicroscopical findings correlated significantly with the microscopical findings. Microscopical examination was the most sensitive method and identified all facet fractures, haemarthrosis, and bleeding in the folds. The microscopical findings correlated well with the exposure to trauma. None of the osseous or soft tissue lesions in the cervical spine facet joints were identified during the autopsy. Furthermore, histomorphometric data were collected for the normal anatomy of the lower cervical spine facet joints.

Discrete injuries in the lower cervical spine facet joints are common after fatal road traffic crashes. Osseous lesions of the facet joints can be reliably identified on computed tomography whereas soft tissue lesions can not. Stereomicroscopical examination does not reliably identify lesions in the facet joints in comparison to microscopical examination which identifies both osseous and soft tissue lesions in great detail.

This presentation should encourage forensic specialists and researchers to include detailed examination of the posterior elements of the spinal column in the evaluation of trauma victims. Furthermore, clinical sciences should consider these findings as potentially relevant in cases of cervical spine

symptomatology after severe road traffic crashes despite negative diagnostic imaging evaluation.

Fatal Traffic Crash, Cervical Spine Injury, Investigation

G94 Reconstruction of a Fatal Dragster Crash

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After attending this presentation, attendees will understand the basic principles in crash reconstruction, vehicle crash dynamics, measures of impact severity, occupant kinematics, seatbelt overloading, and biomechanics of injury in the context of an unique type of motor vehicle collision.

This presentation will impact the forensic science community by presenting concepts in crash reconstruction vehicle crashworthiness, occupant protection and human tolerance to impact by an in-depth analysis of an uncommon type of high-severity collision, this presentation will be of interest to all motor vehicle collision investigators.

This presentation examines a number of different concepts in crash reconstruction, vehicle crashworthiness, occupant protection and human tolerance to impact through the in-depth analysis of an uncommon type of high-severity collision. This illustrative case will be of interest to anyone investigating motor vehicle collisions and consequent injury patterns.

A 17-year-old female driver lost control of her rail-type dragster at the finish line during a routine performance run. The vehicle struck a rigid left concrete barrier running parallel to the track. The driver's seatbelt failed during the crash, and she was ejected and fatally injured. The cause of the seatbelt failure and its role in the death of the young woman were major considerations during the in-depth investigation of the crash.

The light stiff dragster rail was propelled by a jet engine mounted behind the seat and was traveling at a speed of 305 mph when it suddenly veered to the left at the finish line. The driver shut off the jet engine just past the finish line, and the vehicle began to decelerate rapidly due to large aerodynamic forces that also put the vehicle into a hard counterclockwise rotation. The "jet car" was traveling at approximately 280 mph and slipping sideways when it struck the barrier with its front end just 80 yards past the finish line. At impact, the approach angle of the vehicle's center of mass was 9.3 degrees to the barrier as indicated by a single tire mark. The component of the vehicle's velocity directed perpendicular to the barrier was 45 mph. Impact speed is often a poor measure of crash severity, and the velocity change (delta-V) and time duration (delta-t) of the impact must be considered. The delta-V in this case would be similar in magnitude to the component of the impact velocity that was directed perpendicular to the barrier. A delta-V of 45 mph is indicative of a severe crash. By comparison, full-frontal passenger vehicle crash tests into fixed rigid barriers are conducted at test speeds of 30 mph by regulatory agencies in North America. While the delta-V sustained by the dragster was very high and well beyond the compliance limits of passenger vehicles, there are additional considerations when evaluating impact severity. Due to the low mass and very stiff construction of the vehicle it sustained minor front-end crush. As a result of the short ride-down distance, the delta-t would be much less than a similar severity crash by a passenger vehicle. Consequently, the resulting decelerations sustained by the dragster were very large, and the impact extremely severe.

The occupant compartment remained intact, but the driver's five-point restraint harness failed during the crash. The left lap belt, right lap belt latch plate and central crotch strap separated due to occupant loading. The failure of the left lap belt occurred at the adjuster mechanism and appeared similar to the restraint failure observed after Dale Earnhardt's fatal NASCAR crash. The dragster driver was ejected and slipped out of her helmet, which remained tethered to the vehicle. Both driver and vehicle traveled approximately

275 yards from the point of impact before coming to rest near the barrier. The driver sustained severe injuries to the head, neck, torso and abdomen. Some of the injuries that contributed to her death resulted from excessive lap belt loading.

This case is an example of high severity crash occurring in a unique vehicle. The severity of the collision is due not only to the high delta-V of the crash but also its short time duration. Irrespective of the restraint system integrity, a fatal outcome was predictable.

Dragster, Crash, Reconstruction

G95 Death Due to Aquatic Erotic Asphyxia - Accident or Homicide?

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The objective of this presentation is to alert medical examiners, medico-legal investigators and other forensic experts to unusual and potentially deadly forms of erotic asphyxial behavior in an aquatic environment. Our concern is that such behavior can be misconstrued as autoerotic and classified "accident" in the event of a death.

This presentation will impact the forensic science community by illustrating that aquatic erotic asphyxia is a potentially deadly activity that can be a venue for more sinister activities such as aquatic sexual sadism and child abuse. Since aquatic erotic asphyxia requires the participation of two or more individuals, it should not be confused with autoerotic asphyxia. In the event of a death, a thorough investigation is needed to assign manner of death.

Accidental autoerotic deaths generally occur during solitary sexual activity involving the use of props or other stimulatory devices, when the victim miscalculates or when a safety mechanism or breathing apparatus fails. Some of the mechanisms used to produce cerebral hypoxia include ligatures, plastic bags, body wrapping and submersion in water. Aquatic erotic asphyxia (AEA) a potentially dangerous but less known form of erotic asphyxial behavior, may involve more than one participant, whereby the manner of death is at issue in the event of a death. Illustrative cases and a brief review of the literature will be presented.

AEA and its many subcategories as advertised on the internet with particular attention to the more pernicious forms of the practice such as aquatic sexual sadism and the forceful immersion of children are described. Surprisingly, references to aquatic pedophilia can be found on some of the websites catering to "aquaphiles". AEA can involve more than one participant in various gender combinations, with one dominant figure dunking or drowning a submissive figure, or with two individuals wrestling under water for dominance. AEA enthusiasts are careful to avoid injury and even post detailed medical questionnaires on their websites. AEA activity sometimes involves the use of actors wearing underwater makeup and props to ensure a safe and controlled environment. Aquatic sadists on the other hand derive pleasure from the dunking-related torture and/or actual drowning of another person, and promote more "realistic" scenarios.

Given that the AEA community is becoming increasingly organized, with personal ad websites, commercially available videos, DVD's and photographs, and even conventions and hosted parties, the authors strongly recommend that the practice be taken into consideration when investigating a death in water. Investigators should search for unusual items such as cinderblocks, cut lengths of rope, large clear plastic tarps, diver weight belts, unusually set-up scuba regulators, large empty fish tanks, and other apparel not usually worn in hot tubs or pools. Evidence suggesting the participation of more than one individual should also be carefully looked for, since the death scene may have been altered or sanitized. The concern is that when aquatic erotic asphyxial activity results in the death of a participant, we may be dealing with homicidal violence and sexual sadism and not accidental autoerotic activity. The fact that death can potentially occur after the person

exits the water further underscores the need for a thorough and thoughtful death investigation whenever a drowning is suspected.

Aquatic Erotic Asphyxia, Aquatic Sexual Sadism, Autoerotic Asphyxia

G96 Bear Facts Alaska: The Good, The Bad, and the Ugly

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After attending this presentation participants will understand characteristic trauma patterns found in fatal bear maulings , how these patterns relate to bear etiology in the wild and the latest research about and how to avoid bear attacks. The presentation will include autopsy results from highly publized attacks, as well as those that are less well known looking at data from all species of bears.

This presentation will impact the forensic community/humanity by providing the latest information on bear fatality trauma and pathology with data accumulated by wildlife biologists in a synthesized fashion. It will provide the forensic community with a model of the injury patterns that are found in fatal bear attacks and hopefully help in the prevention of future attacks.

There has not been much forensic research conducted in the realm of bear fatal bear maulings and attacks. Because human development continues to encroach on natural habitats the numbers of bear- human encounters appear to be on the increase. A review of the literature consists mainly of brief case studies or papers that have been written in past decades in the context of emergency medicine or wildlife biology. Although being fatally mauled by a bear may be at the fringes of popular forensic science, these deaths usually enter the realm of forensic pathologists either because the death is unattended, suspicious or gets attention from the media. Because of these reasons, pathologists should have an understanding of injury patterns and a general understanding of why they occur. Biologists have contributed a great deal of data to aid pathologists in explaining why particular injuries occur. It is hoped that when fatal bear injuries are carefully documented and analyzed, pathologists can reciprocate and help biologists better understand bear species behavior with the goal of preventing further deaths.

Numerous case studies of bear mauling injury patterns found at autopsy are presented as well as the most recent scientific data from biologists that examine the specific nature of bear-human interactions and the best way to avoid them.

Bear Fatality, Trauma Patterns, Etiology

G97 Concussive Head Injury and Alcohol

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Upon completion of this presentation, attendees will gain an appreciation of the combined effects of ethanol and concussive head injury in causing sudden death. A detailed review of autopsies of individuals whose cause of death was concussive head injury with alcohol will be presented along with outlines of the scene investigations and examination of the toxicology results.

This study is of use to the forensic community in supporting the theory that sudden death occurs from concussive injry of the brain in the presence of alcohol. Consideration of this entity can unquestionably impact the medicolegal investigation of some deaths.

The spectrum of diffuse brain injury ranges from mild concussive injury to diffuse axonal injury resulting in death. The cases of diffuse axonal injury are often apparent to the forensic pathologist at the time of autopsy as the associated markers of injury are often present. That is to say, in cases of sudden death from severe head injury, significant intracranial injuries are often

present. However, there exist rare cases of head injury in which only soft tissue injury is found and there are no epidural, subdural or subarachnoid hemorrhages, or gross injuries to the brain, and yet sudden death has occurred. In these specific rare cases the blood ethanol levels are elevated. The proposed mechanism of death is that the combined effect of concussive brain injury and elevated blood alcohol produces postinjury apnea, leading to sudden death. Normally, concussive brain injury rarely causes postinjury apnea. However, the presence of elevated blood ethanol, a respiratory depressant, appears to potentiate fatal apnea in even mild concussive injury.

A computer search was used to identify all cases in the City of St. Louis and four of the adjacent counties in the past ten years. Eight such cases were found. The ages ranged from 23 to 64 years. Each of the individuals suffered blunt trauma about the head and/or face and had blood ethanol levels ranging from 0.18 to 0.40 g/dl. Two of the cases involved women who had been sexually assaulted and in which the manner of death was homicide. In each of these cases the thorough scene investigations and the circumstances surrounding their deaths exclude other possible causes of death.

Milovanovic and DiMaio published a series of cases of death due to concussion and alcohol in 1999. This review of autopsies in the St. Louis metropolitan area corroborates the findings of these authors and their description of the pathophysiologic processes that take place in such deaths and provides additional cases for review.

This study is of use to the forensic community in supporting the theory that sudden death occurs from concussive injury of the brain in the presence of alcohol. This diagnosis must be seriously considered in any death in which there is injury to the head without visible injury of the intracranial structures and the blood ethanol levels are elevated. Overlooking this cause of death may result in erroneous classifications of manner of death as natural or accidental, for example, when the manner may indeed be homicide. As such, consideration of this entity can unquestionably impact the medicolegal investigation of some deaths.

Blunt Head Trauma, Concussion, Alcohol

G98 Preliminary Study and Potential Role of CT Imaging Autopsy in the Investigation of Death Due to Accidental Blunt Trauma

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The goals of this presentation are: (1) to understand the investigational technique of 2 dimensional and 3 dimensional CT imaging autopsy in the medical examiners investigation of death, (2) to review a U.S. medical examiners office early experience and results of CT imaging autopsy compared with conventional autopsy for fatal accidental blunt trauma, and (3) to describe circumstances where CT imaging autopsy may evolve into a triage tool for the medical examiners investigation of sudden death.

This presentation will impact the forensic community and humanity by addressing the potential role of non-invasive CT imaging autopsy to replace conventional autopsy or enable performance of limited, focused autopsy in the U.S. medical examiners investigation of fatal accidental blunt trauma. CT imaging autopsy has potential for rapid and cost effective investigation in such circumstances, including mass casualty investigations. It may also provide options in the setting of religious and cultural objections to conventional autopsy.

Recent publications have suggested a potential role for high-resolution CT imaging using 2D and 3D techniques in the forensic investigation of death. This pilot study evaluated the sensitivity of CT imaging autopsy for major injuries and accuracy for the cause of death. The study also evalua-

ted the potential role of CT imaging autopsy as a replacement for or adjunct to conventional autopsy in the investigation of traumatic accidental death within a U.S. state medical examiner system.

Of 40 decedents prospectively investigated with whole body 40-detector row 2D and 3D CT within 24 hours of death, 27 were identified as victims of suspected accidental blunt trauma. Each CT study acquired approximately 3,000 images in 10 minutes scanning time and required 30 minutes interpretation time. As this was a new technique, CT was interpreted with consensus reading by 2 radiologists and compared with medical examiners autopsy results for major findings and cause of death in all cases.

CT imaging autopsy correctly identified 217 major traumatic findings (average 8/decedent, sensitivity 93.4%). It correctly identified a specific injury or combination of blunt trauma injuries as the cause of death in 25 cases and excluded traumatic death in 2 others. Fourteen major false-negative CT findings included non-displaced atlanto-occipital subluxation ($n=4$); fractures of the ribs or sternum ($n=3$); lacerations of the aorta ($n=3$), bronchus ($n=1$), and liver ($n=1$); cardiac contusion ($n=1$); avulsion of the renal pedicle ($n=1$). CT identified 8 major findings not detected at conventional autopsy: fractures of sacrum ($n=2$), mandible ($n=2$), skull base ($n=2$), cervical spine ($n=1$); lung lacerations ($n=1$). Suspected significant air embolism associated with major skull base or thoracic trauma ($n=6$) and tension pneumothorax ($n=1$) were noted on CT but not found at autopsy, likely related to the technique used.

This early experience suggests that CT imaging autopsy has promise as a sensitive tool for the detection of major injuries and accurately determines the cause of death after accidental blunt trauma. It may be insensitive for some major findings including non-displaced fracture or subluxation and the exact site of vascular injury in the setting of obvious major hemorrhage. Air embolism appears to be more easily detected by CT than conventional autopsy and may play a greater role in death due to blunt trauma than previously recognized.

CT Imaging, Autopsy, Accidental Blunt Trauma

G99 Stairway Related Deaths: An Analysis of Autopsy Findings of Individuals Found Dead at the Bottom of a Stairway

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After attending this presentation, the attendee can expect to learn the characteristics of autopsy findings of individuals found dead at the bottom of a stairway.

This presentation will impact the forensic science community by showing that it is not possible to predict which individuals found dead at the bottom of a stairway died from injuries and which died from non-traumatic causes based on age, cutaneous injuries, or a past medical history of a disease that could cause sudden death.

Cases from the Sparrow Health System Forensic Pathology Department (Lansing, Michigan) database were searched for deaths of individuals found dead at the bottom of a stairway. Twenty-seven such cases were identified; all of the deaths had full autopsies and twenty-six had blood drug screens.

The cases were divided into two groups: those whose deaths were caused by injuries consistent with a fall and those in which no significant injuries were identified. The age range, natural diseases, toxicology findings, and external injuries were compared between the groups. For the group of individuals who died due to a fall, the types of lethal injuries were characterized.

Twenty-seven deaths investigated since January 1, 2000 were of individuals who were found dead at the bottom of a set of stairs. Nineteen of the twenty-seven died from injuries associated with a fall and eight of twenty-

seven were free of significant injuries.

Of the eight individuals who were found dead at the bottom of a stairway, but had no significant injuries, six were men and two were women. The age range was 48-87 years with an average age of 63 years. Six of the eight decedents had cutaneous head injuries. Six of the eight individuals had cutaneous injuries of the torso and/or the extremities. None of the individuals were free of cutaneous injuries. Seven of the eight deaths in this group resulted from atherosclerotic cardiovascular disease and/or hypertensive cardiovascular disease. One death resulted from a mixed drug intoxication with citalopram and ethanol. Cocaine intoxication was a contributing factor in one of the deaths due to cardiovascular disease. The drug screens in the remaining six were negative for significant findings. Four of the eight individuals in this subset had a reported significant chronic medical condition, known before the autopsy, that might explain a sudden death.

Of the nineteen individuals who died from injuries related to a fall, 15 were men and 4 were women. The age range of this subset was 30-93 with an average age of 63 years. Eighteen of the nineteen deaths in this category were caused by craniocerebral injuries. The one death in this group not caused by head injuries was a 93-year-old woman whose death resulted from a left femur fracture and multiple left rib fractures. Thirteen of the eighteen had cutaneous head injuries, and three of these thirteen had cutaneous head injuries and blood draining from the external auditory canal(s). Fifteen of the nineteen individuals had cutaneous injuries of the torso and/or the extremities. There were no cases of individuals without any cutaneous injuries.

Of the nineteen individuals who died from injuries due to a fall, the blood drug screens in seven were negative for significant findings. Ethanol was present in the blood of eleven of the twelve with positive findings and ranged from 0.04 – 0.30% (in six of these eleven, the level was greater than 0.20%). THC was present in the twelfth case with significant toxicology findings.

Of the eighteen individuals with lethal craniocerebral injuries, most had skull fractures, however, none of the individuals with lethal injuries had depressed skull fractures.

Ten of the nineteen individuals in this subset of individuals who died from injuries had a reported significant chronic medical condition, known before the autopsy that might explain a sudden death.

Conclusions: The majority of individuals found dead at the bottom of a stairway have sustained lethal injuries. The factors that were evaluated (age of decedent, past medical history, presence of cutaneous injuries) are not predictive of lethal internal injuries identified at autopsy. A very high percentage of individuals found dead at the bottom of a set of stairs have positive postmortem drug screens, primarily alcohol.

Stairway, Autopsy, Fall

G100 Discrimination of Falls and Blows in Blunt Head Trauma: Assessment of Predictability Through Combined Criteria

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The goal of this presentation is to propose a criteria tool for the distinction of falls from blows in blunt head trauma.

This presentation will impact the forensic community by providing new insight into the evaluation of blunt head injuries.

The discrimination of falls from homicidal blows in blunt head injuries is a common but difficult problem in forensic pathology. One of the most often used criteria to evaluate this issue is the hat brim line rule. According to this rule, an injury located above the hat brim line (HBL) is more likely the result of a blow, while a fall would generally produce a wound at the level of HBL. The objective of this study was to evaluate the validity of this criterion, as long as of two other possible criteria: side lateralization of skull fractures and number of lacerations. Furthermore, a combined criteria tool

will be developed.

Over a 6-year period (2000-2005), all autopsy cases from the Montreal *Laboratoire de sciences judiciaires et de médecine légale* were analyzed. Cases selected consisted of falls downstairs, falls from one's own height, and head trauma by a blunt weapon. Upon review of photographs and autopsy reports, all cranial fractures and lacerations were positioned on figures representing the head and the skull in different anatomical views. For the present study, HBL was defined as the area located between two lines parallel to a line inspired by the Frankfort horizontal plane (horizontal plane passing through right and left porion points and the left orbitale), the superior margin passing through the glabella (G line) and the inferior margin passing through the center of the external auditory meatus (EAM line). For each case, the following elements were compiled: location of fractures in relation to HBL, side lateralization of skull fractures and number of lacerations.

A total of 114 cases were selected: 21 cases of downstairs falls, 29 cases of falls from one's own height, and 64 cases of head trauma by a blunt weapon. The location of a cranial fracture inside HBL was of little interest in the distinction of falls from blows. On the other hand, fractures located above HBL were associated to blows in 75.9% and to falls in only 24.1%. Hence, a fracture positioned above HBL was in favour of a blow ($\alpha=0.02$, contingency coefficient=0.25). Side lateralization of fractures was also of interest in the distinction of falls from blows: right skull fractures were more likely to result from falls whereas left skull fractures were more often associated with blows ($\alpha=0.007$, contingency coefficient=0.36). Even more interesting was the number of lacerations: cases presenting 3 or less lacerations were mostly falls cases (60.5%), whereas all cases (100%) with more than 3 lacerations were cases of blows ($\alpha =0.000$, contingency coefficient=0.48).

By combining those criteria, a better predicting rate was achieved. Indeed, the presence of at least two criteria in favor of a fall was successfully predicting cases in 65.9%, whereas the presence of at least two criteria in favor of a blow revealed a perfect score of 100% of successful prediction. Furthermore, by combining the three criteria altogether, the predictability of the criteria tool was even better: the presence of a combination of three criteria in favour of blows still demonstrated a success rate of 100%, while the success rate for falls reached 83.3% ($\alpha=0.001$, contingency coefficient=0.62).

Considering the previous results, the presence of a fracture above HBL, of a left side lateralization of skull fractures and the presence of more than three lacerations are criteria in favor of a blow. On the contrary, a typical fall case is more likely to present with a fracture inside HBL, a right side lateralization of skull fractures and 3 lacerations or less. A criteria tool based on combination of those criteria can achieve a predictability rate of 100% for cases of blows and 83.3% in falls cases.

Blunt Head Trauma, Hat Brim Line, Skull Fracture

G101 Unusual Death of a Transsexual (Identification of Damaging Means and Death Time)

Alessandro Dell'Erba, Sandra Cornetta, MD, Fiorenza Zotti, PhD, and Annalisa Addante, MD, PHD, Section of Legal Medicine, Place G. Cesare, BARI, 70124, ITALY*

After attending this presentation, the attendees will understand how scanning electron microscopy and immunohistochemistry can assist the forensic investigator and pathologist in correlating the scene, autopsy findings, and cause of death.

This presentation will impact the forensic science community by illustrating the importance of ancillary studies in the forensic autopsy.

February 2007 in Puglia, a transsexual homicide victim was discovered on a suburban road. The body was adjacent to the victim's automobile.

The autopsy confirmed that the cause of death was a serious encephalic concussion. There were doubts about the means of trauma, and for such a reason further analysis was conducted with the scanning electron microscope. Material that was deposited on the epidermic borders of the scalp was compared with the varnish rests of the automobile. It was suspected that the collision/impact of the victim's head was to the lower clapper of the right front door.

The time of death was evaluated by immunohistochemical surveys executed on samples of cerebral parenchyma using the anti-betaAPP antibody.

Transsexual Homicide, Damaging Means, Immunohistochemical Investigation



Pathology/Biology

G1 Sudden Unexpected Death in a Case of Human Immunodeficiency Virus (HIV) and Mycobacterium Infection Diagnosed Postmortem

Hydow Park, MD, Atlantic County Medical Examiner's Office, 201 Shore Road, Northfield, NJ 08225-2319*

After attending this presentation, attendees will learn: 1) Initial diagnosis of HIV/AIDS can be made postmortem by performing thorough histological examination and necessary laboratory tests, 2) Sudden death can occur in cases of unsuspected HIV/AIDS cases with non-tuberculous Mycobacterium infection in spleen and lymph nodes, 3) PCR technique is available for identifying Mycobacterium species in formalin-fixed paraffin-embedded tissues.

This presentation will impact the forensic community and/or humanity by assisting the forensic pathologists in better identifying HIV/AIDS cases at an early stage, so that it will benefit the immediate family and the community.

This 35-year-old female was found unresponsive at her residence at 6:00 pm. She was pronounced dead at emergency room after the usual resuscitative measures. She had a full-day work as a clerk stenographer and left work at 4:00 pm. She stated to her co-worker that she had chills while riding down on the elevator to leave work. She had a history of cervical carcinoma-in-situ that was treated with total hysterectomy and recently had laser vaporization for dysplasia of vaginal wall. She had been otherwise in good health. At autopsy the spleen was slightly enlarged and had gray nodules and there were skin ulcers in perineum. Microscopic examination of the spleen revealed ill-defined epithelioid cell granulomas containing rare acid-fast bacilli (AFB). Sections of mesenteric lymph nodes revealed lymphoid depletion and numerous AFB in ill-defined epithelioid cell granulomas. The skin ulcers were microscopically consistent with herpes simplex virus infection. In view of the presence of cervical carcinoma-situ, vaginal wall dysplasia, Mycobacterium infection, and herpes simplex skin infection, HIV-1 antibody tests (enzyme-linked immunosorbent assay and Western blot assay) were performed on a blood specimen taken at autopsy. Both tests were positive. Further investigation revealed that the decedent's brother had known that the decedent might have had HIV infection, because her ex-boyfriend had told him that she might have been infected with HIV. To identify Mycobacterium species the formalin-fixed paraffin-embedded tissues of mesenteric lymph nodes were sent to Central Arkansas VA Medical Center laboratory, where Mycobacterium tuberculosis DNA complex was not detected by use of polymerase chain reaction (PCR) assays. This case was reported as HIV/AIDS to NJ State since the diagnosis had not been made antemortem.

HIV/AIDS, Sudden Death, Mycobacterium

G2 Assisted Suicide as Practiced in the French Part of Switzerland

Sandra E. Burkhardt, MD, Jerome Sobel, MD, and Romano La Harpe, MD, Institute of Forensic Medicine, 9, Avenue de Champel, Geneva, 1206, Switzerland*

After attending this presentation, attendees will understand the legal aspects of assisted suicide in Switzerland, where the penal code condones this practice for altruistic reasons, even if not performed by a doctor; the prevalence of this type of death and the way it is treated.

This presentation will impact the forensic community and/or humanity by demonstrating how the number of cases of assisted suicide is growing every year in Switzerland, responding to the requests of very sick patients, when palliative care and other alternatives are not efficient enough anymore.

Assisted suicide is permitted in several countries and jurisdictions: Belgium, the Netherlands, the state of Oregon (USA) and Switzerland. The practice of assisted suicide is controversial leading to debates among doctors, jurists, and ethicists.

In Switzerland, article 115 of the Swiss penal code considers assistance suicide a crime if and only if the motive is for personal gain. It condones assisting suicide for altruistic reasons. This allows associations such as EXIT-ADMD (French Switzerland), EXIT German Switzerland, or DIGNITAS to assist severely ill patients under certain conditions in their desire to end their lives.

This study takes into consideration 200 cases of assisted suicide performed by the association EXIT-ADMD between 2001 and 2005. The districts of Vaud and Geneva were the primary focus of this study, with and the number of cases increasing continually over this time period. Most of the patients were female. The most frequent pathologic conditions were neoplasia, neurological diseases, and cardio-vascular diseases. The average age of patients was over 70. More than $\frac{3}{4}$ of assisted suicides occurred at home; 20 patients died at a nursing home. Due to internal policy restrictions, some of the patients had to leave the hospital or nursing home in which they were staying in order to receive assistance with their suicide.

The most common lethal substance used by patients, when assisted in their suicide, was sodium pentobarbital (between 11 and 15 grams) inducing coma within less than ten minutes, and leading to a painless death within than 30 minutes. At the moment of death, their family or relatives surrounded most patients.

Legal requirements following such a death are quite simple in Geneva. As it is a violent death, the forensic physician must examine the remains, and completes a death certificate noting the unnatural nature of death. Based on these medicolegal observations, the police officer completes a document called the "Nihil Obstat." This permits burial of the remains to take place without any other formality, allowing for full respect of the deceased and his/her family.

Assisted Suicide, EXIT Association, Switzerland

G3 Firearms Injuries: Beyond Entry and Exit Wounds

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After attending this presentation, attendees will learn (1) the diagnostic features of pattern injuries made by firearms; and (2) their relevant role in criminal investigations.

This presentation will impact the forensic community and/or humanity by showing several case studies in which patterned abrasions and wounds were useful in the identification of the firearms used and in the reconstruction of the assaults.

Patterned injuries usually occur when the force is applied at or near a right angle to the skin surface, rather than with the skidding impact of a graze. If a weapon with a patterned surface strikes the skin, abrasions or bruises and even lacerations follow the ridges of the object if it has a

profile of varying height. Formerly it was often claimed that abrasions retained the pattern of the impacting object more accurately than other injuries such as bruises and lacerations. However, even if abrasions do preserve such patterns well, bruises and lacerations may also follow the profile of the inflicting object reproducing exactly the imprint of firearm weapons and/or its parts.

The plastic grip of a firearm weapon can easily imprint its design on the skin producing bruises and/or lacerations at the edges of the impact site such as heavy objects with firm impacts used to do. The skin between the thumb and index finger of the hand holding a pistol may slightly overlap the lumen of the barrel so that a graze wound can occur. Shape and size of pattern injuries are often useful for the identification of the weapon used in the assault. In the literature, there have been many reported cases in which additional pattern injuries have been found in the area surrounding the entry wounds produced by shotguns, revolvers, and semiautomatic pistols due to the peculiar firearm muzzle design. These findings have been used in shooting reconstruction and also to establish the range of fire. It is well known that if the discharge is contact, the muzzle of a firearm can imprint an abrasion on the skin surface. Hard and loose-contact wounds have been described depending on whether the muzzle of the weapon is jammed "hard" against the skin (so that the skin envelops the muzzle) or held lightly against the skin. Even when there is a gap between the muzzle and the skin, for example when the barrel of the weapon is held at an acute angle to the skin, the muzzle can imprint part of its circumference thus producing angled or incomplete-contact wounds. Difficulties in interpreting such pattern injuries may occur when the injury involves a surface not completely flat such as the head. In these cases the position of the edge that digs in most deeply may give an indication of the angle of the blow.

Pattern Injuries, Firearm Wounds, Ballistic

G4 The Mummified Corpse Found in a Domestic Setting

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After attending this presentation, attendees will gain an understanding of the forensic and ethical issues pertaining to unattended deaths of those with little or no contact with society and the mummified remains found after a significant period of time after death.

This presentation will impact the forensic community and/or humanity by presenting a case of a mummified corpse found several years after death.

Mummification refers to all natural and artificial processes that bring about preservation of the body or its parts. Such processes include primarily the drying of the soft tissues instead of liquefying putrefaction. The essential requirement for mummification is a dry environment, preferably with a moving air current, which is usually in a warm environment. The most widely known form of mummification is in hot and arid areas like Egypt, Chile, and Peru. It is also likely to occur in temperate climates especially when the body is left undisturbed in warm dry place such as closed rooms, closets, and attics.

A mummified body of an 86-year-old white male with a history of coronary atherosclerosis was found in the entryway of his apartment located in a condominium of the city of Bari (Southern Italy) approximately seven years after death. The body was sitting on the carpet in front of an easy chair, clothed in a woolen vest with dark pants and shoes. The head was lying face down on the easy chair and the scalp with long grey hair was still present. The appearances of mummification

included desiccation and brittleness of the skin, which was stretched tightly across anatomical prominences such as the cheekbones, chin, costal margin, and hips. The skin and the underlying tissues of the body were darkened, hard, forming a leathery shell over the body and making autopsy dissection difficult. The corpse was well preserved through the mummification process and no external injuries were observed. There was little evidence of insect activity. The shutters of the entry way were closed but the windows were open so that there was accessibility to air. The carpet on which the body was sitting and the upholstery of the easy chair on which the head was lying absorbed most of the early putrefactive fluids. Several empty pupae of *Lucilia sericata* and *Calliphora vicina*, cast larval skins of Dermestidae (Coleoptera) along with dermestid frass (excreta) were found on the floor close to the body suggesting a death occurred during the spring season.

Mummification often occurs in elderly bodies due to rapid dehydration of the outer surface. The rapidity of dehydration may reduce the usual swelling of the body preventing also putrefaction by enteric microorganisms, soil bacteria, and other decay organisms. The rapid drying of soft tissues may also protect the internal organs even from insect colonization as in this case where after the drying had taken place, the corpse remained in that state for many years with no insect activity at all. Larval infestation for all blow fly species is usually hindered by the rapid dehydration of the skin surface; female adults recognize dehydrated and/or mummified skin as hospitable to the larval stages which need both moisture and accessibility to air. Radiographs of the body disclosed osteoporosis but no fractures or other evidence of blunt trauma. The internal organs were well preserved. However, the cause of death was undetermined. Based on the antemortem data available the remains were rapidly identified by dental comparison. The man had been missing seven years. The neighbors stated they had thought that the man had died a long time ago. Unpaid electricity bills resulted in termination of electrical service. The paid condominium bills forced the manager of the condominium led to the entry of the apartment.

Mummification, Postmortem Changes, Forensic Taphonomy and Entomology

G5 Acute Hemorrhagic Leukoencephalopathy (Weston-Hurst Disease): A Natural Disease Presents as Head Trauma

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The goal of this presentation is to describe a case of death due to acute hemorrhagic leukoencephalopathy (AHL), a natural disease masquerading as head trauma.

This presentation will impact the forensic community and/or humanity by demonstrating how AHL, a natural occurring brain disease which may mimic brain trauma and must be considered in the differential diagnosis of cerebral hemorrhage.

Naturally occurring neurologic disease may occasionally mimic traumatic injury.

A 19-year-old man complained of headache after bouncing a soccer-ball on his head. He was admitted to a hospital where he became lethargic, then comatose. A computed tomographic (CT) scan revealed dense, bilateral, frontal lobe hematomas. Angiography did not demonstrate vascular abnormalities. A craniotomy was performed to evacuate the hematomas; however the patient died after a four day hospitalization. Further history revealed that the patient may have sustained head trauma during an altercation in the days previous to the hospital admission. Because of the possibility of a trauma related death, jurisdiction was assumed by the medical examiner and an autopsy was performed. Gross

neuropathologic examination revealed a swollen, soft brain that exhibited evidence of surgical intervention and transtentorial herniation. The frontal lobes had dense, confluent hemorrhages, located predominantly in the white matter, extending across the genu of the corpus callosum. Additional foci of hemorrhage were in the convolutional white matter of the cingulate gyrus and the internal and external capsules. There were no cortical contusions or other traumatic pathology. Histologic examination demonstrated perivascular hemorrhage surrounding necrotic blood vessels with fibrinous exudates within the Virchow Robin spaces, perivascular inflammation, and demyelination. These findings were diagnostic of AHL.

AHL, or Weston-Hurst disease, is a rare inflammatory, demyelinating disease of the brain characterized clinically by an abrupt onset of neurologic symptoms and signs with rapid progression. Its onset is frequently associated with an antecedent viral illness. The disease is usually fatal, although recovery has been described with medical treatment. The clinical differential diagnosis includes herpes simplex virus type 1 encephalitis, meningoencephalitis, encephalomyelitis, sagittal sinus thrombosis, central nervous system vasculitis, and in the elderly, congophilic angiopathy. Traumatic injuries are usually not entertained in the differential diagnosis, although the gross findings are similar to those associated with fat embolism following skeletal fractures. In this case, the unusual CT scan findings and the history of possible antecedent head injuries led to the suspicion that the lesions resulted from head trauma. This case illustrates the importance for forensic pathologists to recognize AHL as a natural disease process that may rarely mimic traumatic brain injury.

Head Trauma, Acute Hemorrhagic Leukoencephalopathy, Demyelinating Disease

G6 Weight That Kills: Adults With Natural Deaths are Heavier Than Those Dying Non-Naturally — A Cross-Sectional Study

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After attending this presentation, attendees will understand the impact of obesity on natural death by applying standard epidemiologic techniques to data obtained at the State of Maryland Medical Examiner Office.

This presentation will impact the forensic community and/or humanity by highlighting the problem of obesity and raising awareness of how deep and broad the problem is and the need to address it.

Introduction: The morbidity and mortality produced by obesity in the United States and other developed societies has reached epidemic proportions. Although the problem starts in childhood and adolescence, the medical impact takes hold in adult life. Clinical studies have shown the effect of obesity on cardiovascular disease, diabetes, cancer degenerative joint diseases among others, and some autopsy studies have confirmed the clinical findings.

Aim: To evaluate the magnitude and severity of the impact of obesity on mortality

Hypothesis: Excess weight is a risk factor for mortality; thus Body Mass Index (BMI) in individuals with a natural death is higher than in those with non-natural deaths (they would be alive if not for the non-natural factors).

Methods: Cross-sectional study involving young and middle age adults (ages 20 – 50 years) in the state of Maryland whose death during a recent three year period (2002-2005) was either unexpected or violent.

Cases were selected from the State of Maryland Office of the Chief Medical Examiner (OCME) database. The State of Maryland has a single,

centralized office that covers the entire state. All non-natural deaths and purely natural deaths that are unexpected or unsupervised by a physician, affecting persons under 50 years of age are transported to the office for cause of death investigation.

- Each body was measured and weighed upon arrival at the OCME.
- BMI was calculated following a standard formula ($BMI = \text{weight in kilograms} / \text{height in meters}^2$)
- Cases were tabulated by age, gender, manner of death, height, weight, BMI and BMI NIH categories (normal [$BMI < 25$], overweight [$25 \leq BMI < 30$], obese [$30 \leq BMI < 40$] and very obese [$BMI \geq 40$])
- Non-natural deaths (Accident, Suicide, Homicide and Undetermined) were analyzed separately and grouped together for comparison
- Statistical analysis included descriptive statistics and multivariate logistic regression, using likelihood ratio tests of statistical significance. Effect sizes were estimated by odds ratios (OR)
- Possible bias (systematic errors impacting the different groups differently) were sought and discussed

Results: The study included 6987 individuals, 2097 (30.0%) had natural deaths and 4890 had non-natural [1345 (19.3%) were accidents, 1210 (17.3%) were homicides, 642 (9.2%) were suicides and 1693 (24.2%) undetermined.

- The percentage of women in the natural death group was higher (34.0%) than in the non-natural deaths (21.5%), and the average age (SD) was higher for the group of natural deaths (41.3 ± 7.0) than the group of non-natural deaths (35.1 ± 9.0).
- BMI was an independent risk factor ($p < 0.0001$, OR=9.4) for natural death when adjusted for age ($p < 0.0001$, OR=15.4) and gender ($p < 0.0001$, OR=1.7 F/M) in a multivariate logistic regression analysis. Per unit of measure, BMI was a comparable risk factor to age.
- The mean (SD) BMI in natural deaths was higher than that of non-natural deaths: $29.3 (9.1)$ vs. $27.5 (6.5)$.
- The percent of natural deaths among the different BMI levels was 26.9% for people in the normal weight range, 27.9% in the overweight group, 32.1% in the obese group, and 48.6% among the very obese.

Conclusions: In an adult population, the relative frequency of natural death increases steadily with increasing levels of obesity. This increase persists when adjusted for both age and gender, indicating that obesity is an independent risk factor, comparable or greater in its effect to age.

Obesity, Body Mass Index, Natural Deaths

G7 Forensic Science “Case Derived” Templates Formulated With Relational Database Software

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This presentation demonstrates the forensic science utility of commercial open-marketed relational databases in template and table production, report and forms formulations, and query fashioning.

This presentation will impact the forensic community and/or humanity by demonstrating the valuable and available merits of relational database use in the forensic sciences as a readily learned, available, and important tool in the armamentarium of the forensic scientist.

Using Microsoft Access relational database software, a series of templates are presented covering forensic science topics, especially those arising in forensic pathology and crime laboratory environment.

Templates are important graphic aids in data entry and case analysis; in relational databases they are formulated by critically selecting fields for data tables. Precise and accurate derivations of essential factors pertaining to the selected data item are necessary; however, database structures are readily edited, improve with review, making templates dynamic and progressive. The ease of template production is emphasized.

Other dimensions of relational database software are demonstrated and include the production of relational tables, the use of queries, and the production of forms and reports. Relational database application mastery is presented as a legitimate forensic science skill.

Evaluations of the available relational databases on the basis of ease of use, availability of support services and educational courses, certifications, personal application, and cost are presented. A summative reference is made available.

Relational Database, Templates, Computer Software

G8 Three Unusual Neuropathologic-Related Causes of Sudden Death

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The goal of this presentation is to make the audience familiar with three unusual neuropathologic entities that may contribute to sudden death in the medicolegal setting.

This presentation will impact the forensic community and/or humanity by demonstrating cases that exemplify the range of neuropathologic maladies that may contribute to sudden, unexpected or suspicious deaths highlight the asset a neuropathology consultation provides and emphasize the utility of postmortem examinations in the elucidation of medical diseases and co-morbidity.

The autopsy findings of three medicolegal cases of sudden death associated with uncommon neuropathologic findings of which the general forensic pathologist may not be familiar are reviewed. Two cases were unexpected deaths that involved relatively young patients with histories of seizure disorders. Neurologic disorders were suspected but the exact relationship to the cause of death was not defined until postmortem examination. The other patient was elderly, thus, not an unexpected death; however, because of circumstances surrounding the scene investigation an autopsy was performed and an unexpected rare neuropathologic abnormality was found.

Case 1 was a 43-year-old male with a history of congenital nevi of his head, torso, and extremities. The patient also suffered from hypertension, chronic alcoholism, and a poorly controlled grand mal seizure disorder of five years duration prior to death. He was discovered unresponsive in a bathroom and autopsy revealed a malignant melanocytic tumor diffusely infiltrating the leptomeninges and focally the cortex of the superior gyrus of his left temporal lobe. The cause of death was attributed to a seizure due to a malignant melanoma of the temporal lobe arising in the context of neurocutaneous melanosis.

Case 2 was a 57-year-old female with a history of mental retardation, clumsiness, incoordination, and a childhood seizure disorder that developed as a sequel to chronic infantile lead poisoning. She was discovered unresponsive and asystolic on her bedroom floor. Twelve days prior to her death she had a witnessed fall down a staircase, and fractured her left leg. The cause of death was a pulmonary thromboembolism due to deep venous thrombosis status post left leg fracture. Autopsy also revealed profound atrophy and gliosis of her cerebellum consistent with residual damage from chronic lead poisoning. Although peripheral nervous system involvement in chronic lead poisoning is well known, less so is marked cerebellar atrophy with subsequent incoordination as occurred in this case.

Case 3 was a 75-year-old female with a history of chronic osteoarthritis, hypertensive atherosclerotic cardiovascular disease, and

depression and, six month duration of neck and head pain. She was found dead in bed under suspicious circumstances so a postmortem examination was performed. The cause of death was due to acute bacterial leptomeningitis at the cervico-medullary junction, acute inflammation of the adjacent dura mater and the tissue of her upper cervical spinal column associated with subluxation and instability of her atlanto axial (AA) joint. The case compares to what is known as Grisel's syndrome, a subluxation of the AA joint due to inflammation-induced ligamentous instability associated with an infectious/inflammatory process of the head or neck. Grisel's syndrome is more often found in children than adults; it may produce spinal and neurologic complications and, rarely, death.

Neurocutaneous Melanosis, Lead Encephalopathy, Grisel's Syndrome

G9 Ruptured Cerebral Artery Aneurysm Mimicking Home Invasion and Assault

Albert Y. Chu, MD, MHS, and Luis A. Sanchez, MD, Harris County Medical Examiner's Office, 1885 Old Spanish Trail, Houston, TX 77054*

After attending this presentation, attendees will understand a case of a 48-year-old white female with blunt force injuries who was found nude and semi-conscious in her ransacked residence. While the case was initially investigated as a possible home invasion and assault, the "victim" was ultimately diagnosed with a ruptured left posterior communicating artery aneurysm before dying.

This presentation will impact the forensic community and/or humanity by demonstrating that cases of ruptured cerebral artery aneurysm may rarely present with psychotic and/or violent behavior and that this behavior may in turn result in scene findings and injuries that may initially be confused with criminal activity and awareness of psychotic and/or violent behavior as an unusual presenting symptom of ruptured cerebral artery aneurysm and its potential to mimic assault at the scene.

A 48-year-old white female with a history of hypertension was found at her residence during a welfare check performed by her landlord and her best friend. The decedent was nude, semi-conscious, and "appeared to have been beaten." In addition, the house, which according to the landlord was typically kept very clean and tidy, was "trashed." EMS was activated, and the decedent was taken to the hospital.

Police arrived on the scene and investigated the case as an assault. The doors to the residence were locked but not secure and showed no signs of forced entry. Disarray at the scene was limited to the living room, kitchen, dining room, and bathroom; the two bedrooms were tidy. In the living room and dining room, various pieces of furniture and the television had been overturned, and broken dishes and glassware were strewn about. A lampshade had been torn to pieces. In the kitchen, the door of the oven had been removed and was located in an adjacent hallway, a bathrobe was in the refrigerator, and pieces of chicken were scattered throughout. Vacuum cleaner parts were in the washing machine. In the bathroom, vomit was on the floor and a can of insect repellent was in the toilet. No valuables were missing from the house.

At the hospital, the decedent was noted to have numerous contusions and abrasions, predominantly on the extremities. Toxicologic screening for drugs of abuse and alcohol performed the day of admission was negative. A sexual assault examination was also negative, and ultimately no evidence of semen was detected in any of the swabs or clothing collected. A computed tomography scan detected subarachnoid hemorrhage at the base of the brain, and angiography detected a ruptured left posterior communicating artery aneurysm. Despite a coil embolization procedure, the decedent never became coherent and expired nine days after arrival to the hospital. Because the attending physician thought that the decedent's blunt force injuries may have contributed to death, the decedent was brought to the Harris County Medical Examiner's Office for autopsy.

Autopsy examination confirmed the presence of subarachnoid hemorrhage associated with the treated left posterior communicating artery aneurysm. Injuries were limited to cutaneous injuries of the torso and extremities detected externally; no internal evidence of blunt force or penetrating trauma was identified. Additional findings included evidence of the decedent's known hypertensive cardiovascular disease including cardiomegaly with concentric left ventricular hypertrophy and myocyte hypertrophy and renal arteriolosclerosis. The cause of death was classified as ruptured cerebral artery aneurysm due to hypertensive cardiovascular disease, and the manner was classified as natural.

Cerebral artery aneurysms are relatively common and have been reported as incidental findings in up to five percent of all autopsies. Typically, these aneurysms are asymptomatic unless they rupture, in which case most symptoms are due to the resulting subarachnoid hemorrhage. The classic presentation is that of "the worst headache in my life"; other common symptoms include loss of consciousness, seizures, meningeal signs, nausea and vomiting, drowsiness, dizziness, and cranial nerve deficits. Psychiatric symptoms, while previously reported, are unusual. This rare presentation of ruptured cerebral aneurysm resulted in a criminal investigation of possible assault.

Cerebral Artery Aneurysm, Psychosis, Assault

G10 Checking In to Check Out: The New Mexico Experience of Suicide Occurring in Hotels

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After attending this presentation, attendees will have an awareness of features of hotel facilities, which may attract individuals contemplating suicide and the characteristic findings of the population that complete the act in this setting.

This presentation will impact the forensic community and/or humanity by delineating findings and behavior, which may assist in the determination of manner of death as suicide occurring in a hotel as well as facilitate discussion with the family under these circumstances. Possible points of intervention by hotel personnel are examined. Safety issues in the hospitality industry are underscored.

Hotels offer many advantages to the individual contemplating suicide, including but not limited to, privacy, an expected guarantee of timely discovery which will not traumatize loved ones, a place to stay when one has traveled to avoid recognition in their own community, sanctuary, a place to act out, neutral ground during disputes, or simply a high building with access to the roof. For others, it may be the end of a long road trip during which suicide was contemplated. Perhaps the sterility and depersonalized setting appeals to those with depression. All cases in New Mexico certified as suicide where the death occurred in a hotel setting or equivalent between 1995 and 2005 were reviewed for demographics and unique features (N=74, 2% of suicides certified in the State in this time frame).

This setting is preferred by White (73%) males (74%) between the ages of 30 and 50 (69%).

Firearm injuries are the method of choice in 42% of cases; no firearm suicides were immediately discovered because of the sound of the discharge of the weapon.

Drug intoxications accounted for 22% of the deaths; 22% of the non-illicit drug intoxications had detectable antiemetic substances. Although *Final Exit* recommends the use of an antiemetic in cases of contemplated overdose, it is also recommended that when death occurs in a hotel, a note of apology to the staff and a large tip be left. Neither of these was present in any of the cases.

There were a surprising number of somewhat unusual deaths, including cyanide poisoning, a stab wound of the leg (in a paraplegic individual), cold exposure, helium inhalation, jumping from a height (through a skylight into the lobby), and self-immolation.

Notes were present in 30% of cases and 18% of cases were considered to be highly organized (photographs, wills, insurance policies, "do-not-resuscitate" statements, Hemlock Society membership, religious material, etc.). Suicide in a hotel would seem to require at least some degree of planning and organization. Of the six deaths due to incised wounds, only one employed a weapon at hand (broken bottle). Of the five hangings, only two individuals brought a ligature to the scene; the remainder used linens or clothes hangers, items likely to be found in a hotel setting. In nine cases, there was multiple occupancy of the hotel room, although most of these were not witnessed.

The suicide notes in two cases indicated that the decedents had an advanced malignancy. At autopsy, neither case had an identifiable neoplasm. It is not known if this was a sincere belief on the part of the decedent or an attempt to console the family.

Cocaine was present in 12% of cases and was related to the cause of death in only one. It was by far the most common drug of abuse detected. Alcohol was present in 38% of cases, with 18% of these less than 0.04 mg/dL (possible bracing effect) and 36% greater than 0.2 mg/dL. It appears that when alcohol is consumed in this setting, the blood concentration is likely to be high. In three cases where death was attributed to illicit drug intoxication, all had suicide notes.

Decedents resided out of state in 28% of cases, almost half of these in states adjacent to New Mexico. Over half of the cases resided less than 100 miles from the scene, with 22% less than ten miles. It is possible that a polite question or inquiry by registering personnel regarding nearby residence may be a point of intervention.

There should be concern for the safety and welfare of personnel in the hospitality industry as these cases included physical domestic violence (x3), violent felons (x2), law enforcement stand-offs (x2), shooting outside the hotel room (x2) and a prison escapee. The case of self-immolation in particular could have caused a large-scale tragedy.

Suicide, Hotel, New Mexico

G11 Liver Laceration as a Result of Resuscitation in an Adult Man

Ellen G. Moffatt, MD, Office of the Chief Medical Examiner, 850 Bryant Street, San Francisco, CA 94103*

After attending this presentation, attendees will understand some of the more obscure complications of resuscitation in adults, in order to identify them at autopsy. This case is presented as an example of an injury that may be mistakenly interpreted as one that caused or contributed to death.

This presentation will impact the forensic community and/or humanity by differentiating injuries as the result of trauma and as the result of postmortem (or perimortem) resuscitation and reasons for their formation.

A 41-year-old male police officer on a nighttime training exercise collapsed suddenly. His fellow police officers immediately began CPR. His past medical history included controlled hypercholesterolemia, and complaints of left arm tingling the week prior to his death.

At autopsy, abrasions were on the center of the chest with fractures of the right fourth and fifth ribs at the sternum and the right fifth rib laterally. An 8.0 centimeter laceration was at the falciform ligament. Approximately 750 milliliters of unclotted blood was in the abdominal cavity.

Although the total cardiac weight (380 grams) was normal for his height and weight, the left ventricle measured 2.0 centimeters and the

septum thickness ranged from 2.0 centimeters to 1.1 centimeters. Histologically the heart showed focal cytomyolysis and fibrosis adjacent to the bundle of His. Occasional parenchymal vessels had medial hypertrophy with narrowing of their lumens. Toxicology studies were negative. There was no evidence of head injury.

Liver lacerations are an uncommon, but recognized, complication in resuscitation in children. Liver lacerations as a complication of resuscitation in adults have been rarely reported, and are usually seen in patients receiving thrombolytic or anticoagulant therapy (1, 2). Other uncommon complications of resuscitation include tracheal rupture (3), lung herniation (4), heart rupture (5, 6) and gastric rupture (7,8). Other more common complications of resuscitation in adult include broken ribs, along with heart and splenic lacerations.

Proposed mechanisms of this injury include disparate size between rescuer and victim, and over-enthusiastic or incorrect placement of chest compressions.

Resuscitation, Complication, Laceration

G12 The Epidemiology of Sudden Cardiac Death in Young Decedent Medical Examiner Cases

Sharon M. Derrick, PhD, Stacey A. Mitchell, MSN, RN, and Luis A. Sanchez, MD, Harris County Medical Examiner's Office, 1885 Old Spanish Trail, Houston, TX 77054*

After attending this presentation, attendees will understand the epidemiology of sudden cardiac death cases (SCD) presenting to a large medical examiner's office over a five year time span (2001-2005) resulting in increased understanding of the etiology of this cause of death.

This presentation will impact the forensic community and/or humanity by providing detailed medical and social history information recovered from a population of young individuals who died from sudden cardiac death. The resulting database is large enough to provide statistically significant data that can be used as a basis for further research. Dissemination of this information may support an emphasis on innovative screening and prevention practices targeting youth, ultimately contributing to decreased mortality from SCD in this at-risk segment of the United States population.

Sudden Cardiac Death (SCD) is the leading cause of natural death each year in the United States. This poster presentation will inform attendees regarding the epidemiology of SCD cases presenting to a large medical examiner's office over a five year time span (2001-2005), resulting in increased understanding of the etiology of this cause of death. SCD is often the result of untreated rapid ventricular tachycardia or ventricular fibrillation but it may be due to a variety of different conditions, including but not limited to acute myocardial infarction, coronary artery disease, cardiomyopathies, myocarditis, valvular heart disease, conduction abnormalities and drug toxicity (prescription and recreational).

SCD is a significant public health problem, the basis of which will be more effectively addressed through building a clear and accurate picture of young SCD decedents, thereby broadening innovative intervention projects to include previously underserved at-risk segments of the population.

A retrospective record review was conducted at the Harris County Medical Examiner's Office in Houston, Texas (HCME) that identified natural deaths reported to the HCME from 2002 through 2004. A full case review was performed for all of the cases in which cardiac death was listed as the primary cause of death after autopsy or external exam and in which the decedent was under the age of 50 years. Socially influenced factors, such as obesity (listed as contributory on the death certificate), tobacco use, and chronic ethanolism were noted for each case in addition to the decedents' medical histories.

Decedents whose cause of death was cardiac-related comprised 52% of cases presenting to the HCME during the 2002-2004 time period. Of those cases, 20% were under the age of 50, 72% were male and 51% were of Caucasian descent. A notable 43% were smokers. Obesity was listed on the death certificate as a contributing factor in 5% of the cases and chronic ethanolism contributed in 3%. Atherosclerotic Cardiovascular Disease and Hypertensive Cardiovascular Disease were diagnosed in 54% of those individuals under the age of 20 years. From 2002 to 2004, cardiovascular disease was shown to be the cause of death in 16 children between the ages of 12 and 18, with the majority collapsing while participating in athletic events. In light of these findings further study has been initiated at the HCME, expanding the study to the five year span of 2001-2005, reducing the upper age limit to 40 years, and exploring other case history factors for all of the cases such as cardiac enzyme levels, and prescription and recreational drug use. Body Mass Index was also calculated for each decedent. The analyzed results of the expanded findings are described in the poster presentation.

The important contribution of socio-cultural behaviors to health status has been documented in the medical and public health literature. Modifications of these behaviors, combined with the use of basic non-invasive cardiac diagnostic screening tests may greatly reduce the risk of SCD among younger individuals, such as student athletes. The HCME and other medical examiner offices can be instrumental in raising community awareness of SCD. A key goal of this public health education should be to promote the benefits of screening and prevention measures.

Cardiac, SCD, Epidemiology

G13 Significance of Blood Neopterin Measurement in Forensic Autopsy Cases

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After attending this presentation, attendees will understand how increased neopterin levels in postmortem blood samples identified with immunohistochemistry indicate non-specific viral infection.

This presentation will impact the forensic community and/or humanity by demonstrating how correct interpretation of postmortem blood neopterin levels can direct the postmortem examination in a cost-effective and efficient manner.

Definitive and specific diagnoses regarding infection with fatal viral pathogens are often hampered by the significant cost and labor associated with immunohistochemical staining. However, examination of non-specific markers for viral infection through high-throughput laboratory methods serves to direct the postmortem examination in a cost-effective and efficient manner. Neopterin, a pteridine released by macrophages, is a well-established marker of immune system activation. This study analyzes postmortem blood neopterin levels from multiple anatomic sites in an attempt to elucidate their accuracy in diagnosis of fatal viral infection. Medicolegal autopsy cases (n=521, 1-96 years of age, 366 males and 155 females) were examined. Causes of death were blunt injury (n=118), sharp injury (n=27), poisoning (n=26), drowning (n=30), fire fatalities (n=85), hypothermia (n=10), asphyxiation (n=30), hyperthermia (n=7), and natural death (n=143). Blood samples were collected at the time of postmortem examination from the subclavian and femoral veins and from the left and right heart. Neopterin levels were measured by high performance liquid chromatography. Neopterin levels greater than 500 pmol/mL correlated with fatal viral infection. Viral infection was

confirmed by histology and PCR. Levels of C-reactive protein, an additional marker of immune system activation, and neopterin were compared and a high correlation was observed in right heart blood. However, neopterin levels from all sites were significantly higher in cases of multiple organ failure that was not associated with viral infection than in other cases.

This study indicates that postmortem blood neopterin levels are both useful and cost-effective as a non-specific marker of viral infection. As the purpose of the postmortem examination is to provide the most specific information regarding cause of death possible, it is appropriate, though expensive, to elucidate the specific pathogen. Increased neopterin levels, in cases of possible viral infection, should trigger the immunohistochemical examination of tissue samples for specific viral antigens. However, neopterin levels may also be elevated in the face of drug use, chronic heart failure, and renal disease and caution should be used in interpreting blood neopterin content in the presence of these conditions.

Neopterin, C-reactive Protein, Viral Infection

G14 Evaluation of Nasopharyngeal Viral Swabs in Infants Dying of Natural Causes

Wendy A. Stroh, DO, and Deborah Kay, MD, Office of the Chief Medical Examiner, 400 East Jackson Street, Richmond, VA 23219*

After attending this presentation, attendees will be more informed on viral nasopharyngeal swabs in the infant population regarding frequency of use, results, and their impact on cause of death.

This presentation will impact the forensic community and/or humanity by elucidating the impact of viral postmortem testing in infants dying of natural causes.

This presentation will acquaint conference attendees with viral nasopharyngeal culture swabs use in an infant population less than one-year-old, dying of natural causes as well as the use of positive results in determining the cause of death. Information on the viral nasopharyngeal swab such as appropriate collection and submission techniques, sample rejection criteria utilized at the laboratory, and laboratory technology employed in determining results and its limitations of the technology is also provided.

The Office of the Chief Medical Examiner in Richmond, Virginia has used nasopharyngeal swabs to obtain viral culture samples since 2003. Viral nasopharyngeal culture swabs are performed in the vast majority of infant autopsies at this institution. They are routinely submitted along with blood and cerebrospinal spinal fluid cultures as part of the postmortem evaluation of all infants in whom Sudden Infant Death Syndrome is a consideration.

Autopsy charts on all infants under the age on one year dying of natural causes were reviewed. Data was tabulated on the total number of autopsies, total number of viral nasopharyngeal cultures obtained, submitted resulted and rejected or not performed and reasons for rejection, total number of positive cultures including virus type detected and total number of negative results (no virus identified).

The viral nasopharyngeal swab kit contents are discussed. Appropriate procedures for obtaining optimal results in regards to sampling, storage of the specimen and proper submission are provided. Examples of rejection criteria are included as are factors that adversely affect culture results.

A discussion of the laboratory technology employed to obtain viral nasopharyngeal culture results is included. The limitations of the technology are listed. A list of types of viruses detected is included. Other technologies for obtaining viral culture results are mentioned as well as the limitations of these methods and factors affecting culture results.

Postmortem viral nasopharyngeal swab culture results are compared with antemortem results on infants of a similar age group. Factors, which

may contribute to differences in the results of the two groups, are postulated.

The influence of positive viral nasopharyngeal swab culture results on the cause of death is discussed including correlation of the viral results with other autopsy findings such as microscopy. Negative culture results and factors, which may contribute to negative results, are also mentioned. Brief case summaries on several autopsies with positive viral nasopharyngeal culture results are presented as examples of correlation of culture results with other autopsy findings to determine the causes of death.

Nasopharyngeal Swabs, Infants, Autopsy

G15 Succession of Microfungi in Grave Soil

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After attending this presentation, attendees will understand that soil microfungi possess the potential to act as a tool to estimate extended postmortem and postburial interval.

This presentation will impact the forensic community and/or humanity by providing investigators with a novel method for estimating time since death in cases involving buried remains.

The estimation of postmortem interval (PMI) becomes increasingly inaccurate as decomposition proceeds. Estimating postmortem period in cases where a body is buried in soil is particularly difficult because soil typically prevents forensically important insects from accessing the body. Thus, the development of insect larvae is generally unavailable as a forensic tool in investigations involving burials. Therefore, a need exists to develop new techniques for estimating PMI of buried bodies and postburial interval (PBI). This need is particularly great for bodies associated with an extended postmortem period (months to years).

The forensic application of microfungal ecology has the potential to improve the estimation of extended postmortem periods. Like the macrofungi, microfungi respond to nutrient amendment. This response typically results in fungal proliferation and, as the nutrient source is utilized, a succession of microfungal taxa occurs. This phenomenon is similar to insect succession associated with cadaver decomposition on the soil surface. In addition, some microfungi, primarily from order Onygenales, possess the ability to access keratin as a food source. This might be of particular importance to forensic science, as a body in extended PMI primarily comprises keratinaceous material such as skin, hair and nails.

A study was carried out to identify fungal species present in grave soil over a period of six months following inhumation. In spring 2006 five pig (*Sus scrofa*) carcasses were placed in separate shallow graves (40-50 cm) and covered with soil. Carcasses were exhumed at monthly intervals for the 6-month period. Soil was collected from the walls and base of each grave. These soils were sprinkled or diluted in water and spread onto tapwater, cornmeal, or Mycosel® agar plates containing the antibiotic chloramphenicol. This antibiotic was used to suppress the growth of bacteria and rapidly proliferating fungi that can overwhelm the fungi of interest.

Following the first exhumation, minimal decomposition had occurred and the carcass was classified as being in the fresh/bloat stage. As expected, there was no discernable difference between microfungus communities in control soil samples (taken at four depths one meter away from the cadaver) and soil taken from various microsites in contact with the cadaver. Communities were dominated by *Trichoderma* spp., *Mucor* spp., *Acremonium* spp., *Sordaria fimicola*, and coelomycete spp.; all common soil microfungi. These findings were able to provide a thorough background of the microfungi community in the soil.

Following the second exhumation, considerable decomposition had occurred and the carcass was classified as being in the active/advanced decomposition stage. Discernible differences in the microfungi community were apparent between grave soil and control soil samples, particularly with regard to the soil nematode community. This stage of decomposition is associated with an increase in bacterial-feeding nematodes that are then succeeded by fungal-feeding nematodes.

Exhumations will continue for the remainder of the trial and results for the six month period will be presented. Based on the preliminary results, it is anticipated that communities of nematophagous fungi will change in response to shifts in nematode community composition. These changes should be predictable over time. As a result, community structure data for nematophagous fungi has the potential to act as an additional forensic tool in estimating PMI and PBI of buried remains.

Microfungi, Grave Soil, Postburial Interval

G16 Improved Estimation of Postmortem Interval With Multiple Protein Markers and Improved Analytical Methods

Behnoush Memari, MS, Kenneth G Furton, PhD, and Alberto Sabucedo, PhD, Florida International University, Department of Chemistry and Biochemistry, 11200 SW 8th Street University Park CP-345, Miami, FL 33199*

After attending this presentation, attendees will learn about the development and utility of cardiac Troponin I (cTnI) and Troponin T (cTnT) as time since death markers for PMI Estimation.

This presentation will impact the forensic community and/or humanity by improving the accuracy in postmortem interval estimates. PMI provides crucial information required in many criminal, civil, and forensic investigations.

Time since death markers have lagged behind advances in forensics technology. Knight (1994) explains, "regrettably, the accuracy of estimating the postmortem interval (PMI) has by no means kept pace with the enormous strides made in technological sophistication." Early work on time since death focused on postmortem temperature measurements and algorithms to model postmortem cooling behavior. Current technology is still largely based on postmortem temperature methods similar to those described in the 1800's. Marshall summarized the temperature measurement method as follows, "It would seem that the timing of death by means of temperature can never be more than an approximation."

Biochemical markers for estimating time since death offer the possibility of increased accuracy and reliability in time since death estimates. Cardiac Troponin I (cTnI) and cardiac Troponin T (cTnT) are heart tissue proteins and selective markers of cardiac muscle damage. Investigation of these proteins as a marker for time since death shows great promise in mammalian heart tissue. cTnI and cTnT are found as intact protein in freshly sampled tissue at the onset of death, (T_0). These proteins are good substrates for several enzymes released in cardiac tissue upon death (necrosis). The proteolytic breakdown of these proteins by proteases in postmortem cardiac tissue is exploited to determine the postmortem interval. Both bovine and human heart tissue show similar banding patterns upon degradation. This technique takes a small sample of cardiac tissue that is homogenized and extracted with magnetic microparticles. The proteins are separated by SDS-PAGE electrophoresis and selectively visualized by Western blot. The Western blot is probed with mouse monoclonal antibodies against cardiac TnI and TnT. This step is followed by an anti-mouse conjugate labeled with alkaline phosphatase that is developed with a precipitating colored substrate. The degradation pattern of cTnI and cTnT is monitored using this bioanalytical protocol. The area of the bands within a lane is quantitated by scanning and digitizing the bands. Project methodology will be migrated to more

automated system such as capillary electrophoresis. This technique exploits the use of separation of the complex fraction isolated followed by detection of the fragments.

The results show a linear relationship between percent protein degraded and the log of postmortem time. A fresh "reference" human heart tissue obtained at time T_0 was incubated to obtain a temporal degradation profile. Comparison of human cardiac tissue samples with unknown time of death can be evaluated qualitatively against the "reference" human heart tissue. The time of death can be estimated by matching the "degradation fingerprint." Similarly, a calibration curve ($r > 0.95$) can be obtained with the percent cTnI degraded plotted against the log of the time postmortem using the reference human heart tissue. This curve can be used to estimate the time since death relative to the "reference" tissue based on the percent degradation. Data indicates that the degradation of cTnI in heart tissue shows very specific bands during a postmortem interval of a week. Troponin T is more stable in comparison to Troponin I so the degradation of cTnT should be longer. Data combined from cTnI and cTnT could be used for extended PMI estimate. Human cardiac tissue samples frozen at known time of death were analyzed by both semi-quantitative and qualitative techniques and both show similar agreement with the known time of death.

Overall, the data demonstrates that this technique represents a major advance in time of death determination providing a reliable semi-quantitative biochemical marker from a protected organ versus estimates based on direct temperature measurements. Tissue cardiac Troponin I and Troponin T shows excellent characteristics as time of death markers in the extended postmortem interval that is difficult to estimate with current methods.

TnI (Troponin I), TnT (TroponinT), Postmortem Interval (PMI)

G17 Drowning of a Child With a Cardiac Fibroma of the Interventricular Septum

Darshan R. Phatak, MD, and Luis A Sanchez, MD, Harris County Medical Examiner Office, 1885 Old Spanish Trail, Houston, TX 77054*

After attending this presentation, attendees will have a better comprehension of the nature of the presentation of this potentially fatal mesenchymal cardiac tumor, an understanding of the gross and microscopic pathology and the physiology of potentially fatal disturbances to cardiac function resulting from the size of the tumor and location in the heart.

This presentation will impact the forensic community and/or humanity by demonstrating why it is strongly recommended that those involved in the determination and certification of the cause and manner of death familiarize themselves with cardiac tumors" presentation, pathology and lethal potential and remember to include them in their differential diagnosis when confronted by cases such as this one.

This presentation will have a positive impact on pathologists, coroners, medical examiners, other autopsy practitioners and humanity at large as it can heighten general awareness towards a potentially treatable cardiac tumor that may be found either incidentally or strike down children, a vulnerable population subset, without warning.

A four-year-old Hispanic female child drowned in a swimming pool at a family gathering and had a past medical history of cardiomegaly and a heart murmur which were diagnosed neonatally, yet reportedly neither treated nor followed medically since infancy. Prior to death, the decedent had no health complaints or behavioral changes. At the scene, the decedent's stomach was bloated and clear fluid was reported in the respiratory tract.

Pertinent autopsy findings included cerebral edema, serous fluid within the pleural cavities, pneumonomegaly, and hepatosplenomegaly. Cardiomegaly and a fibroma of the interventricular septum were also found at autopsy. Toxicological tests were negative.

The majority of primary cardiac tumors are benign, with fibromas representing five percent of all cases. In the pediatric population, it is the second most common primary tumor of the heart after rhabdomyomas. The tumor also has a predilection to form within the interventricular septum and grows in size rapidly. Despite the lack of aggressive behavior or any metastatic potential, fibromas of the heart can interfere with normal physiologic function due to the interdigititation of tumor cells around and between cardiomyocytes and cardiac blood vessels and the possibility of entrapment and disruption of the cardiac conduction system that can result in a fatal arrhythmia. In addition to immediate local effects, the physical alteration of the cardiac muscle also results in pathologic changes of the other organ systems that will also impair the health of the individual over time.

The tumor is often surgically resectable or treatable by heart transplantation so therefore, proper diagnosis and prompt treatment can be lifesaving. Cardiac fibromas may also occur in the setting of the nevoid basal cell carcinoma syndrome (Gorlin-Goltz syndrome), so it can be beneficial for parents and other relatives to know the diagnosis. The most important lesion in the differential diagnosis is fibrosarcoma, a malignancy that is rare in the heart and in the general pediatric population. In a primary cardiac tumor, it is also of crucial importance to rule out a metastasis from a primary tumor of another location, as the treatment will vary.

This case of cardiac fibroma serves as a good example of a primary cardiac tumor's potential for fatal presentation in a child. Sometimes children with congenital heart abnormalities do not receive close monitoring of their health under a physician's care, and it is strongly recommended that those involved in the determination and certification of the cause and manner of death familiarize themselves with cardiac tumors' presentation, pathology and lethal potential and remember to include them in their differential diagnosis when confronted by cases such as this one.

Cardiac, Fibroma, Drowning

G18 Estimating Time of Death From Livor Mortis Patterns: A Case Presentation

William Massello III, MD, Office of the Chief Medical Examiner; 6600 Northside HS Road, Roanoke, VA 24019*

After attending this presentation, attendees will understand the forensic importance of recognizing patterns of lividity produced by articles of clothing and of documenting these patterns of lividity photographically. Patterns of lividity can be useful in estimating the time of death. Attendees will also come to appreciate how a pains taking analysis of postmortem photographs can have relevance to the application of the proper criminal charges.

This presentation will impact the forensic community and/or humanity by demonstrating how both scene photography and postmortem photography of the remains, when used in conjunction with computer resources, can be valuable in estimating the time of death. It also demonstrates that a careful analysis of patterns of lividity, even in postmortem digital photographs, can be important in providing evidentiary material for use in helping resolve important questions in criminal law.

Following this case presentation, the attendees will understand the forensic importance of recognizing patterns of lividity produced by articles of clothing and of documenting these patterns of lividity photographically. Additionally, it will be shown how these patterns of lividity can be useful in estimating the time of death. An understanding of the importance of postmortem photography as a tool in death investigation will be underscored. Attendees will also come to appreciate how a pains taking analysis of postmortem photographs can have relevance to the application of the proper criminal charges.

This case involves a 19-year-old white female who was a still-life photography model participating in a pornographic photo shoot in a studio in a small rural community. Following a photo shooting session, she voluntarily, orally took an unknown amount of a proprietary liquid morphine preparation and lay down to take a nap. While she was asleep on the bed, the photographer took some additional photographs and, later, by his own admission, performed sodomy on the individual while she was asleep. Approximately one hour later, he noticed that she wasn't breathing and called the local rescue squad. She was rushed to the hospital, where it was determined that she was pulseless, apneic, cold, and blue. It was determined by postmortem examination and toxicology that she had died from a lethal concentration of morphine, in combination with two other benzodiazepines, dextromethorphan in the presence of a residual concentration of cocaine and its metabolite, benzoylecgonine. Questions arose during the investigation concerning whether the decedent was alive and/or was capable of consent during the purported act of sodomy by the photographer.

Postmortem police scene photographs and digital photographs taken at the studio by the photographer while the decedent was asleep on the bed were reviewed. It was revealed that numerous patterned lividity markings, made by the decedent's clothing, had persisted for several hours after the clothing items had been removed. These photographs were matched up with the "date and time modified" column on the computer explorer window. They demonstrated that the decedent had expired at least more than an hour before the photographer admitted to sodomizing her. This finding was instrumental in showing that charges of non-consensual sexual assault, to include animate object penetration, were not appropriate in this case, because the decedent was already dead at the time the act of sodomy and digital insertion were performed.

Time of Death, Livor Mortis, Digital Photography

G19 Dispersion of Hesitation Marks and Defense Wounds: A New Criterion of Differentiation of Sharp Force Suicide and Homicide

Stéphanie Racette, BSc, Célia Kremer, MSc, Anne Desjarlais, and Anny Sauvageau, MD, Laboratoire de Sciences Judiciaires et de Médecine Légale, 1701, Parthenais Street, 12th floor, Montreal, Quebec H2K 3S7, Canada*

After attending this presentation, attendees will be introduced to a new criterion of differentiation of hesitation marks and defense wounds in sharp force injuries.

This presentation will impact the forensic community and/or humanity by providing new insight in the evaluation of hesitation marks and defense wounds.

In evaluating manner of death, forensic pathologists often rely on widely accepted criteria of differentiation at autopsy. For example, the presence of hesitation marks or defense wounds in sharp force injury cases has been accepted as a criterion of differentiation between sharp force suicide and homicide.

With this study, the authors wanted to enrich the description of hesitation marks and defense wounds. The authors hypothesize that (1) hesitation marks would predominantly be present on inner surface of upper limbs while such predominance would not be found for defense wounds, (2) a possible left predominance in hesitation marks could be found, considering the higher proportion in the general population of right-handed person and finally that (3) hesitation marks and defense wounds would show a different pattern of dispersion on upper limbs.

Over a 5-year period, in the Quebec province (Canada), all cases of suicidal and homicidal sharp force injury presenting hesitation marks (n=43) and defense wounds (n=91) were retrospectively reviewed. For

each case, hesitation marks or defense wounds were drawn on an upper limb chart divided into 12 sections covering the upper arm to the hands. The total amount of lesions for each section was compiled as well as the total amount of wounded sections. For all suicidal victims, a general chart of upper limbs was done by superimposing every chart with hesitation marks. The same was achieved with homicidal victims for defense wounds.

- (1) Sharp force victims of suicide presented a significant higher average amount of hesitation marks on inner aspect of upper limbs then on exterior surface ($p<0.05$). In victims of homicide, no difference was revealed between inner and exterior average amounts of defense wounds.
- (2) In terms of left and right comparison, a left predominance was not found for hesitation marks cases or for defense wounds cases. In fact, in suicide cases, the average amount of hesitation marks was the same on each inner side of upper limbs.
- (3) Graphical superimposition of hesitation marks/defense wounds for all victims visually revealed low dispersion of hesitation marks and high dispersion of defense wounds. This was statistically confirmed by comparing the average amount of hesitation marks/defense wounds and the average total number of wounded sections. For both inner and exterior aspects of upper limbs, the average total number of wounded sections was significantly higher for defense wounds compared to hesitation marks ($p<0.05$), while no significant difference was revealed for the comparison of average amount of wounds. In other words, for a similar average amount of hesitation marks and defense wounds, the average number of wounded sections on upper limbs revealed to be higher for defense wounds than for hesitation marks. Thus, defense wounds show higher dispersion on upper limbs compared to hesitation marks.

This retrospective study of hesitation marks and defense wounds first confirmed the initial hypothesis of predominance of hesitation marks on inner surface of upper limbs. However, while it is often said that sharp force victims, considering the proportion of right-handed person in the general population, are more likely to present hesitation marks on their left upper limb, this five year study failed to confirm such predominance. Consequently, the authors discourage the use of a left-right characteristic in the evaluation of hesitation marks and defense wounds. The pattern of dispersion of hesitation marks and defense wounds suggests a difference in the pattern of dispersion as a new criterion for hesitation marks and defense wounds.

Hesitation Marks, Defense Wounds, Sharp Force Injury

G20 Neck and Scleral Hemorrhage Due to Drowning

Russell T. Alexander, MD, and Jeffrey M. Jentzen, MD, Milwaukee County Medical Examiner's Office, 933 West Highland Avenue, Milwaukee, WI 53233*

The goal of this presentation is to review a case of drowning associated with extensive bilateral scleral and neck hemorrhage.

This presentation will impact the forensic community and/or humanity by discussing the occurrence and possible mechanisms for the creation of scleral and neck hemorrhage in drowning related deaths.

The decedent was a 30-year-old male who was found with his 5-year-old stepson at the bottom of a nine foot deep hotel pool after hotel workers noted two of the decedent's other young children playing unattended on the steps in the shallow end of the pool. The decedent and his stepson were pulled unresponsive from the pool. Firefighters arrived at the scene and started CPR after finding the decedent pulseless and not breathing. After 30 minutes of resuscitative efforts, he was declared dead at the scene. The child was taken in "critical" condition to a nearby children's hospital, and was discharged the next day with no neurological deficits. At

that time, the stepchild reported that the last thing he remembered was falling into the pool.

The decedent's wife last saw him alive 2.5 hours before he was found. She thought he and the three children were going back to their room to watch television. She did not know why they would go to the pool, since he and the children were unable to swim. An investigation by law enforcement found no evidence of foul play.

A "foam cone" was at the mouth and nose of the decedent at the scene. At autopsy, there was marked bilateral scleral hemorrhage. No abrasions or contusions were on the anterior or posterior neck. Internally, the lungs were hyperinflated. Frothy fluid filled the airways and exuded from the cut surfaces of the lungs. The sphenoid sinus contained 3 ml of bloody fluid. Blood was in the mastoid air cells bilaterally. The right ventricle of the heart was dilated and the thyroid gland was markedly congested. A layered anterior neck dissection revealed hemorrhage on the surface of multiple strap muscles that was confined to the fascial surfaces of the muscle; sectioning did not reveal contusion within the substance of the muscle. A comprehensive toxicology screen did not detect alcohol or drugs within iliac blood. A vitreous electrolyte screen was within normal limits. The cause of death was determined to be drowning. The manner of death was accident.

Despite the assertion that anterior neck muscle hemorrhage "do not occur in drowning and should always raise the suspicion of foul play" (Spitz, 2006), others have reported this finding (Carter et al., 1998; Puschel et al., 1999). This hemorrhage has been attributed to hypostasis (livor mortis), muscular injury due to violent neck movements or an artifact of decomposition (Carter et al., 1998). Conjunctival and facial petechiae are due to increased cephalic venous pressure; a phenomena that may be exaggerated by coughing, gagging or a struggle that increases cardiac output and blood pressure (Ely and Hirsch, 1999).

Increased central venous pressure due to coughing and gagging, as well as increased cardiac output and blood pressure during the struggle of the drowning process, led to the scleral and neck hemorrhages described in this case. The elevated central venous pressure would be transmitted through valveless veins to the neck musculature as well as the head. Such elevated pressure could also cause right heart dilation and congestion of the thyroid gland.

Strangulation can result in neck and scleral hemorrhages similar to those described in the current case. Direct trauma to the neck during strangulation would typically cause hemorrhage within the substance of the muscle rather than just fascial hemorrhage. When a body recovered from water has these findings, it is imperative to consider all scene, autopsy, and toxicology findings to arrive at the proper cause and manner of death.

This case presentation demonstrates that drowning can result in significant neck and scleral hemorrhage, probably due to increased central venous pressure during the drowning process.

Drowning, Hemorrhage, Strangulation

G21 Papillomacular Folds: Whiplash Maculopathy or Postmortem Artifact?

Patrick E. Lantz, MD, Wake Forest University Health Sciences, Department of Pathology, Medical Center Boulevard, Winston Salem, NC 27157*

After attending this presentation, attendees will understand the usefulness of postmortem monocular indirect ophthalmoscopy in differentiating postmortem fundal artifacts from pathologically significant retinal folds.

This presentation will impact the forensic community and/or humanity by demonstrating that horizontal, hypopigmented, non-hemorrhagic retinal folds represent a postmortem artifact and must not be misinterpreted as retinal injury from putative vitreoretinal traction associated with whiplash or presumed shaking (Shaken Baby Syndrome or Inflicted Childhood Neurotrauma).

Clinically, whiplash maculopathy has been associated with three subtle macular disturbances following head/neck trauma from hyperextension/flexion. These include mild reduction of central visual acuity or paracentral scotoma, grayish swelling of the foveal zone and a small pit or depression in the fovea. The retinal opacity usually resolves and visual acuity most often returns to 20/20 but the foveal depression invariably remains. No specific pathophysiologic mechanism has explained the development of traumatic retinopathy after this indirect ocular trauma. Some authors favor a mixed mechanism, mechanic and vascular, to explain these alterations while others postulate that local microcirculatory disturbances are the cause of the retinopathy as opposed to the systemic disturbance associated with Purtscher's retinopathy.

A recent publication claimed the first account of the macroscopic and microscopic pathologic findings that they believed were the result of whiplash maculopathy and retinopathy (*Forensic Sci Med Pathol* 2005;1:19-25). The macular and retinal findings were found at autopsy in 20-year-old woman who suffered fatal head and neck injuries following a roller-coaster accident. Both eyes had horizontal folds extending temporally from the optic disc just beyond the fovea presumably secondary to vitreous traction.

However, the horizontal hypopigmented, non-hemorrhagic papillomacular retinal folds depicted in this case report represent postmortem artifacts readily apparent by postmortem monocular indirect ophthalmoscopy as evidenced by the following case. A 4-month-old infant presented to the Emergency Department of a regional medical center apneic and pulseless. Resuscitative efforts re-established cardiac activity but mechanical ventilation was required. Direct and indirect ophthalmoscopy in the Pediatric Intensive Care unit did not reveal any fundal hemorrhages or retinal folds. Death occurred 56 hours after admission. Postmortem monocular indirect ophthalmoscopy performed four hours after death confirmed clinical fundoscopic findings; however, the following morning, 21 hours after death bilateral hypopigmented, non-hemorrhagic retinal papillomacular folds had formed that were grossly and microscopically similar to the retinal folds attributed to whiplash maculopathy.

Subsequent examination of infants and adults who have died from natural disease processes has demonstrated that these artifactual papillomacular retinal folds initially form a few hours after death as retinal elevations around the fovea centralis then extend nasally and temporally. This fairly uniform sequence has been demonstrated by serial postmortem fundal imaging utilizing monocular indirect ophthalmoscopy. It is imperative that this postmortem artifact is not misinterpreted as retinal injury from putative vitreoretinal traction associated with whiplash or presumed shaking (Shaken Baby Syndrome or Inflicted Childhood Neurotrauma).

Whiplash Maculopathy, Postmortem Monocular Indirect Ophthalmoscopy, Postmortem Artifact

G22 To Dye or Magnify! A Proposal to Study the Efficacy of Toluidine Blue Dye vs. Colposcopy in the Postmortem Anogenital Examination

Sharon R. Crowley, RN, MN, 122 Emeline Avenue, Santa Cruz, CA 95060*

The goals of this presentation is to determine if toluidine blue is a reliable or useful adjunct in the postmortem genital examination; to describe a baseline study protocol that compares results from photocolposcopy at 7.5X and 15X magnification vs. photocolposcopy plus the addition of toluidine blue dye; and to better understand the nature and appearance of the postmortem anogenital anatomy.

This presentation will impact the forensic community and/or humanity by demonstrating an increase in the reliability and consistency

of postmortem anogenital examination techniques; and increasing in the diagnostic acumen of the forensic examiner.

Recent studies have focused on the application of a 1% solution of toluidine blue dye, a general nuclear stain, as a practice standard for the medical-legal examination of *living* sexual assault victims. Specific recommendations, e.g., the sequence of the dye application during the pelvic examination, have been delineated and advocated. Some authors and numerous practitioners recommend application of the nuclear stain *prior* to insertion of the speculum. This is based on the assumption that the nuclear stain will delineate iatrogenic injury from pre-existing traumatic findings due to a sexual assault. In one study of antemortem sexual assault cases, Jones, Dunnuck, Rossman, et al described a 3.7% incidence (1/27 cases) where one additional genital injury was delineated via toluidine blue, after speculum insertion and removal by the examiner. This injury was located on the posterior labia minora.

In a study by Hochmeister, Whelan, et al., (JFS, 1997), there was no effect on either PCR or RFLP recovery when vaginal swabs were exposed to the dye. However, the sample size was limited to only five women and postcoital swabs were collected within six hours of coitus. In California, the medical-legal protocol recommends that dye application be deferred until *after* collection of biological specimens.

A review of the original methodologies from Richart (1963), Collins (1966), Lauber & Souma (1982), and McCauley (1987) was done by Crowley and Peterson (*To Dye or Not to Dye*, AAFS, 2005). Variability in interpretation of results in antemortem patients may be due to *many* factors. Toluidine blue is specific for zones of parakeratosis; thus positive results can be due to inflammatory, benign, or malignant vulvovaginal diseases. Twenty-three different benign vulvovaginal conditions, in addition to the presence of cervical mucous, will yield false positive results with application of this dye *in vivo*.

A paucity of data exists on the "normal" appearance of the anogenital tissues during the postmortem interval. Detailed observation and baseline studies are ideally done with colposcopy and documentation via magnified photos, to facilitate peer review. Colposcopy has been thoroughly utilized by numerous authors to enable the study of both normal and abnormal findings in both child and adult sexual assault victims since the late 1980s. The protocol for detailed postmortem inspection and the methodology for an evidentiary anogenital examination have been previously described (Crowley, JFS, 2004). The correct application and interpretation of results/findings were thoroughly described by the earlier authors (Richart, Collins, Lauber & Souma, and McCauley). The intensity of the stain is correlated to the nuclear density of the tissues. Most of the earlier authors reiterated that the proper decolorization of the dye was the most important part of the methodology. Conventional methodologies vary widely, as do the post-assault time intervals for application of the dye. Another salient factor in any discussion of the efficacy of a nuclear stain vs. colposcopy is the anatomic site to which the dye can be appropriately applied. Although used by the earliest authors for diagnosis of cervical and vulvar neoplasias, Lauber and Souma, in 1982, first described its use for evaluation of sexual assault victims and comparison to a control group of consenting women. It is important to remember that at that time, colposcopy was not widely available for examination of this population. These authors also limited the application of the dye to the posterior fourchette, an area that is histologically comprised of skin-like stratified squamous epithelium.

As mentioned previously, subtle findings may be an examiner issue (Slaughter, personal communication, 2004). Many programs do not routinely include follow-up examinations in their protocol. Without incorporation of follow-up examinations, it may be extremely difficult to evaluate findings such as localized redness and swelling. In all cases, both antemortem and postmortem, it is essential to employ the highest standards, in order to differentiate traumatic findings from either preexisting benign vulvovaginal conditions or postmortem artifact. Even experienced sexual assault examiners, whose expertise is confined to antemortem cases, may confuse normal postmortem changes or findings secondary to the cause and manner of death with traumatic lesions that are consistent with penetrating injury, i.e., sexual assault.

Materials and Methods: Using the mobile system of technology described by Crowley (*JFS*, 2004), the author proposes a baseline study of postmortem genital examinations with concomitant application of a 1% solution of toluidine blue dye. Utilizing colposcopy at 15X magnification, no injuries were noted in living sexual assault victims via the nuclear stain that had not already been visualized with colposcopy (Slaughter, Brown, Crowley, & Peck, *Amer. J of Ob Gyn.*, 1997).

Careful scrutiny and photo documentation with colposcopy at 7.5X and 15X should be done *prior* to speculum insertion and anoscopy. After the speculum (and anoscopic) examination, the dye can be applied to the following sites: lateral aspects of the **labia majora, posterior fourchette, fossa navicularis, perineum**, and the **perianal** area up to, but not beyond the area of the anal verge. The labia minora are moist and the epithelium is similar to mucous membrane. Only the lateral aspects are covered by skin. Thus, any positive findings at this anatomic site must be interpreted with caution. Application of the dye and scrupulous decolorization should then be done in the manner described by the original authors. These anatomic sites are selected based on histological composition and applicability to the techniques that were thoroughly described by previous authors, Richart (1963), Collins (1966), Lauber & Souma (1982), and McCauley (1987).

Another salient factor that requires further study and comparison to photocolposcopy is the interval of applicability for both antemortem and postmortem cases. Currently, a wide variation exists in standards. In non-genital sites, toluidine blue has been shown to yield positive uptake in granulation tissue. The great variety of normal artifact often present in postmortem cases presents many additional challenges. It is crucial that examiners avoid working in a vacuum. Often forensic nurse examiners are called to examine postmortem cases because of their expertise in living sexual assault cases. It is imperative that they consult and collaborate with the forensic pathologist, especially if their expertise has been previously confined only to the antemortem arena. Normal postmortem artifact has been misinterpreted as trauma and the additional use of toluidine blue will likely only complicate interpretation until it has been sufficiently studied. In equivocal cases, the forensic pathologist can remove the relevant tissues en bloc for dissection and microscopic evaluation. Prior to this, it is useful to have an initial *in situ* examination via colposcopy of the anogenital tissues.

The ultimate goal is to better visualize the anogenital tissue in the postmortem patient, in order to improve the understanding of what is normal, and what is not, at various postmortem intervals. It is possible that the application of toluidine blue dye may then enhance, for pictorial documentation.

Colposcopy, Toluidine Blue Dye, Forensic Nurse Death Investigator

G23 Viropsy - Virtual Autopsy, Where We Go?

Michael J. Thali, MD, University Bern, Centre Forensic Imaging and Viropsy, Buehlstrasse 20, Bern, Bern 3012, Switzerland*

After attending this presentation, attendees will learn about the newest imaging technologies for forensic medicine.

This presentation will impact the forensic community and/or humanity by discussing the upcoming cutting edge developments and steps in visual documentation and reconstruction of forensic cases. Therefore there will be a great impact of the paper. Invasive “body opening” autopsy is today’s state of the art in human postmortem investigation. Modern cross section techniques can supplement and may replace autopsy to some extent with several improvements for the forensic workflow.

A combination of 3D optical and photogrammetric surface scanning with full body CT scans as well as postmortem MRI investigations to correlate the radiological findings with the forensic findings documented in traditional autopsy performed afterwards is discussed. Using the Armed Forces Institute of Pathology (AFIP) design comparison approach, well

known from clinical radiology and pathology correlating radiological and pathological findings, different forensic morphological findings are presented. Additionally the application of micro CT and Magnetic Resonance Microscopy is introduced for the forensic use.

The new possibilities that are based on the combined data sets of forensic corpses (visible human in forensics) such as real data based forensic virtual reconstruction and application of “morphological fingerprints” are demonstrated. The article gives an overview on postmortem application of 3D surface scanning and radiological cross sectional scanning using CT and MRI in forensic medicine by correlating imaging appearances of essential forensic findings to their appearance in traditional autopsy.

This paper presents the newest developments in postmortem biopsy, postmortem angiography, and the MRI whole body imaging using “Total imaging Matrix.”

Viropsy, Virtual Autopsy, Imaging

G24 Female Firearm-Related Suicides: A Reappraisal

Kevin D. Whaley, MD, Anna Noller, PhD, and William T. Gormley, MD, PhD, Central District, Office of the Chief Medical Examiner, Commonwealth of Virginia, 400 East Jackson Street, Richmond, VA 23219*

After attending this presentation, attendees will recognize that suicides by women using firearms, including shotguns are not rare and may be increasing in incidence.

This presentation will impact the forensic community and/or humanity by demonstrating the increasing incidence of self-inflicted gunshot and shotgun wounds by women.

After attending this presentation, attendees will appreciate the increasing incidence of female firearm-related suicide. Moreover, they will become familiar with the most common risk factors associated with these cases.

When women die from apparently self-inflicted firearm wounds, especially shotgun wounds, many citizens, family members, and death investigators are very suspicious that the death is really a homicide. This presentation will impact the forensic community, particularly forensic pathologists, and medicolegal death investigators, by facilitating accurate and efficient determination of the manner of death in female firearm-related suicides. Furthermore, proper classification of these deaths as suicides will also result in a more efficient expenditure of time and other resources with regards to law enforcement and the judicial system.

Notwithstanding increasing data to the contrary, female suicides are often stereotypically associated with less violent means (i.e., poisoning, hanging, carbon monoxide) while their male counterparts are stereotypically associated with more destructive means (i.e., firearms, jumping from heights, motor vehicle accidents).

Despite being historically associated with male suicide, a retrospective review of female suicides occurring in Virginia from 2000 – 2005 revealed a significant percentage of female decedents utilized a firearm. This study reviewed the case files of all female firearm-related suicides from 2000 to 2005 at the Richmond District Office of the Chief Medical Examiner. Additional data was gathered from the other three districts with regards to the incidence female firearm-related over this five year period. Data collected from each case included the age, race, comorbidities, socioeconomic status, and substance abuse history, type of firearm utilized, firearm availability, and whether or not other methods of self-destruction accompanied the firearm injury. The demographics and risk factors associated with female firearm-related suicides differ from those associated with their male counterparts. Appreciating these differences will facilitate accurate and efficient medicolegal death investigation of female suicides involving a firearm.

Of particular concern is a gradual increase in the incidence of firearm-related female suicides annually. In Virginia, the incidence of firearm-related female suicides has increased by approximately ten percent over a four-year period. Moreover, of firearm-related female suicides, a significant percentage involves a shotgun rather than a handgun or rifle.

The presentation will include case examples that illustrate the most common scenarios involving female firearm-related suicide.

Shotgun, Suicide, Women

G25 Agonal Sequences in Four Filmed Hangings: Analysis of Respiratory and Movement Responses to Asphyxia by Hanging

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The goal of this presentation is to first review the literature on physiological responses to asphyxia by hanging in human and animal literature, and then to compare such data to four cases of filmed hanging. In the conducting of investigations and trials, forensic pathologists are often asked to discuss the body's responses to hypoxia/anoxia and their temporal relationship to the timing of asphyxial deaths. However, those questions are difficult to answer considering the actual paucity of research literature.

This presentation will impact the forensic community and/or humanity by providing new insight into the physiopathology of human asphyxia.

Introduction: The human pathophysiology of asphyxia by hanging is still poorly understood, despite great advances in forensic science. Even though some studies have been conducted on animals, the extent to which those results can be applied to human is uncertain. Since experimental protocols are, of course, out of the question, filmed hangings hold the key element to answer questions regarding the sequence of events leading to death in the context of human asphyxia.

Methods: A total of four filmed hangings were analyzed: one suicide filmed by a video camera, two autoerotic deaths and one suicide in custody filmed by a surveillance camera. Those filmed hangings were compared in terms of loss of consciousness, convulsions, decortication, and decerebration rigidity, loss of muscle tone, last muscle movement, and respiratory responses. Two independent judges scored the time frame at which each of these responses occurred.

Results: With the time 0 representing the onset of hanging, rapid loss of consciousness was observed (at 13-18s), closely followed by appearance of convulsions (at 15-19s) in all cases. Within the first minute (19-21s in most cases, 46s in one case), decerebration rigidity was observed. Two phases of decortication rigidity was also noted, the first one being relatively sudden and quick (onset at around 1min00s -1min 08s in most cases, 21s in one case) while the second one (onset between 1min04s - 1min32s) extended for about one minute, with an observed climax of rigidity about 20 seconds after its onset. Appearance of loss of muscle tone varied between 1min 38s and 2min 47s, with last isolated muscle movement occurring between 2min 15s and 4min 10s. Similar patterns between cases was observed for respiratory responses: onset of very deep respiratory attempts between 20 and 22 seconds, last attempt between 2min 00s and 2min 04s for an average interval of 1min 40s to 1min 42s. Overall, total hanging time before apparent death was between 2min 47s - 4min 10s.

Conclusion: Despite differences in the types of hanging, similarities could be revealed regarding rapid loss of consciousness and onset of

convulsions, pattern of decortication rigidity and respiratory responses. To date, this is a unique study of agonal movements in asphyxia by hanging. The importance of inter-laboratory collaboration in extending this project by adding other available filmed hangings is discussed and the importance of a Working Group of Human Asphyxia (WGHA) is further emphasized.

Asphyxia, Hanging, Forensic Pathology

G26 The Methods of Committing and Alcohol Intoxication of Suicides in the Southwestern Croatia From 1996 to 2005

Alan Bosnar, MD, PhD*, Valter Stemberga, MD, Miran Coklo, MD, and Sanja Dobi Babic, BSc, Department of Forensic Medicine, Rijeka University School of Medicine, B. Branchetta 20, Rijeka, 51000, Croatia; and Emina Grgurevic, MD, Public Health Institute of Primorsko-Goranska County, Kresimirova 52a, Rijeka, 51000, Croatia

After attending this presentation, attendees will understand the relationship between alcohol intoxication and the choice of suicide method in the Southwestern Croatia from 1996 to 2005.

This presentation will impact the forensic community and/or humanity by through the contribution to a better understanding of the relationship between alcohol intoxication and the choice of suicide method, and by pointing towards efficiency of specific suicide prevention measures in specific methods of committing suicide.

This study was undertaken to determine if the level of alcohol intoxication and the choice of specific methods of committing suicide are related.

Suicides in the Southwestern Croatia in a ten year period, especially regarding the method of committing and alcohol intoxication, were analyzed. The examined region has an area of 7,993 km² with the population of 322,964, mostly living in the city of Rijeka, as a regional center.

In the examined period, 512 suicides were recorded, with 367 male and 154 female victims. The average age of male victims was 50.81 years, while female victims were older with the average age of 56.02 years. Ten various methods of committing suicide were recorded, with hanging as the most frequent (34%), followed by jumping from height (17%), firearms (15%), poisoning (14%), drowning (10%), jumping under/in front of a train (4%), explosive devices (4%), cutting/stabbing (1.2%), electrocution (0.4%) and self-immolation (0.4%). The average blood alcohol concentration at the moment of suicide was 0.68 g/kg with male, and 0.29 g/kg with female victims. The highest blood alcohol levels at the moment of suicide were recorded with suicides by explosive device (with the average blood alcohol concentration of 1.71 g/kg), while the lowest concentrations were recorded with female hanging suicides (with the average blood alcohol concentration of 0.0153 g/kg) and male cutting/stabbing suicides (with the average blood alcohol concentration of 0.103 g/kg).

This study suggests that the alcohol consumption before committing suicide is more significant in cases of suicide with an explosive device than in the other methods of suicide. This especially drastic method of suicide was rare in Croatia in a period prior to the Croatian Independence War (1991-1995), but its incidence significantly increased during the war and in a post-war period. These victims were not chronic alcoholics, but they consumed excessive alcohol as a result of psychiatric disorders as a consequence of war stress they suffered. This study showed that increased alcohol consumption in Croatia is more closely associated with certain methods of suicide over other methods.

Suicide, Alcohol, Croatia

G27 Suicide by Self Immolation in Cook County, Illinois, USA

Ponni Arunkumar, MD*, J. Scott Denton, MD, and Edmund R. Donoghue, MD, Cook County Medical Examiners Office, 2121 West Harrison Street, Chicago, IL 60612

After attending this presentation, attendees will learn of the prevalence of suicide by self-immolation and conditions leading to self-immolation.

This presentation will impact the forensic community and/or humanity by generating awareness of death by self-immolation, discuss, and describe the predisposing factors for this rare cause of death.

Suicide by self-immolation is extremely rare in the United States. This study aims to describe and determine the prevalence of such deaths in Cook County, Illinois, with an ethnically diverse population of 5.5 million people, which includes the city of Chicago and its neighboring suburbs. A thirteen year retrospective study from 1993 to 2005 was conducted to determine whether there were any common factors that lead to death by self-immolation. Computerized records of the Office of the Medical Examiner of Cook County were searched and reviewed for causes of death from self-immolation. The review identified 33 cases from 1993 to 2005 of such deaths. Seven cases were excluded from the study as one was a homicide, four were accident, and two were undetermined.

The age, sex, mental illness history, location of event, yearly incidence, use of accelerant, and presence of witnesses were studied.

Of the 33 cases, 23 were male and ten were female. The male: female ratio was 2.3:1. The ages ranged from 16 to 91 years old. The average age was 38.2 years. Most of the cases were in the 30-39 year age group with the following distribution: three cases (9.1%) were 11-19 years; eight cases (24.2%) were 20-29 years; nine cases (27.3%) were 30-39 years; three cases (9.1%) were 40-49 years; eight cases (24.2%) were 50-59 years; one case (3.0%) was 60-69 years; one case (3.0%) was 90-99 years. Of the 33 cases, 22 were white; ten were black, and one Asian.

Carbon monoxide determination was done in seventeen out of 33 cases. The carbon monoxide level ranged from negative to 45%. The average blood carbon monoxide level was 11.4%. Twenty-two cases received medical treatment.

An accelerant was used in 27 cases (81.84%). Gasoline was the most frequently used accelerant. It was used in 21 cases (63.6%). Charcoal lighter fluid was used in two cases. Acetone in nail polish remover was used in one case. An unknown accelerant was used in four cases.

The majority of self-immolation cases occurred at home, with nine cases. Three cases occurred in the garage adjacent to the home, one case in the front lawn of the home, two cases in the driveway of the home, two cases in the backyard of the home, two cases in a forest preserve, two cases in a parking lot, two cases in an alley, two cases near or on railroad tracks, two cases on a street, and one case each in a church, a college, a grassy area near major toll roads, and a shop.

Nine out of the 33 self-immolation cases were witnessed. Six of the cases had attempted suicide before. One had a prior attempt of self-immolation. Ten subjects had talked previously about suicide. In only five cases, a suicide note was left.

Twenty-seven cases (81.8%) had a history of mental illness, mostly depression. A history of depression was seen in seventeen cases (51.5%).

In ten cases, the cause of death was thermal burns due to self-immolation. Seven cases were determined as thermal burns due to house fire or fire. Four cases were determined as thermal burns due to gasoline fire. Three cases were closed as thermal burns and two cases as simply self-immolation. In two cases, the cause of death was carbon monoxide intoxication due to clothing fire. One case was closed as inhalation of smoke and soot due to house fire. One case each was closed as thermal injury, inhalation injury due to self-immolation, sepsis due to self-immolation, and multisystem organ failure due to thermal burns due to motor vehicle fire.

The study confirms that suicide by self-immolation is extremely rare in Cook County, Illinois, USA with an overall yearly average of 2.54 cases (0.05%). The majority of cases were male, white, with a history of mental illness, and immolated themselves at home.

Forensic Science, Self-Immolation, Suicide

G28 Seasonal Incidence of Suicides in Crete Island: A Five Year Study

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After attending this presentation, attendees will learn information concerning seasonal peaks of the suicide rates, as well as the reasons for this distribution in Mediterranean countries.

This presentation will impact the forensic community and/or humanity by increasing understanding of the suicide incidence during all year round in a country with many special factors (religion, weather conditions, people's attitude, Mediterranean temperament etc.).

Suicide is defined as the intentional act of self-destruction committed by someone who knows what he or she is doing, and who is aware of the probable consequences of his or her action. The epidemiology of the suicide phenomenon is always of major interest in contemporary forensic science. Studies have shown that suicide in some countries constitutes the third, or even the second most common cause of death for persons aged between 15 and 24 years, including accidents and homicides.

In order to study this phenomenon on the island of Crete, a retrospective analysis of all suicide cases for the period 1999 to 2003 was conducted, based on the archive files of the Department of Forensic Sciences (Medical School, University of Crete, Greece), which serves the entire region. Crete is an island (the southernmost island in Europe) with a population of about 750,000 inhabitants with millions of tourists annually.

The parameters chosen were the personal data of the subjects (age, sex, and nationality), the information concerning time and location where death occurred (date and exact time of the incident, area, and exact location), and the cause of death. In a total of 183 cases, 80.0% of them involved men and 20.0% women. One hundred seventy-two cases concerned persons of Greek nationality (94.0%) and the rest concerned foreigners. Thirty-six incidents (19.7%) occurred in 1999, 51 (27.9%) in 2000, 30 (16.4%) in 2001, 30 (16.4%) in 2002 and 36 (19.7%) in 2003.

Hanging prevailed as the main cause of death (41.0%), followed by chemical substance overdose (drugs and pesticides, 26.8%), and firearm injuries (gunshot and shotgun wounds, 21.2%). The age specific suicide rates per year were 20.0%, 16.4%, 13.1%, 15.3%, 12.0%, 12.6%, and 7.7% for 21-30, 31-40, 41-50, 51-60, 61-70, 71-80, and 81-90 age groups respectively. Four persons were of undetermined age. Seventy-one out of 183 (39.0%) cases occurred at the region of Heraklion, which corresponds with the population distribution of Crete.

The bimodal seasonal peak in the suicide rate observed in this study was in agreement with several other reports, indicating that suicide follows a seasonal pattern with a dominant peak during the spring or early summer (months of maximum day light, 14.2% and 12.0% stand for June and May respectively) and a lesser peak in the autumn. The spring peak in the suicide rate has been typically observed in Mediterranean countries. It has also been reported that agricultural populations have a longer spring peak, while industrial populations have a shorter one. This should be considered as a further explanation for the extended spring peak observed, since the suicide incidence was higher in rural areas, which were represented by 61.2%.

The suicide incidence in Crete (3.9 per 100,000 inhabitants) seems to be lower than the reported average in Greece (7.1 per 100,000 inhabitants), but higher compared to other Greek geographical regions, e.g., a suicide incidence rate of about 2.7 stands for Epirus, at the north-western coast of Greece.

Suicide, Seasonal incidence, Crete Island

G29 Suicidal Electrocution in Australia

Peter Y. Chan, BSc*, and Johan A. Duflou, MBChB, MMed, Department of Forensic Medicine, PO Box 90, Glebe, NSW 2037, Australia

The goal of this presentation is to describe a series of electrocution suicides in Australia.

This presentation will impact the forensic community and/or humanity by providing details of the typical electrical suicide death scene, autopsy features, and some specific problems associated with suicidal electrocution.

Introduction: While suicide is a worldwide phenomenon, the method that is used frequently has a geographic correlation. For instance, firearm suicides make up 50% of all suicides in the USA, while intentional poisoning with agricultural pesticides is used in up to 80% of cases in some Third World countries. While electrocution is not the most common form of suicide in Australia, compared to most parts of the world it appears to be a relatively frequent mechanism of suicide that warrants further study.

Materials and methods: This retrospective study investigates the trend of suicide by electrocution in the period from 1996 to 2005 examined at the Department of Forensic Medicine, Glebe, Sydney. Reviewed were the common autopsy, histology, and death scene characteristics of individuals who commit suicide via electrocution. A total of 25,675 deaths were investigated at between 1996 and 2005, with definite or probable suicide as the manner of death in 2029 cases. Suicidal electrocution cases were obtained by searching the Department of forensic medicine autopsy text database. All cases in this study had a full autopsy, including toxicology and histology, and a detailed death scene investigation by criminalists and electricians had been performed.

Results: There were 25 cases of definite suicidal electrocution (mean 2.5 cases/annum, 1.2% of all completed suicides), and a further three cases of possible suicidal electrocution in the time period. The latter three cases were not analyzed further. Eighty-one percent of decedents were male, and the mean age was 57 years (range 22 to 90 years). At least 40% of decedents were either currently working or had worked as electricians. Psychological comorbidities, predominantly depression, were observed in 73% of cases.

In 20 of the 25 cases, the mechanism of electrocution was by attachment to a live main electrical power point using electrical flex. The flex was typically tied around the wrists, causing a lethal current to pass through the body. Deep circumferential electrical burn marks on the wrists or other extremities were typical, although there were three cases where the electrical flex had been placed elsewhere (chest or mouth). The remaining five cases had electrocuted themselves by dropping an electrical appliance in the bath. There were histological findings consistent with electrocution in one of these cases. Two showed no signs of electrocution despite the body being found immersed in water with an appliance active or recently turned off, and two others were too badly decomposed for any further assessment.

Toxicology was positive in 17 (68%) cases. These included a single drug in 14 (56%) cases, with alcohol and benzodiazepine use predominating (5 and four cases respectively). Autopsy revealed the presence of significant organic disease in 17 cases, with nine of these presenting with at least two separate pathological processes. Grossly, pulmonary congestion or edema was found in 12 cases. Histologically, morphology consistent with electrocution was found in 11 cases.

In 78% of cases, the mains circuit in the premises was still live, as was the electrical outlet used to cause electrocution. Timers had been used in eight cases, but the remaining 17 bodies were "live" on arrival of witnesses or electricity personnel. In at least one case it was reported that witnesses touched the electrically active body. Notes from the deceased warning of potential electrical hazard from touching the body were found in at least five of the cases. Safety mechanisms were not tripped in any of the cases, and were only tampered with in one case.

Discussion: While suicide by electrocution is typically described as the activation of electrical appliances while immersed in a body of water, cases in Sydney appears to have a high proportion of individuals who attach themselves to power points via exposed wires. In the majority of cases in this study the body was "live" at the time of discovery, presenting a life-threatening risk to initial responders to the death. Investigators and emergency workers should remain vigilant upon discovery of electrical suicides, due to the fact that most bodies remain electrically active long after death.

Electrocution, Suicide, Death Scene Hazards

G30 Open Fractures in Pedestrians Mimicking Gunshot Wounds

Melissa A. Brassell, MD*, Mary G. Ripple, MD, and David R. Fowler, MD, Office of the Chief Medical Examiner, State of Maryland, 111 Penn Street, Baltimore, MD 21201

After attending this presentation, attendees will understand the similarities and differences in the appearance of pedestrian injuries and gunshot wounds and the implications of non-forensic trained health care professionals confusing these types of injuries on initial inspection.

This presentation will impact the forensic community and/or humanity by emphasizing the need for continuing education and a close working relationship between medical examiner/coroner's offices and health care professionals.

In February and April 2006, autopsies were performed on two pedestrians that were thought to have sustained gunshot wounds. While it was clear that the individuals had been struck by a motor vehicle, there was concern in both instances based on initial external examination at the scene by emergency personnel and at the hospital emergency department, that they had sustained gunshot wounds prior to being struck.

The first case was a 27-year-old male who was struck by a Chrysler 300 as he ran across the intersection of a local street. Information obtained from paramedics following a preliminary external examination at the scene was that the individual sustained a gunshot wound to the right thigh prior to being struck. An investigation was begun by police into the probable shooting. At autopsy, there was an open right femur fracture with an associated $\frac{1}{2}'' \times \frac{5}{8}''$ irregular laceration with a surrounding irregular, contiguous abrasion located on the inner right thigh. In addition, there was a curvilinear, $3'' \times 4''$ laceration on the lateral thigh with associated extension lacerations, abrasions, and protrusion of the quadriceps muscle. Postmortem radiographs and dissection of the thigh showed no beveling and no bullet fragments or distinct wound path. Thus, the findings were not consistent with a gunshot wound. The second case was a 25-year-old female who was struck by a Nissan Maxima as she crossed a busy expressway at approximately 6:00 a.m. She was taken to the nearest hospital, where physicians interpreted injuries of the left eyebrow and right temporal region as a possible through and through gunshot wound. Because of suspicion of a gunshot wound, her hands were bagged for preservation of evidence. A homicide investigation was begun. At autopsy, a $3''$ curvilinear abrasion and adjacent $1''$ laceration with skin avulsion was present on the right temple and a $\frac{1}{2}''$ laceration with a contiguous curvilinear abrasion was present lateral to the left eyebrow. Autopsy, including radiographs showed linear and diastatic skull fractures, no beveled skull defects, no wound track, and no bullet fragments. Thus, the findings were not consistent with a gunshot wound.

Open fractures of long bones sustained as a pedestrian struck by a motor vehicle primarily mimic gunshot wound defects at the skin surface. The overlying skin surface can show a full thickness laceration produced by the blunt trauma. Some of these lacerations are roughly circular to irregular with contiguous abrasions similar to that of an atypical entrance gunshot wound with its surrounding abrasion collar. Closer external examination of these wounds shows that the edges can be re-approximated, unlike that seen in an entrance gunshot wound. In addition, internal dissection and radiography reveal typical compound fractures with distinct linear edges, no bone dust or minute bone fragments, no beveling, no wound track and no bullet fragments.

Since open fractures can mimic gunshot wounds, close inspection of the external wound and evaluation of the internal injury both by dissection and radiography are essential in determining whether the injuries were caused by a gunshot. This presentation emphasizes the need for educating health care professionals, especially first responders and emergency room staff, in injury patterns in order to prevent an unnecessary homicide investigation.

Gunshot Wound, Pedestrian, Laceration

G31 Homicide in a Surgical Intensive Care Unit

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The goals of this presentation will be to increase the forensic community's awareness of the potential for potassium overdose to be intentionally administered to patients in health care facilities; to explore the problems and difficulties encountered in the medicolegal investigation of such cases; and, to devise means of preventing hyperkalemic deaths as a result of intentional overdose.

With the increasing number of frail, elderly patients with multiple medical complications, it may be tempting for health care workers who are taking care of these patients to put them "out of their misery." However logical it may sound, it is unethical and contrary to law. The criminal use of intravenous potassium salts on these victims usually will not leave any evidence to identify the cause of death or the perpetrator. Investigating these cases is very difficult because the victims have multiple problems and police departments, medical examiners, and forensic pathologists are reluctant to conduct a homicide investigation in a hospital, especially the intensive care unit. Publicizing these cases will keep the forensic community alert. This presentation will impact the forensic community and/or humanity by discussing the various means of investigating such cases.

Case Background: On January 3, 2002 at 09:30 hours, E.J.M., an 83-year old woman who lived alone, was found by police in a semi-conscious state in her home. She was taken to the emergency department of a tertiary care hospital in Winnipeg, Manitoba. She was diagnosed with a fractured left hip, renal failure, myoglobinuria, and pneumonia. She was admitted at 17:47 hours and transferred to the Surgical Intensive Care Unit (SICU). The plan was to stabilize her condition before she underwent corrective hip surgery.

The following day, at 15:45 hours, her serum electrolytes revealed a potassium level of 3.3 mmol/L. As her serum chloride level was elevated, the physician prescribed potassium acetate – to be infused at a rate of 5 mmol/hour for four hours for a total of 20 mmol. A 50 cc vial of potassium

acetate (with a concentration of 4 mmol/ml) was sent to the SICU by the pharmacy. Apparently 5 ml of the potassium acetate was drawn into a 10 cc syringe and injected into a 100 ml buretrol and topped with 95 ml of normal saline and 5% dextrose. The pump was set to run at 25 ml/hour beginning at 17:00 hours.

E.J.M. was also started on 4 ml of magnesium sulfate (2000 mmol/L) intravenously to run over two hours. At 18:40 hours, as the primary nurse was otherwise occupied, the nurse responsible for the patient in the next bed added 4 ml of magnesium sulfate to the same buretrol. This nurse noted that the buretrol contained 60 ml of fluid and the pump was running at 25 ml/hour.

At 19:30 hours a shift change occurred and a third nurse became involved with E.J.M. On taking over the patient's care, the nurse "eyeballed" the buretrol and noted it contained about 75 ml of fluid and that the fluid was infusing at a rate of 50 ml/hour. Although the patient's chart contained instructions for the pump to run at 25 ml/hour, based on the volume remaining in the buretrol (75 ml) and that it would take two hours to complete the infusion, the nurse apparently, at 20:00 hours, overwrote the order to read 50 ml/hour. Around this time it also became apparent that E.J.M.'s condition was becoming unstable. Blood was drawn at 20:30 hours and sent to the hospital laboratory for electrolyte and hemoglobin levels. At 20:38 hours, E.J.M. went into cardiac arrest. An emergency code was called and she was pronounced dead after 15 minutes of resuscitation.

At 21:13 hours, the SICU was notified by the laboratory of a critical potassium level of 7.6 mmol/L. The physician was informed of these results and immediately suspected a medication error. The buretrol was seized and sent to the hospital laboratory for analysis. A search for the used 50 cc vial of potassium acetate, however, was not successful.

The death of E.J.M. was reported to the medical examiner's office on January 4, 2002 at 22:35 hours by the physician due to the possible medication error. The medical examiner commenced an investigation that included the results of the medicolegal autopsy (concluded that hyperkalemia was the cause of death), as well as the findings from the internal investigation done concurrently by the hospital. Following extensive meetings between the medical examiner's office, the hospital and the police; hours of interviewing physicians, nursing staff and other health care workers; numerous searches for the missing potassium acetate vial; and repeated testing on the buretrol contents, the medical examiner's office and the hospital jointly concurred that E.J.M.'s death was not an accident, but the result of an intentional act. Consequently, detectives from the Winnipeg Police Service officially took over the investigation on February 12, 2002.

Results: Repeated laboratory analyses of the buretrol contents revealed a potassium concentration ten times higher than what had been prescribed for the patient, an increased amount of chloride, and a trace amount of diphenhydramine, which had never been prescribed. It was also evident from the investigation that the pump speed had been doubled and additional fluids had been injected into the buretrol. Lastly, the used 50 cc vial of potassium acetate had never been recovered. Thus, it was reasonable to conclude that someone, probably a member of staff at the hospital, had doubled the pump speed and added potassium acetate, potassium chloride and diphenhydramine to the buretrol to intentionally cause E.J.M.'s death. Therefore, the manner of death was homicide. Despite a thorough police investigation, which included an extensive report by a Major Crimes analyst, there was insufficient evidence to lay charges against any individual or individuals involved.

Conclusion: This death clearly illustrates that administering excessive amounts of potassium can kill patients in health care facilities. However, hyperkalemia as a result of intentional overdose is next to impossible to diagnose by autopsy alone. Other, thorough investigations, including a review of the medical chart, analyses of any remaining fluids, and examination of the pump's memory system, are vital to the investigator in reaching a conclusion of intentional overdose. Following the death of E.J.M., it is now the practice in intensive care units in

Manitoba hospitals not to store potassium acetate or potassium chloride on the wards.

In February 2003, in the absence of criminal charges, the Chief Medical Examiner directed that an inquest be held into the death of E.J.M. The findings of the inquest judge were released in September 2005. The report can be accessed by visiting website: http://www.manitoba.courts.mb.ca/inquest_reports.html (Report No. 6 - E.J.M. – September 12, 2005).

Hyperkalemia, Intensive Care Unit Death, Homicide

G32 Subdural Hemorrhage, Subarachnoid Hemorrhage, and a Healing Tibia Fracture: Abuse or Complications of Leukemia?

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The goal of this presentation is to discuss the natural diseases that may mimic inflicted trauma and discuss methods of differentiating natural disease from neglect and inflicted trauma.

This presentation will impact the forensic community and/or humanity by highlighting issues related to pediatric autopsy and findings that may obscure cause and manner of death. A better understanding of ways that natural disease can mimic inflicted trauma will better enable forensic pathologists to avoid inaccurate diagnoses.

Objective: Child fatalities due to natural disease vs. abuse and/or neglect are challenging forensic autopsies.

Case Summary: A two-year-old boy was found dead in his foster care bed. He was receiving treatment with L-asparaginase and steroids for acute lymphoblastic leukemia. In the weeks prior to his death he became increasingly weak and had several falls witnessed by therapists and family members. In the days prior to his death he had marked thrombocytopenia.

Autopsy revealed acute small cerebral subdural and subarachnoid hemorrhage, and superior sagittal sinus and cerebral venous thromboses, a healing tibial compression fracture and extensive bronchopneumonia. There were no retinal or optic nerve sheath hemorrhages.

Discussion: Although subdural and subarachnoid hemorrhages in children are suggestive of inflicted injury, correlation of the medical history with autopsy findings in this case indicated that the neuropathologic findings were likely a result of minor trauma associated with underlying leukemia and treatment effects. L-asparaginase has been associated with abnormal blood clotting. Careful review of a decedent's medical history and correlation with autopsy findings is crucial to distinguish inflicted trauma from accidental trauma, and from natural disease processes that mimic trauma. The cause of death in this case was certified as complications of acute lymphoblastic leukemia and the manner of death was certified as natural.

Thrombosis, Neuropathology, Pediatric

G33 An Exceptional Case of Death Due to Lesions of Water Nozzle

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The goal of this presentation is to describe an exceptional case of mortal lesions due to water nozzle, a professional tool used to wash solid surfaces.

This presentation will impact the forensic community and/or humanity by describing unusual high pressure water injuries.

A 28-year-old young worker at a navy yard, died while he was trying to clean the hold ports of a ship moored at wharf of Arsenale S. Marco in Trieste (Italy).

During the investigation, the remains of the man was found laying face down on the floor of a little mobile platform raised several meters from the ground, where he was working alone.

Close to the body there was the water nozzle with the switch in the off position. There was a wide tear in the overall she was wearing and "homogenized" organic tissues were found on the platform. Skeletal elements of the remains were exposed where soft tissue had been avulsed. The postmortem examination showed skin abrasions on the right half of the face with a fracture of the skull, wide and deep soft tissue injuries of the right upper limb with areas of complete soft tissue avulsion. The soft tissue of the right side of the chest was largely absent and perforated with laceration of the lung and heart. Technical testing of the tool by an engineer showed the equipment for water cleaning was working properly, providing of water with a pressure of about 500 bars by an auto-turning nozzle. However, the safety devices had been altered. Unaltered, the jet of water should be stopped automatically if the water release and safety buttons (the last one has to be activated by the other hand) are not activated at the same time.

The scene investigation, with particular reference to the remains position, and the water nozzle found close to the body, the nature of the injuries, the negative toxicology testing, along with the technical findings about the functioning of the tool and its altered safety devices provided a clear sequence of events that led to this death. This accidental death was caused by the inappropriate use of a water cleaning device.

Water Nozzle, Crime Scene Investigation, High Pressure Water Injuries

G34 Hanging Deaths in Ontario: Retrospective Analysis of 755 Cases

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After attending this presentation, attendees will gain an appreciation of the demographics and pathology of hanging deaths in Ontario. The findings will be compared to the other series and discussed with regards to influencing factors and quality assurance standards.

This presentation will impact the forensic community and/or humanity by emphasizing the importance of documenting neck injuries in

hanging deaths, and will discuss factors influencing their frequency. It will address quality assurance issues, such as an importance of recording of pertinent negatives, use of standardized autopsy reports and dissection protocols, and utilization of additional postmortem techniques.

The frequency of neck injuries in deaths by hanging is controversial. In the literature, the range is wide, varying from 0 to 76.6% for hyoid and laryngeal fractures. Multiple factors account for this variation. Complete neck examination and accurate recording of not only positive but also negative findings are important.

This study is a retrospective analysis of deaths by hanging that happened in Ontario during a two-year period (January 1998 to December 1999). The main goal of the study was to determine the frequency of different hanging-related neck injuries. Fractures of the neck structures and soft tissue injuries were studied. Secondly, factors recognized as important in the incidence of neck fractures, such as age, sex, and weight of the deceased were evaluated. The third goal was to determine whether the frequency of hyoid/laryngeal injuries varied depending on autopsy location, i.e., forensic pathology unit, teaching hospital, or community hospital.

A total of 755 cases were available for evaluation of which 632 had a complete autopsy and 68 were limited to external examination only. In 55 cases, no postmortem examination was conducted. The largest category was suicidal hanging, at 737 cases (97.6%). Nine cases (1.2%) were accidents and two cases (0.3%) were homicides. In seven (0.9%) cases the manner of death was not determined. The mean age of the deceased was 40.58 years (the youngest victim was two and the oldest 94 years old), and there was a male predominance (82.6%). The following represents a breakdown, by location, of the cases that were examined: 240 (34.3%) in forensic facilities (of which 72.9% were complete autopsies and 27.1% were external examinations); 48 (6.9%) in teaching hospitals (of which all were complete autopsies), and 412 (58.9%) in community hospitals (of which only three were limited to external examination).

Of the 632 cases that had complete autopsies, the most common hanging related neck injuries were those of soft tissue. The latter were quite variable in severity, ranging from minute soft tissue hemorrhages to complete transection of the neck structures. Soft tissue injuries not associated with skeletal trauma were reported in 59 cases (9.3%). Associated fractures of the hyoid bone and/or laryngeal cartilages were present in 46 cases (7.3%) with the most common being hyoid fractures (30 cases). Less common were fractures of thyroid cartilage alone (10 cases), combination of hyoid and thyroid cartilage fractures (3 cases), and cricoid cartilage (3 cases). Seven cases of cervical spine injuries (fractures or dislocations) were documented.

A higher incidence of neck fractures occurred among men. There was a tendency for the number of fractures to increase with increasing age and weight/BMI of the deceased.

The frequencies of hyoid/laryngeal fractures distributed over forensic, teaching, and community facilities were as follows: 7.4%, 16.7% and 6.1%, respectively. The frequency of fractures reported in specialized forensic facilities reached 10.6% if the Forensic Pathology Unit in Toronto was excluded from the analysis. The lower frequency of fractures (2.8%) registered in this unit could be explained by different demographics of cases that underwent complete postmortem examination, specifically due to a higher proportion of complete autopsies performed on female and younger individuals. Higher frequency of fractures correlated with a higher percentage of cases in which there was accurate reporting, i.e., definite comments were made upon presence or absence of specific injuries and their site.

Hanging, Neck Injuries, Pathology

G35 Maternity and Paternity Testing of a Discarded Dead Neonate Involving a Young Girl and Her Father

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Upon completion of this presentation, participants will know how to gather evidence when the case involves a discarded dead neonate using DNA identification. In the presented case, the infant's mother was 16 years old and the infant's father was also the infant's mother's father. This is a rare paternity testing case. Sixteen Y-plex chromosomal STR testing was used to analyze the relationship of the girl's father and the infant.

This presentation will impact the forensic community and/or humanity by showing that Y-Plex STR is a very useful genetic marker for forensic practice.

A male neonate was found dead in a paper box, with the umbilical cord coarsely amputated. Next to the body there were several bloodstains on a pair of sandals marked with the name of a family living near the scene. A 16-year-old girl with the same family name was suspected as the neonate's mother, as her house was near the scene and blood was found in the toilette of her home. The girl's father and mother were divorced years ago, and her father was remarried to another woman. In order to obtain evidence to determine whether the infant was the girl's son and to establish the identity of the infant's father, DNA was extracted from the oral epithelium of the girl and her father. Blood taken at autopsy provided the source of DNA from the infant. Fifteen autosomal STR loci plus the amelogenin locus were investigated using DNA samples of the girl, her father, and the infant. To investigate the relationship between the infant and the girl's father, sixteen Y chromosomal STR loci were analyzed using DNA samples from the girl's father and the infant. The probabilities of maternity and paternity were 0.9999999 and 0.9999999, respectively, for all fifteen autosomal STR loci analyzed. Furthermore, the sixteen Y chromosomal STR loci were an exact match between the dead infant and the girl's father. These results conclusively proved that the 16-year-old girl and her father were the biological parents of the discarded dead neonate.

Discarded Dead Neonate, Maternity and Paternity Testing, STR

G36 Undetected Polyglandular Autoimmune Syndrome Type II (Schmidt Syndrome) as a Cause of Sudden Death

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The goals of this presentation are to discuss the clinical features and disease association characteristics of the Polyglandular Autoimmune Syndrome Type II, and to increase the recognition of the morbidity and mortality arising from polyglandular autoimmune disorders.

This presentation will impact the forensic community and/or humanity by demonstrating how polyglandular autoimmune (PGA) syndromes are associated with a diversity of related diseases. Diabetes mellitus Type I is a common manifestation of PGA Types II and III. Less

frequently observed is Addisonian crisis arising from co-occurring thyroiditis and adrenalitis in the absence of pancreatic involvement and resulting in sudden, unexpected death. The premorbid clinical and laboratory manifestations of this disorder can be subtle and non-specific, yet are critical benchmarks to be recognized in order to avoid a potentially lethal outcome.

Immunologic syndromes impacting multiple endocrine organs and giving rise to other nonendocrine immune disorders are a rare cause of sudden, unexpected death. Endocrine deficiency due to Polyglandular Autoimmune Syndrome can be brought on by infection, infarction, or tumor that results in the destruction of all or a large part of an endocrine gland. In most cases, however, the activity of an endocrine gland is depressed as a result of an autoimmune reaction that produces inflammation, lymphocytic infiltration, and partial or complete destruction of the gland. There are three patterns of Polyglandular Autoimmune (PGA) Syndrome, referred to as types I, II, and III. PGA Type I usually occurs in childhood and is characterized by hyperparathyroidism (79% of cases), followed by adrenal cortical failure (72%). Diabetes mellitus Type I seldom occurs. PGA Type II generally occurs in adults and always involves the adrenal cortex and frequently the thyroid gland (Schmidt syndrome) and the pancreatic islets. Type II is the most common of the syndromes and is characterized by the occurrence of autoimmune Addison's disease in combination with thyroid autoimmune diseases and/or diabetes mellitus Type I. The most frequent clinical association is between Addison's disease and Hashimoto's thyroiditis, while the least frequent clinical combination is Addison's disease, Graves' disease, and diabetes mellitus Type I. PGA Type III occurs in adults and does not involve the adrenal cortex, but includes at least two of the following: thyroid deficiency, diabetes mellitus, pernicious anemia, vitiligo, and alopecia.

Following the sudden death of a 38-year-old Caucasian female an autopsy revealed findings consistent with the diagnosis of Schmidt syndrome, or Polyglandular Autoimmune Syndrome Type II. While diabetes mellitus Type I was not diagnosed, as is the case in 50% of PGA Type II presentations, her past medical history included an ill-defined thyroid disorder and recent premorbid history of listlessness to extreme fatigue and non-specific somatic complaints. Her healthcare professional failed to make the correct premortem diagnosis. The differential diagnosis of this disorder is addressed, as is a brief discussion of the polyglandular autoimmune syndromes, with particular emphasis on the etiology, epidemiology, morbidity, and mortality associated with Polyglandular Autoimmune Syndrome Type II.

Autoimmune, Polyglandular, Endocrine

G37 Suicide by Ingestion of Carbamate Insecticide: Case Report and Regional Variations

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After attending this presentation, attendees will understand how insecticide ingestion is a significant method for suicide both globally and nationally. Attendees will also understand the possible threats to first responders and healthcare personnel attending to victims of insecticide self-ingestion.

This presentation will impact the forensic community and/or humanity by attempting to further increase understanding of suicide patterns, focusing upon a means not commonly observed in the United States but frequently employed in select regions of Asia. In addition to

addressing mechanisms of actions and common routes of administration, health risks that such ingestions present to responding personnel are also presented. Based upon commonly understood risk factors lending to insecticide-related suicide from certain areas of Asia, potential parallels to certain regions of the United States are reviewed. Additional issues explored include assessing the predisposition to insecticide-related suicide based on geography, agricultural intensity, accessibility to such poisoning agent(s), and relative lack of access to medical centers capable of rendering rapid treatment and antidote(s).

Propoxur (Baygon) is a potent carbamate insecticide used to control cockroaches, flies, mosquitoes, and lawn and turf insects. It is also a poison used to complete suicide. Insecticide intoxication is a significant method of suicide in some areas of the world. A 55-year-old black male was found unresponsive in his garage with a glass of Propoxur adjacent to him. Upon transport to a suburban Philadelphia hospital emergency department, fumes from the insecticide emanated from the victim's body, sickening 29 hospital workers and 12 hospital patients. As a safety precaution, the hospital was quarantined and its employees decontaminated. It is imperative for physicians, emergency medical service personnel, and investigators to be aware of the risks and detrimental consequences involving deaths associated with insecticide ingestion. While proper handling of patients is crucial, healthcare personnel should be aware of the public health risks created by individuals who ingest select poisons. Propoxur's mechanism of action relies upon the reversible carbamylation of acetylcholinesterase, resulting in a subsequent accumulation of acetylcholine in myoneuronal junctions (i.e., both in nicotinic and muscarinic systems). The modes of absorption include inhalation, ingestion, and dermal penetration, and the pertinent signs and symptoms include diaphoresis, urination, bradycardia, seizures, and bronchospasm. Insecticide ingestion as a means of suicide is stratified by two principal variables, these being availability of the agent(s) utilized and the related variable of agricultural intensity within the region of the world studied. In rural, agricultural regions of Sri Lanka and China, a high incidence of self-poisoning deaths have been attributed to harsh living conditions, stressful situations, accessibility to the poisoning agent(s), and relative lack of access to medical centers capable of rendering rapid treatment and an antidote(s). Access to lethal means is one principal variable observed from suicide patterns in the United States, though the most common injury associated with completed suicides in this country derives from firearms. The premise proposed is that those regions of the United States which parallel most closely those conditions predisposing to suicidality as observed in Sri Lanka and rural China should exhibit higher insecticide ingestion-related suicide rates in comparison to other areas of the country.

Insecticide, Suicide, Healthcare Worker Risks

G38 Chemical Asphyxia and Bondage: Autoerotic Fatality Induced by Chloroform Inhalation

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It is important to acknowledge variations from characteristic autoerotic asphyxial death practices. The use of chemical inhalation, more specifically chloroform, as a means to create a euphoric autoerotic state has rarely been discussed in past literature. After attending this presentation, attendees will learn how autoerotic asphyxia is also rarely observed in those older than the sixth decade.

It is well recognized in contemporary literature that autoerotic asphyxial deaths are most commonly observed among Caucasian males in the third to fourth decade of life. However, there are cases that are distinct from the common pattern of age demographics and the means of attaining

a hypoxic state. This presentation will impact the forensic community and/or humanity by demonstrating how it is imperative to acknowledge that significant variations from characteristic autoerotic asphyxial practices do occur. The possibility of autoerotic asphyxial death should be entertained in the aged population when corroborated by appropriate scene and evidentiary information.

Autoerotic asphyxia is a paraphilia in which a hypoxic state is induced in order to enhance orgasm during sexual activity. The medical examiner becomes involved in those situations in which the hypoxic state becomes irreversible and results in the death of the practitioner. While this practice is observed most commonly in Caucasian males whose ages range from the third through fourth decades, deviation from these demographic variables do occasionally occur. Autoerotic asphyxiation through the use of a ligature about the neck, with escape mechanism, is the most common means of this practice. More atypical approaches to reach a euphoric state through oxygen deprivation include rebreathing via the use of a plastic bag, positional asphyxia through thoracic compression, submersion, and chemical inhalation. Chemicals most frequently cited as hypoxic agents in available literature documenting autoerotic practices include propane, butane, ether, aerosol glue, tetrachloroethylene, 1-1-1 trichloroethane, and ketamine. Documentation of chloroform use in autoerotic asphyxial practice is distinctly uncommon.

A 67-year-old Caucasian male was discovered in bed and multiply bound within his suburban Philadelphia, PA residence. The decedent was discovered wearing a black rubber gas mask, with a bottle of chloroform situated on an end table adjacent to his head. A postmortem interval of at least two to three days had transpired from the time of death until the time of discovery. Toxicological assessment demonstrated the presence of chloroform in the blood, liver, brain, and lung of the decedent, consistent with inhalation of this agent in an effort to induce a hypoxic, reversible state. Scene investigation disclosed evidence supportive of multiple paraphilic acts engaged in by the decedent, including leather and black rubber fetishism and masochistic acts, including earplugs and genital entrapment. Numerous enema bags were distributed throughout portions of the otherwise fastidious residence, suggesting klismaphilia. While deaths arising from the performance of autoerotic asphyxia characteristically involve young Caucasian males through the use of a neck ligature, it is important to recognize significant variation from this general pattern. It is likewise imperative to consider the possibility of additional participants and criminal activity when confronted with such scenarios.

Chloroform, Autoerotic, Paraphilia

G39 Hemophagocytic Lymphohistiocytosis: A Case Report and Review of the Literature

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The goal of this presentation is to discuss a case of a rare hematologic syndrome (Hemophagocytic Lymphohistiocytosis), and a literature review. New data has shown, that in the infection associated form of hemophagocytic syndrome, a selective loss of cytotoxic function in antigen presentation to T cells, creates an imbalance in the immune system, and promotes abnormal/excessive production of T cell derived cytokines, such as Interferon gamma (IFN γ), which is quite toxic, and leads to the characteristic clinical and histopathologic features of HLH. This is a rare entity, yet important, because it has a primary and secondary form, which may occur in the young, and in individuals with no known underlying immune deficiency/lymphoproliferative disorder.

This presentation will impact the forensic community and/or humanity by identifying and discussing the different forms of this syndrome, i.e., primary and secondary; its clinical, laboratory and histopathologic findings and its unusual cause of death in those individuals

affected by this syndrome. The entity is a hematologic and anatomic/forensic curiosity, with remarkable gross and microscopic findings.

Statement of Methods: This poster will present a case report and literature review of: Sporadic Hemophagocytic Syndrome, and its clinical, laboratory, and histopathologic manifestations, with a focus on its sometimes innocuous presentation as a viral illness, leading to rapid (within 14 days) death in both young and older patients.

Abstract: The focus of this case report is patient EC, a 77-year-old male, who was transferred from an outside hospital to the institution with confusion, ataxia, pancytopenia, diffuse lymphadenopathy/ splenomegaly, and a flu-like illness with temperature spikes to 103° F. His past medical history included CAD s/p MI, dermoid tumors, and hypercholesterolemia. He underwent a cervical lymph node biopsy during admission, which demonstrated a non-clonal proliferation of T-cells with Ebstein-Barr virus positivity (by in-situ hybridization, consistent with mononucleosis). EC was treated with steroids without improvement of his lymphadenopathy. Labs during admission: WBC 2.6; Hgb 9.5; Plt 34 Neut: 40.9%; Lymphs: 51.5 %; Eos: 3.6% Absolute Neutrophil Count: 5650. Serology tests showed EBV IgG positive/Ig negative, CMV IgG positive/IgM negative, RPR negative, HIV negative, toxoplasmosis negative. For his entire hospital admission, he had no bacterial growth in his blood cultures, but did have *S. aureus* positive respiratory cultures.

Within two weeks of admission, EC suffered a non-Q wave myocardial infarction, with an echocardiogram study showing an EF of 25 – 30%. Although the work up of his hematologic aberrancies continued, the patient's medical status deteriorated following his MI.

The patient developed hypoxic respiratory failure and cardiogenic shock, and expired on 15 days after admission.

At autopsy, the body was that of a cachectic older male with marked generalized lymphadenopathy. Histologic findings included a newly diagnosed pleomorphic high-grade large B-cell lymphoma, which showed EBV positivity and systemic hemophagocytic lymphohistiocytosis. The presence of the stain LMP-1 in most of the lymphoma cells is consistent with an EBV-driven disorder. There was also evidence of a remote myocardial infarct and pleural fibrosis.

Hemophagocytic lymphohistiocytosis (HLH) is a life-threatening condition characterized by uncontrolled hyper-inflammation on the basis of various inherited or acquired immune deficiencies. It is also characterized by clinical, laboratory and histologic findings. The clinical symptoms/signs include: fever, severe constitutional symptoms, lymphadenopathy, hepatosplenomegaly, icterus/jaundice, neurologic symptoms (seizures, CN palsies, encephalitis, meningismus) and rash (maculopapular/nodular eruptions). Laboratory criteria include: pancytopenia (cytopenia in at least two cell lineages), hypertriglyceridemia, high ferritin, transaminases, bilirubin, and LDH. Also, hypofibrinogenemia, high levels of the α chain of the soluble IL-2 receptor and Impaired function of Natural Killer Cells and cytotoxic T cells. Histopathologic findings are: reactive and systemic proliferation of benign histiocytes that phagocytose blood cells and their precursors in bone marrow, and or spleen. EC fulfilled the criteria for the acquired form of hemophagocytic syndrome, due either to an EBV infection, lymphoma, or a combination of both: an EBV-driven high-grade lymphoma.

Familial forms (FHLH) hemophagocytic lymphohistiocytosis is the entity where HLH is the primary and only manifestation, occurring in approximately in 1/50,000 births. FHLH is associated with immune deficiencies such as: Chédiak-Higashi Syndrome, Griscelli Syndrome, and X-linked lymphoproliferative Syndrome. Secondary (Sporadic) HLH is associated with the trigger of a benign or neoplastic disease (most patients have no known underlying immune deficiency), such as in the patient, EC. Various infectious microorganisms, mostly viruses, such as EBV, but also bacteria, protozoa and fungi, induce secondary HLH. In a review article from 1996 of children with infection-associated hemophagocytic syndrome (IAHS) EBV was found to be the triggering event in 74% of cases. HLH may also occur as a complication of

rheumatologic disorders (macrophage activation syndrome), malignancies (especially T cell lymphomas), also known as Lymphoma associated Hemophagocytic Syndrome (LAHS). EBV was detected only rarely in those with B-cell lymphomas, and much more so, 80%, in patients with T/NK lymphomas. The median survival time with pts with LAHS is about 11 days.

New data about what the possible etiologies are for sporadic hemophagocytic syndrome have shown that uncontrolled secretion of cytokines may stimulate the proliferation and phagocytic activity of macrophages, and therefore cause widespread inflammation, and the severe pancytopenia seen in this entity. More specifically, a selective loss of cytotoxic function in antigen presentation to T cells, creates an imbalance in the immune system, and promotes abnormal/excessive production of T cell derived cytokines, such as Interferon gamma (IFN α), which is quite toxic, and leads to the characteristic clinical and histopathologic features of HLH.

In conclusion, in the presented case, the clinical, laboratory, and autopsy findings demonstrate case of Secondary Hemophagocytic Lymphohistiocytosis. The disease entity has specific clinical, laboratory and histopathologic findings, and when sporadic, can present as an innocuous viral illness, as in EC's case, with fatalities occurring within two weeks of presentation, due to uncontrolled hyper-inflammation and activated macrophages/histiocytes that kill/ingest all hematopoietic elements, causing widespread pancytopenia.

Hemophagocytic Lymphohistiocytosis, Ebstein Barr Virus (EBV), Interferon Gamma (IFN α)

G40 Snake-Shot From a Handgun: An Unusual Gunshot Wound Suicide

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After attending this presentation, attendees will learn about projectiles for handguns that fire snake-shot and the use of such a projectile in this case of suicide and be able to recognize the following: How snake-shot can be fired from a handgun, how such a projectile can create an unusual entrance wound on postmortem examination, how to reconcile radiologic findings typical of a shotgun with a handgun as the weapon, and why such findings are not inconsistent with a suicide.

This presentation will impact the forensic community and/or humanity by providing useful information about unusual but not uncommon ammunition used in a suicide.

A 49-year-old man had an argument with his wife at his home. He got a revolver out of his locked gun cabinet, went out to his car, and was found dead in the car some time later with a gunshot wound. Scene investigation found the revolver in the deceased man's hand. There was no shotgun present in the house or the car. A suicide note to the son was located in the house.

Initially, the location of the gunshot wound made this suspicious for a homicide. He was shot behind the right ear. Autopsy procedures included photography, gunshot residue, X-Ray, toxicology, and visceral dissection. The X-Ray of the decedent's head showed unusually extensive fracturing of the cranium and numerous pellets in the cranial cavity.

Close examination of the gunshot wound revealed a hard contact, stellate, penetrating wound of the head, of unusual dimension for a handgun, located above and behind the right ear. A muzzle mark was difficult to distinguish because of the numerous stellate tears radiating from the entrance perforation. The parietal bone of the skull had a perforation with fouling beneath the periosteum. The right parietal and occipital lobes were perforated by multiple pellets, partially dividing the midbrain from the cerebral hemispheres. The pellets also perforated the left cerebral hemisphere, pulpifying the brain parenchyma.

These pellets on X-Ray and direct examination were consistent with snake-shot. This ammunition is most frequently used in shotguns. When it is fired from a handgun, it is typically used to kill reptiles and other thin-skinned small animals at short distances, up to approximately five yards. Handguns of many calibers including 9 mm, .357 Magnum, .38 Special, .40, .44 Special and Magnum, and .45 semi-automatic may accept small pellet-filled projectiles which contain shot of the same size as that used in a shotgun, but with a smaller load and charge.

The rounds consist of a hollow plastic projectile that contains the loose shot. If snake-shot is used in a gun without the encapsulating plastic, the lead shot may form pits in the rifling of the barrel. The cartridge moves down the barrel of the handgun and opens on leaving the muzzle; normally, the shot does not separate until after it has left the barrel. With shot of size #12, colloquially known as snake-shot, there might be as little as 1.5 to 3 ft-lb of energy in each pellet as it hits the target. While it might easily penetrate human skin at close ranges (but not contact), it would not be expected to penetrate deeper into the body than muscle tissue, and so would not be typically used in a homicide. Some experts report that the rounds are not useful for self-defense, especially against a human assailant, as the penetration is minimal and the shot diameter tiny. However, in the case of a direct hard contact gunshot wound this ammunition created a surprising amount of damage that was more than sufficient to kill.

The cause of death in this case was a hard contact gunshot wound of the head. The manner of death was suicide, based on the autopsy and scene investigation. The use of snake-shot as ammunition was unusual but just as lethal as a bullet.

Snake-Shot, Handgun, Suicide

G41 Non-Traumatic Homicide Following Assault: 16 Cases - A Review of Investigation, Pathology, Toxicology, and Judicial Outcome

Patricia A. Aronica-Pollak, MD, Jack M. Titus, MD, and David R. Fowler, MD, Office of the Chief Medical Examiner State Of Maryland, 111 Penn Street, Baltimore, MD 21201*

After attending this presentation, attendees will understand some principles of the classification of the manner of death as homicide when death occurs as the result of a physical altercation or a significant implicit threat in the absence of fatal traumatic injuries, by reviewing the investigation reports, the pathology reports, the toxicology reports, and the judicial outcomes of these cases.

This presentation will impact the forensic community and/or humanity by discussing how these types of cases can differ from traditional homicides which most often result from traumatic injuries and the classification problems which can arise including a review of the Davis guidelines written in 1978 and the judicial outcome differences.

Homicide is most often defined as death at the hands of another. When traumatic injuries are the cause of death, the manner of death is usually obvious and clear. However, when the traumatic injuries do not cause death and one must rely on the investigation for the manner of death, the case must be critically evaluated. If a physical altercation takes place immediately prior to death or the development of signs and symptoms such as chest pain begin during or within a short time after the assault, then temporal relationship between the assault and the death cannot be ignored and a manner of death of homicide must be considered. Likewise, if no contact between the decedent and the assailant(s) occurs, but there is a significant implicit threat to safety (Davis guidelines), one must also consider homicide, as again, the temporal relationship cannot be ignored.

Sixteen cases were reviewed from the state of Maryland from the years 1990 through 2006 where death was determined to be the direct

result of a struggle/assault or the result of a significant implied threat. All of the cases were classified as homicides on the death certificates. None had any traumatic injuries listed on the cause of death line or as contributory to the cause of death although some did have minor lacerations, contusions, and abrasions. Of the 16, three (19%) were female. Eight (50%) were African American. The ages ranged from 15 years to 89 years with a mean age of 55 years. Most of the causes of death were cardiac in nature including cardiac arrhythmias, coronary artery disease, hypertensive changes, congenital anomalies, aortic dissection, and coronary artery tunneling. In addition, one case of ruptured berry aneurysm was noted. Toxicology was negative for ethanol in 12 of the 15 cases (80%) cases and negative for illicit drugs in ten out of 13 (77%) cases in which drugs were tested. Of the positive cases, cocaine and morphine were the illicit drugs that were identified. Cocaine was detected in all three cases with morphine additionally detected in one of the three. Cocaine was listed as a contributing cause of death on the death certificate in all three cases.

In 15 of 16 cases (94%), there were physical altercations between at least two individuals. Of these, four (27%) were known to use a blunt object other than a fist such as a baseball bat (2), walking cane, or walker. In one case a blunt object (plank) was thought to have been used but was not confirmed through investigation. One individual was held at gunpoint but a physical struggle never ensued prior to loss of consciousness. In three (19%) cases no injuries, even minor, were described. The majority of cases (69%) involved individuals over 50 years of age. The remaining younger population could be further subdivided into those with congenital abnormalities and those with positive toxicology.

The judicial outcomes for these cases varied from no charges filed to full jury trials. The determination of the extent of prosecution for each case was case dependent because of their complexity and nature. In one case there was a bench trial with a conviction, subsequent appeal and retrial with a jury.

Davis Guidelines, Non-Traumatic Death, Homicide

G42 Death by Cue in the Parietal Pocket: An Unusual Injury Pattern Caused by the Use of a Blunt Object

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The goal of this presentation is to stress the importance of obtaining accurate and detailed investigative information, and keeping an open mind about the findings at autopsy. The injury pattern and the weapon may not be what you expect them to be.

This presentation will impact the forensic community and/or humanity by continuing to reiterate the need for excellence in forensic investigation and by alerting the community as to other potential uses of a seemingly harmless recreational object.

A 27-year-old man died from a penetrating injury of the head with perforation of the skull and brain by a pool cue. The decedent was involved in an altercation with another individual that began with an exchange of punches, and ended with the decedent lying on the floor with a pool cue in his head. Bystanders reported the decedent being immediately unresponsive following the altercation. Paramedics arrived and used a bolt cutter to cut the pool cue, leaving a portion remaining in the decedent's head. The decedent was then transferred to a local hospital where he remained in critical condition throughout his 8- day hospital stay.

Computed tomography of the head revealed a tubular piece of foreign material embedded into the skull with acute fractures in the left parietal bone, at the point of entry. The wound tract extended through the left parietal lobe, crossing the midline and traversing the thalamus. Acute fractures were seen in the squamosal portion of the right temporal bone at

the point of exit. Associated findings include hemorrhagic foci along the wound tract, scattered foci of subarachnoid hemorrhage, acute blood throughout the lateral, third, and fourth ventricles, air within the left temporal horn and a 1 to 2 millimeter thick acute subdural hematoma along the right fronto-temporal convexity.

The decedent was operated on immediately. The retained portion of pool cue was 16.8 centimeters in length and 1.4 centimeters in diameter. The distal end of the pool cue was intact with a blood stained disrupted white collar, 2.5 centimeters from the distal end. Dried blood and strands of attached hair were present on the cue up to approximately 4 centimeters from the distal end. The proximal end was uneven and broken off. The remaining portion of the pool cue was obtained from law enforcement and consisted of a traditional wooden stick with a broken distal end that matched the removed segment.

The findings at autopsy included a surgically altered left parietal scalp defect, and discrete foci of subscalpular hemorrhage at the points of entry and exit of the object through the skull. The oval left craniotomy window had a central round metal surgical device covering a 2 centimeter round defect with inward beveling. A 2.2 centimeter, somewhat square-shaped, fractured defect with partial outward beveling was within right temporal bone.

Small round defects are in the frontal bone and dura due to the insertion of pressure monitors. Gel foam and subdural hemorrhage were in the left parietal region and associated with a 3.0 centimeter sutured round dural patch. Approximately 20 milliliters of subdural hemorrhage was present over the right cerebral convexity. A circular, punched-out, round defect involved the dura of the right temporal bone and is associated with the aforementioned temporal bone defect. The calvarium was 2 to 3 millimeters in thickness, diffusely.

The brain weighs 1300 grams. It herniated through the right temporal bone defect. A 2.0 centimeter circular defect was in the left parietal convexity, and a 1.5 centimeter defect was in the right lateral temporal lobe. The cerebral hemispheres were symmetrical with marked swelling characterized by flattened gyri and narrowed sulci. Patchy subarachnoid hemorrhage was present over cerebral convexities and at the base of the brain.

Following formalin fixation, sections through the cerebral hemispheres, cerebellum, and brainstem revealed a hemorrhagic wound track coursing through the left parietal lobe, midline structures including the thalamus, and the right temporal lobe. Extensive hemorrhage and tissue destruction were associated with the wound track. Secondary hemorrhages are in the rostral brainstem.

Microscopic examination showed parenchymal hemorrhage in the brainstem, ischemic neuronal change, and hemorrhage with tissue destruction from the section of the wound track. Iron stains on the sections were negative.

Head Injury, Blunt Object, Unusual Pattern

G43 Pediatric Malignancies Presenting as Sudden Death: A Case Series

Allison S. Nixdorf-Miller, MD*, Tracey S. Corey, MD, Barbara Weakley-Jones, MD, and William R. Ralston, MD, Office of the Chief Medical Examiner, 810 Barrett Avenue, Louisville, KY 40204

After attending this presentation, attendees will learn how pediatric malignancies, though rare, may present as sudden death. Careful examination of the history and physical findings will aid in the ultimate cause of death.

This presentation will impact the forensic community and/or humanity by aiding in better understanding of pediatric malignancies in sudden death.

The goal of this presentation is to review causes of sudden death due to previously undiagnosed malignancies in the pediatric population from

1994 to 2006 at the Office of the Chief Medical Examiner in Louisville, Kentucky.

Five deaths due to malignancies in children between the ages of five months and fourteen years were identified during this time period. Two Wilm's tumors, a T-cell mediastinal acute lymphoblastic lymphoma, and two acute myeloblastic leukemias are listed as the causes of death. None of the five cases reported had a previous diagnosis of malignancy prior to death. In fact, one case (AML M5) was thought to be a victim of child abuse due to the physical findings of bilateral black eyes.

Cases 1 and 2: Unlike death in the case of Wilm's tumor due to intraperitoneal hemorrhage reported by Somers et al, the children in both of these Wilm's tumor cases died as a result of pulmonary tumor emboli. A five-year-old girl followed closely by her family physician for mild developmental delay was participating in class activities and was thought to have fallen asleep in class. She was unarousable, and subsequently it was determined she had died. At autopsy, a 6.5 cm Wilm's tumor was found in the upper pole of the left kidney, with extensive but microscopic pulmonary tumor emboli within all lobes of the lungs. The second Wilm's tumor was found in a three-year-old boy who had a three day history of vague abdominal pain and constipation. He collapsed after being given antacids for his pain. The 8.0 cm tumor within the left kidney caused a large tumor thrombus within the inferior vena cava and a tumor embolus with occlusion of the right ventricular outflow tract and pulmonic trunk.

Case 3: A ten-year-old boy presented to his primary care doctor five times in the three months preceding his death with complaints of fever, cough, wheezing, and neck swelling. He was diagnosed at the last visit as having pneumonia with a widened mediastinum. That evening he began gasping for air, became cyanotic, and collapsed. At autopsy a 470 gm, 22.0 cm mediastinal mass completely encased the aortic arch and great vessels, trachea, anterior pericardial sac and hilum. The superior border of the mass was the thyroid gland. Immunophenotyping confirmed a T-cell mediastinal acute lymphoblastic lymphoma. In this case no other organs were involved.

Case 4: A 14-year-old girl with a three week history of headache, abdominal pain, extreme fatigue and fevers, was brought to the emergency room in full arrest. She had been seen in the ER three times in the week prior to her death with the above listed symptoms and given a clinical diagnosis of pharyngitis with a suspected etiology of infectious mononucleosis. At autopsy a large intracerebral hemorrhage was found, with petechiae in all visceral organs. In addition to massively enlarged visceral lymph nodes, leukemic infiltrates were found within the spleen, liver, heart, adrenals, and brain. Immunohistochemical stains performed on the paraffin embedded tissue confirmed the diagnosis of acute myeloblastic leukemia.

Case 5: A five-month-old boy presented to an outlying hospital with a two day history of gasping for air, bloody emesis, lethargy, and decreased urine output. He rapidly deteriorated in the emergency room, and was brought to a local hospital where he was pronounced dead. A history of abuse or neglect by the family was suspected due to severe bilateral periorbital ecchymoses, and multiple additional contusions. After his death, laboratory results revealed his white count to be 269,000. At autopsy, small bowel intussusception with resultant bowel necrosis was identified, with an extensive leukemic infiltrate. Ensuing disseminated intravascular coagulation led to petechiae and the large periorbital ecchymoses, as well as extensive subarachnoid hemorrhages. Leukemic infiltrates were found within the pericardial sac, liver, kidneys, leptomeninges, pancreas, spleen, gastrointestinal tract, and lung leading to acute pulmonary crisis. Immunophenotyping revealed an acute monocytic leukemia (M5).

These cases correlate with one recent paper in which Wilm's tumor and white cell malignancies were the most common malignancies presenting as sudden death in the pediatric age group. These findings differ from another paper, which found that tumors, malignant or benign, involving the central nervous system and heart were most common in their case series. Accidents are the most common cause of death in the pediatric

age group, with cancer being second. Leukemia is the most common malignancy in children between the ages of 0-19, followed closely by central nervous system malignancies. These constitute the two most common causes of cancer deaths in this age group. Most malignancies are diagnosed by classic signs and symptoms, failure to thrive, weight loss, fatigue, feeling poorly, and autopsies on these patients, when requested, are undertaken in the hospital setting with a known or suspected diagnosis. In the five cases presented, preceding symptoms did not lead to a timely diagnosis. Sudden death is a rare, unfortunate presentation of pediatric malignancy.

Sudden Death, Malignancy, Pediatric

G44 An Experimental Comparison of Bone Wound Ballistics of Non-Lead and Lead Bullets

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After attending this presentation, attendees will gain an understanding of how the increasingly prevalent use of non-lead bullets affects forensic examination and investigation.

This presentation will impact the forensic community and/or humanity by increasing knowledge of wound ballistics extended to the non-lead bullet trajectory through results from experimental impact biomechanics testing.

In this work a new type of small arms ammunition is evaluated to determine its capability of producing wound trauma. This new ammunition dispenses the toxic lead core of conventional bullets in favor of a non-toxic pressed tungsten and tin powder core. The testing involved firing rifle and pistol caliber tungsten tin and lead core bullets against real porcine femurs encased in ballistic gelatin. The lead bullets were used to establish a benchmark of performance for the tungsten tin bullets to be measured against. Various metrics such as penetration depth and bone fragment weight were recorded.

The specific cartridge calibers used in the testing were the 9mm x 19mm (Luger) and the 5.56mm x 45mm (5.56 NATO). The specific bullet types evaluated were the semi-jacketed soft point with a brass enclosed base. The bullet weight of the 9mm projectile was 124 grains and the bullet weight of the 5.56mm projectile was 60 grains. The ratio of tungsten powder to tin powder was set by weight at 68% W and 32% Sn for a net density nearly identical to lead. This resulted in the tungsten tin bullets being the same shape, size, and density as the lead bullets.

Ordnance gelatin powder was mixed 10% by weight according to accepted standards to replicate within 3% the penetration depth measured in living swine leg muscle as established by Fackler (1985). The gelatin was molded into a rectangular block with a rounded front face. The overall dimensions of the block were 24" long, 8" wide, and 16" high and required 36 liters of water and 4 kilograms of gelatin powder to manufacture. The bones were mounted upright approximately 4" behind the front face. The blocks were maintained at 39° F for at least eight hours prior to and during the shot. The ballistic gelatin block was mounted on a table 10' away from the muzzle of the firearm in accordance with FBI ballistic testing protocol. Three separate 0.177" BB's were fired into each ballistic gelatin block to verify acceptable block density.

Four combinations of bullet type were evaluated and three shots of each combination were made. The tungsten tin pistol bullets had a mean velocity of 1035 ft/s and a total mean penetration depth of about 14.5" with a mean distance of 9.12" beyond the bone. There were

approximately 180 grains of bone fragments generated by the W-Sn bullet impact. The lead pistol bullets had a mean velocity of 1048 ft/s and a total mean penetration depth of about 13" with a mean distance of 6.78" beyond the bone. There were approximately 73 grains of bone fragments generated by the Pb pistol bullet impact. The lead rifle bullets had a mean velocity of 2792 ft/s and a total mean penetration depth of about 6" and went a mean distance of 1.08" beyond the bone. There were approximately 287 grains of bone fragments generated by the Pb rifle bullet impact. The tungsten tin rifle bullets had a mean velocity of 2843 ft/s and a total mean penetration depth of about 16" with a mean distance of 10.33" beyond the bone. There were approximately 266 grains of bone fragments created by the W-Sn rifle bullet impact.

It was found that the performance of the W-Sn pistol bullets was closely similar to that of the Pb pistol bullets, but the W-Sn bullets created a higher mean collective weight of bone fragments than the Pb pistol bullets did. The W-Sn rifle bullets exhibited much deeper post-bone penetration depth than the Pb rifle bullets, although the mean collective bone fragment weight was approximately the same. It was concluded that there was essentially no difference between the W-Sn and Pb pistol bullets but that the W-Sn rifle bullets would create a much deeper permanent cavity than Pb rifle bullets. The mechanism of this deeper penetration depth was attributed to the resistance to fragmentation of the W-Sn bullet in hard and soft tissue.

Reference:

1 Fackler, M.L., Malinowski, J.A.: The Wound Profile: A Visual Method for Quantifying Gunshot Wound Components. *J. Trauma*, 25 (6) : 522-529, 1985.

Bone Wound Ballistics, Non-Lead Bullet, Ballistic Gelatin

G45 Model Protocol for Forensic Medical Examination of Victims of Trafficking in Human Beings

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After attending this presentation, attendees will understand basic health issue related to trafficking in human beings (THB), in particular these related to physical trauma, sexual violence, and substance misuse. The attendees should also become familiar with advantages of early medicolegal examination of THB victims.

This presentation will impact the forensic community and/or humanity by giving arguments and advocate for necessity of medicolegal health-care for THB victims that is mostly being neglected in existing local anti-trafficking policies and intervention protocols. A positive example of Istanbul Protocol use in evaluation of torture victims would serve as an illustration of good practice in sound related field.

The presentation will discuss the experience gained through the trainings for medical and judiciary professionals in countries of Western Balkans (Serbia, Bosnia and Herzegovina, and Croatia). A protocol developed for forensic medical examination of victims of THB will be discussed in detail. It is recommended that the agenda of anti-trafficking policies needs to be redrawn to include forensic medical assessment of victims for legal purposes.

Human Trafficking, Forensic Medical Examination, Injury

G46 The Role of Postmortem Cardiac Enzymes in the Diagnosis Acute Cardiac Deaths

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After attending this presentation, attendees will have a greater understanding of biomarkers of acute myocardial injury and their role, or lack thereof, in the postmortem diagnosis of myocardial infarction. The information presented here will help guide the investigations and autopsies in cases of suspected acute cardiac deaths.

Sudden deaths due to myocardial infarction compose a large percentage of the workload of investigators, coroners, and forensic pathologists and others whose work involves death investigation. This presentation will impact the forensic community and/or humanity by aiding these workers in the approach and workup of suspected acute cardiac deaths. While biomarkers of myocardial damage may have some utility in the diagnosis of acute cardiac deaths, they should not be used exclusively to make the diagnosis. As deaths certified due to myocardial infarction occasionally incite legal battles involving employers and treating physicians, it is of the utmost importance to correctly classify these deaths and not simply rely on a single or series of biological markers. In addition, performing routine postmortem markers of myocardial damage can be costly and may consume resources that could be better utilized on other testing or equipment.

Sudden cardiac deaths due to myocardial infarction constitute a large percentage of the caseload for death investigators, coroners, and forensic pathologists. While sometimes one has a high level of suspicion of a myocardial infarction at autopsy, it is only by finding a thrombus or seeing characteristic gross or microscopic morphological changes in the myocardium that one can definitively make this diagnosis. Because of this, researchers continue to seek out a more sensitive method of determining acute myocardial damage. For years, treating clinicians have been able to measure serum levels of proteins and enzymes normally contained within the myocardium. Increased serum levels of these markers have been shown to be highly sensitive and specific for myocardial damage. The preferred markers have changed over time, but currently three of the more reliable markers include troponin (isoforms I and/or T), total creatine kinase (CK), and CK-MB a more specific isoform of CK.

Various authors have investigated the role of postmortem cardiac markers at autopsy and have had varying results. Some of the studies include a correlation of postmortem and antemortem levels of cardiac markers, a comparison of postmortem serum and pericardial fluid levels, and several have attempted to determine if postmortem levels are significantly higher in deaths due to myocardial ischemia than due to other causes of death. To date, though, there has not been a standardized study determining postmortem levels of cardiac markers from serum of different anatomic locations.

The current study included ten decedents, five with histories suspicious for myocardial infarction and confirmed at autopsy, and five control subjects who died of non-cardiac disease. For each decedent, six different samples (pericardial fluid and serum from the femoral veins, subclavian veins, aorta, left cardiac ventricle, and right cardiac ventricle) were drawn and tested for CK, CK-MB, and troponin-I (TnI). Three main conclusions were drawn; the levels of cardiac markers from the control group are significantly higher than the reference range for living patients; there are significant differences in the levels of cardiac markers between serum samples from different anatomic locations; and only three cardiac marker/anatomic site combinations were significantly different between the control and study groups (femoral/TnI, right ventricle/CK-MB, and pericardial fluid/CK-MB). These complete findings, a review of the literature, and a discussion about the role of postmortem cardiac markers in detecting acute myocardial damage will be discussed.

Cardiac Enzymes, Acute Myocardial Infarction, Death

G47 Histologic Evidence of Repetitive Blunt Force Abdominal Trauma in Three Pediatric Fatalities

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After attending this presentation, attendees will understand the importance of retaining sections of the retroperitoneum for microscopic examination.

This presentation will impact the forensic community and/or humanity by increasing awareness of recognizing certain patterns of fibroblastic proliferation and reactive vasculature encountered if proper sections are taken in cases of repeated child abuse.

In cases of fatal child abuse, the discovery of external blunt force trauma, skull fractures, subdural hematomas, abdominal hemorrhage, as well as retinal hemorrhages are all well described in the pediatric and forensic literature. The gross findings at autopsy, when taken into consideration with scene investigation and interviews with caregivers, point to a clear manner and cause of death in many cases. In such cases, the discovery of changes attributable to older abusive injuries helps support a conclusion of death due to inflicted trauma. Three cases of fatal child abuse in which acute blunt force abdominal trauma was the cause of death and the manner of death was homicide are presented. In each of these cases, careful examination with proper sectioning and microscopy of select abdominal tissues revealed the presence of fibroblast proliferation, increased vascularity, and hemosiderin laden macrophages indicating abdominal injuries older than the acute, fatal blunt force trauma. Iron and trichrome stains were used to highlight hemosiderin and fibrosis in all three cases; however the recognition of a fibroblast proliferation and a reactive vascular pattern was best seen on routine hematoxylin and eosin stains. These findings at autopsy, along with good investigative evidence, were helpful in establishing the diagnosis of chronic physical abuse.

Fibroblast, Proliferation, Child Abuse

G48 Death by Suicide in Maryland: A Cross-Sectional Study, 2002 to 2005

Jonrika M. Malone, MD*, Ana Rubio, MD, PhD, Corey Tayman, and David M. Fowler, MD, State of Maryland Office of the Chief Medical Examiner, 111 Penn Street, Baltimore, MD 21201

After attending this presentation, attendees will recognize the impact of suicidal deaths among various age groups, races, and between genders, allowing them to better understand that suicide as a manner of death is not isolated to the young or the old.

This presentation will impact the forensic community and/or humanity by bringing to the forefront the significance of suicide in overall mortality, detailing the different causes of death in diverse groups, and drawing epidemiologic data from the entire state of Maryland, representing the population as a whole.

Introduction: An estimated 5,600,388 individuals called the state of Maryland home in 2005 according to the United States Census Bureau. The ratio of men to women is nearly 50-50, with 48.4% and 51.6% respectively. With a population increase of 5.7% from 2000, the state is steadily growing, as is the rest of the country.

The overall rate of suicide in the state of Maryland is 8.8 per 100,000 populations per year (about 493 deaths per year). Although age (both extremes of life with adolescents and the very old being at higher risk), race (Caucasians being overrepresented) and gender (males more likely to complete suicidal deaths) are known risk factors for suicide in the literature, a detailed analysis of these and other risk factors and the

interaction with the cause of death may reveal recent trends in suicide in the Maryland population.

Methods: The Office of the Chief Medical Examiner (OCME) for the State of Maryland oversees all suicidal deaths occurring in the state. From January 2003 to December 2005 there were 1477 suicidal deaths in the state. Cases within the time frame were extracted from the OCME database, each case was reviewed, and data were analyzed for age, ethnicity, cause of death, county of residence, history of depression and/or previous suicide attempts, and whether or not there was a suicide note and of what type. Of all cases, 800 (54.2%) had a complete autopsy, 264 (17.9%) had a partial autopsy, 56 (3.8%) were inspected at the OCME, 300 (20.3%) scene inspections in respective counties, and 57 (3.9%) were approvals (cases were not examined at the office, death certificates were signed by the certifying physician and co-signed at the OCME office).

Results: Men were more likely to commit suicide (80% of the cases versus 48.4% of the Maryland population), and were slightly younger (45.7 +/- 18.7 years of age) than women (46.5 +/- 16.9 years). Caucasians were over-represented (79.1% of cases and 59.8% of the population) while the remaining racial or ethnic groups had fewer suicides than the overall Maryland rate. The rate of suicide was highest among the elderly. While 11.4% of the population of Maryland are over 65 years of age, in this study 17.4% were in that age group. The three most common causes of death were gunshot wounds (46.7%), asphyxia (26.4%) and drug intoxication (13.5%). Less common were blunt force injuries (5.5%), carbon monoxide intoxication (3.8%), sharp force injuries (2.4%), and rarely other methods (such as electrocution) or more than one method (such as gunshot wound and hanging) were employed. Suicides were fewer than expected in Baltimore City per capita and other large metropolitan areas, in part due to the different racial and ethnic mix in urban versus rural populations. The cause of death was influenced by gender [men were nearly ten times (627 cases men versus 63 cases women) as likely to use guns, whereas drug intoxication was almost equally distributed between the genders], age (there were no suicides by sharp force injuries in the adolescent group, where the most common cause of death was asphyxia due to hanging) and racial/ethnic background (asphyxia was the most common cause of death among Asian [48.6% of all suicides in this group] and Hispanics [45.2%], while gunshot wounds were the most common cause in African Americans [49.3%] and Caucasians [47.8%]).

Conclusions: A three year cross sectional study of suicide in Maryland confirmed known risk factors (male gender, Caucasian race, and old age) and also found association between these risk factors and the cause of death (suicide method). These associations may be useful in targeting efforts at prevention.

Suicide, Cause of Death, Risk Factors

G49 Can Mandibular Fractures Occur in Non-Oral Contact Shotgun Wounds of the Head?

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After attending this presentation, attendees will be aware of the characteristics of contact shotgun wounds of the head that do not directly involve the oral cavity, lower face, or mandible.

This presentation will impact the forensic community and/or humanity by demonstrating how mandibular fractures can occur with non-oral contact shotgun wounds of the head and that these fractures do not imply separate blunt force injury to the mandible.

Contact shotgun wounds of the head most commonly involve the oral cavity, submental region, temple, or frontal scalp. Although these wounds are usually suicides, homicides do occur. In all cases, autopsy findings should correlate with the investigation. Additional injury, such as a mandibular fracture in a contact shotgun wound to the temple region, must be explained in order to rule in or rule out the probability of separate blunt force injury.

The files of the Office of the Chief Medical Examiner (OCME) for the state of Maryland were reviewed for shotgun wounds to the head from January 1995 through June 2006. Review showed 215 total shotgun to the head cases with available records. Of those 215 cases, 133 were contact shotgun wounds to the head. According to available information, the location of the contact shotgun wounds included 26 cases (20%) that were intraoral, 49 cases (37%) with contact under the chin, 52 cases (39%) with contact at the level of the nose or above and 6 cases (4%) with contact at the side of the face at the mandible. Of the 52 cases with contact at the level of the nose or above, ten cases (19%) had mandibular fracture. Three of the ten cases (30%) were determined to be homicides and seven of the ten cases (70%) were determined to be suicides. Location of the shotgun wounds were right side of the head at the temple (3 cases), middle of forehead (2 cases), between the eyes (1 case), right eye (1 case), left eye (1 case), nose (1 case), and back of the head (1 case).

The gauge of the shotgun was known for seven of the ten cases with mandibular fractures. Six of the shotguns were 12 gauge (60%), one was a 20 gauge (10%), and three were unknown (30%). Of the 42 cases that did not produce a mandibular fracture, 21 were 12 gauge (50%), nine were 20 gauge (21.5%), three were .410 (7%) and nine were unknown (21.5%).

In a previous study by Harruff comparing the injury produced by different gauge shotguns, 20 of 89 cases (22%) of contact shotgun wounds of the head were located at the temple, scalp (above the level of the ears) or forehead. In these 20 cases, there was no reported difference in the internal features of the damage caused. The internal injuries included extensive fractures of the skull and maceration of the brain without injury to the facial structures. In contrast to the internal injuries, 12 gauge shotguns produced extensive external lacerations while larger gauge shotguns produced lacerations primarily at the site of contact. In the current study, the 12 gauge shotgun on average caused more extensive lacerations when compared to the larger gauge shotguns. However, both the 12 gauge and 20 gauge shotguns were able to cause a mandibular fracture.

In contact shotgun wounds of the head, fragmentation of the skull is caused by the increase in internal pressure of the skull due to the charge of the shot and the increase in pressure caused by the rapidly expanding gas from combustion of the propellant. It is postulated that this force is directly transmitted from the temporal bone to the mandible resulting in fracture.

This report emphasizes that mandibular fractures can occur with contact shotgun injuries at or above the level of the nose and that these injuries can occur regardless of the gauge of the shotgun. It is paramount not to report separate blunt force injury as the cause of the mandibular fractures without further investigation and autopsy findings supporting those conclusions. If there are allegations or concern of blunt force injury, then autopsy should show separate points of impact on the skin of the jaw area as evidenced by contusion, abrasion, or lacerations.

Contact Shotgun Wound, Head, Mandibular Fracture

G50 A Retrospective Review of Youth Suicide in New Mexico

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The goal of this presentation is to provide a brief overview of youth suicide in the United States; discuss one model of suicide and suicidal behavior; provide an overview of youth suicide in New Mexico including demographics, decedent characteristics, and circumstances of death; and discuss possible interventions to prevent youth suicide, based on the New Mexico experience.

This large-scale study on suicide in children and adolescents will impact the forensic community and/or humanity by demonstrating increasing understanding of this large (and growing) public health problem. With a solid understanding of the circumstances surrounding youth suicide, it may be possible to predict, and hopefully prevent, future cases of child and adolescent death.

Introduction: Although a suicidal behavior in children and adolescents is a major public health problem, large-scale research on suicide in this population is uncommon. Analysis of the methods and risk factors over time may permit more focused planning for suicide prevention programs.

Methods: All pediatric suicide cases referred to the New Mexico Office of the Medical Investigator from 1979 to 2005 were reviewed. For the purpose of this study, pediatric deaths were defined as deaths in the age group of one day up to and including 17 years of age. The autopsy, field investigator, and police reports were examined in detail regarding age, sex, location, and method of suicide; presence of suicide notes; and any contributing psychologic factors or stressors.

Results: There were 433 pediatric suicides during the study period, ranging in age from nine to 17; the age-adjusted suicide rate was 4.8 per 100,000 with a male-female ratio of 3.8:1. There was no significant change in gender, race, or age over time; however, there was a significant increase in the number of suicides per year. Greater numbers of suicides were observed during the months of December and February as compared to other months. Psychologic stressors were identified in some cases, such as psychiatric problems (46%) and chronic family problems including physical or sexual abuse (32%). There was a history of previous suicide attempt or suicidal ideation in 28% of the cases. Most of the suicides (76%) occurred in the victim's home or yard, and 25% left a suicide note. In 26% of cases alcohol or other drugs were detected postmortem; toxicology testing was more often positive in decedents over the age of 15 and only rarely positive in decedents younger than 15. Gunshot wound was the most common method overall (58%), followed by hanging (30%), overdose (5%), and other (including drowning, jumping from height, and blunt force vehicular trauma, 5%). Of note, hanging deaths were significantly more common among Native Americans as well as those decedents younger than 13. In addition, there has been a statistically significant decrease in deaths by firearm and a concurrent significant increase in hanging deaths.

Conclusions: Although the age-adjusted suicide rate is markedly higher in New Mexico than nationally, the trends in the regional population are similar to those seen nationally. The authors therefore present their findings in this 26-year retrospective study to increase understanding of pediatric suicides. With a solid understanding of the circumstances, it may be possible to predict, and hopefully prevent, future cases of child and adolescent death.

Adolescent, Death, Suicide

G51 A Homicide Due to a “Disguised Mail Bomb”

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Attendees will learn about a case of a homicide due to blast injuries from a bomb disguised as a package in the mail.” The goal of this study is to underline the importance of the cooperation between the forensic pathologists and the forensic laboratory section in cases of death due to explosion and the importance of the use of confocal microscope to identify the exact origin of the material present in skin samples.

This presentation will impact the forensic community and/or humanity by demonstrating the importance of histopathology in explosive-related death and the application of confocal microscope to support investigation to clarify the circumstances surrounding the death.

Explosive-related deaths fall into three types: accident, homicide, and suicide. Homicidal explosive deaths, although rare, are often associated with acts of terrorism.

An explosion following the opening of a mail package addressed to his father wounded a young Italian man. The boy was quickly taken by ambulance, but was declared dead before he arrived at the hospital. At the crime scene, along with biological material, several small and large pieces of yellow mail paper, metal, and glass fragments, and numerous shotgun pellets were collected.

Prosecutor arranged the autopsy on the body to clarify the exact mechanism of death and the correlation with the type of bomb. While undressing the body a gunshot pellet was discovered, but a preliminary total body radiographic examination exhibited no radiopaque metallic pellets within the body. A complete autopsy was performed. A large number of abrasions, burns, and contusions were present on the face, the anterior part of trunk, and upper and lower limbs. Additional solid gray metal fragments and white-gray granular material were deposited throughout the facial and trunk injuries. Eyebrows, eyelashes, head and trunk hair, were singed. Blast injury was present to left hand with skin loss, and to right hand with skin and bone loss. The posterior surface of the body was not injured. The internal examination showed confluent bruising of lungs and a band-like pattern related to the overlying ribs, bruising of the abdominal wall, both the skin and the underlying muscles, 900 cc of blood in the peritoneal cavity; extensive bruising of the gut and the mesentery; and lacerations of liver and spleen were present. Examinations of other organs were unremarkable; no fractures of ribs and sternum were detected. Routine histological investigations, applying hematoxylin and eosin staining, were performed on all organs samples. Lungs sections showed alveolar ruptures, thinning of alveolar septae, and enlargement of alveolar spaces, subpleural and intraalveolar hemorrhages, venous air embolism and soot aspiration in smaller bronchi. Fat red staining, used to document the occurrence of pulmonary fat embolism, was negative. The air embolism were confirmed by the positive results to the immunohistochemical stain for fibrinogen and CD 61 (platelet glycoprotein III a). Liver and spleen sections showed intraparenchymal diffuse hemorrhages. Samples of soot collected from the skin of face, and trunk showed a detachment of the upper epidermal areas, longitudinal elongation of the cells and nuclei of the basal cells. The cutaneous heat injuries were confirmed by the positive results by the immunohistochemical dye for HSP 90-70-27. Except for brain edema and generalized haemostasis, examination of other organs was unremarkable.

The skin samples were also examined with a light microscope, in transmitted bright field illumination and phase contrast mode, and with confocal microscope using auto-fluorescence emission of skin and metal deposited on corneum stratum and fixed in lower layers of epidermidis; a three-dimensional reconstruction of samples was performed. Fragments of the mail package were analyzed by Forensic Laboratory Section of R.A.C.I.S. (Raggruppamento Carabinieri Investigazioni Scientifiche - Grouping Scientific Investigations Carabinieri).

The trigger mechanism of the bomb was connected in turn to an electric blasting cap; such a setup affords subsequent detonation of the device. The package was a typical “disguised bomb” with the explosive contained in an innocuous appearing container.

According to the autopsy findings and histological data, death was attributed to primary blast injury (PBI). The primary blast injury arises from the overpressure of the wave that crushes the body and damages the air containing organs directly, and other organs indirectly.

The investigation of explosion-related fatalities can be a substantial challenge in forensic casework. Determining whether the mode of death is suicide, homicide, or accident in such cases can present an especially difficult task to the forensic pathologist.

Therefore the detailed forensic investigation performed with autopsyal and histological findings, and the study of metal fragments present in the skin using a confocal type laser profile microscope at the same time the analysis of the bomb package permitted the exact reconstruction of the homicidal explosion.

Blast Injury, Confocal Microscopy, Disguised Bomb

G52 Ocular Study in Pediatric Deaths Under Two Years of Age With Novel Findings in the Retina of Children Who Died of Sudden Infant Death Syndrome (1994 – 2004)

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After attending this presentation, attendees will learn of novel findings of the retina of children who die with the diagnosis of SIDS.

This presentation will impact the forensic community and/or humanity by presenting novel findings which are easily demonstrated on routine histologic processing will aid in the understanding of a component of the pathophysiological process in children who die of SIDS.

Pediatric autopsies are considered one of the most difficult areas in Forensic Pathology, due to the small stature, different physiology, and the increased vulnerability of children to abuse.

Sudden infant death syndrome (SIDS) is defined as the sudden death of an infant less than one year of age that remains unexplained after a thorough case investigation, including performance of a complete autopsy with negative results, examination of the death scene, and review of the clinical history. SIDS is the leading cause of infant death beyond the neonatal period, mostly between one month and four months. Although the etiology largely remains unknown, many factors have been associated including metabolic, cardiac, and prone sleep position.

Differential diagnosis includes Shaken baby syndrome (SBS), subtle accidents, asphyxias, and inflicted trauma. The retinal findings are a key part of the investigation specifically identifying areas of retinal hemorrhage.

The purpose of the study was to describe ocular findings in children under two years of age who died suddenly.

One hundred two forensic pediatric cases of deaths under two years old were selected from the Regional Forensic Pathology Unit of Hamilton Ontario, over a period of 11 years (1994 – 2004).

Forensic reports were analyzed and data such as age, sex, cause of death, and postmortem intervals were obtained.

A grossing and microscopic protocol for eyes was created including description with measurements, fixation, sectioning, photography, and systematic histology.

Pigs' eyes were processed with same protocol at different postmortem intervals, as a control for postmortem tissue changes.

The majority of the cases (55%) were between one month and six months of age. The most common diagnosis was SIDS (59/102).

Seventy-two (70.5%) cases showed the presence of cytoid bodies in the retina. Cytoid bodies are smooth, rounded, eosinophilic balls that measure from 7-15 µm and can mimic red blood cells. They were located predominantly (90%) at the anterior part of retina involving the internal limiting membrane and nerve fiber layer of retina. Cytoid bodies were positive for S100, Synuclein, CD 56, and negative for Glycophorin A (an RBC marker).

Extramedullary hematopoiesis (EMH) was identified in 35 (34%) cases. The most frequent location of EMH was the choroid 29/35 (82%). Myeloid and erythroid precursors were confirmed by immunohistochemistry (myeloperoxidase and glycophorin A respectively). Electron microscopy verified the presence of neural filaments.

The changes were not seen with control samples, excluding postmortem artifact as the cause for the findings.

This study is the first to demonstrate the presence of extramedullary hematopoiesis and cytoid bodies in the retinas of SIDS children. The findings suggest a subtle hypoxic component in the natural process in SIDS. The two cases of victims of Shaken Baby Syndrome did not demonstrate EMH or cytoid bodies. Other causes of asphyxia show a 60% incidence of cytoid bodies and 30% incidence of EMH. SIDS cases did not show retinal hemorrhage.

The forensic community may benefit from these observations further aiding in the understanding of the pathogenesis of SIDS.

SIDS, Ocular Findings, Cytoid Bodies

G53 Exsanguination Associated With Vascular Access Sites in Hemodialysis Patients

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After attending this presentation, attendees will understand some principles associated with death secondary to exsanguination from vascular access sites in hemodialysis patients including the vascular access types, the frequency at which this occurs, associated circumstances under which this occurs, and possible modalities for prevention.

This presentation will impact the forensic community and/or humanity by providing a review of exsanguination deaths that are directly related to arteriovenous fistulas, arteriovenous grafts and venous catheters used for hemodialysis in patients with end stage renal disease. This information can augment knowledge of this lethal complication associated with hemodialysis and thereby reinforce the need for patient, caregiver and health personnel education and vigilance.

Patients with end stage renal failure requiring hemodialysis have three options for vascular access depending on the severity of their disease, their vascular anatomy, and their vascular viability. Native arteriovenous fistulas are the preferred choice for long term dialysis treatment because of their lower rate of breakdown and infection. Arteriovenous grafts can also be used for long term dialysis treatment if the patient's anatomy is not conducive to the creation of a natural fistula but has a greater risk of infection and clotting. Intravenous catheters are preferably used for a short duration, usually for emergency dialysis or while waiting for a fistula to mature. Exsanguination from any of these vascular access sites is a lethal complication for hemodialysis dependent patients.

A retrospective search of cases from January 2000 to July 2006 in the State of Maryland yielded 24 deaths due to exsanguination from arteriovenous fistulas, arteriovenous grafts, and venous access catheters. The age range was from 28 years to 85 years with a mean age of 58 years. Fifteen (63%) of the decedents were male. Eighteen (75%) were African American and six (25%) were Caucasian. Seven access sites (29%) were arteriovenous fistulas and four (17%) were venous catheters. Ten access sites (42%) were arteriovenous grafts. Of these ten grafts, seven (70%) were synthetic, two (20%) were made of natural materials, and one (10%) was comprised both synthetic and natural materials. Exsanguination was due to erosion of an arteriovenous graft or fistula in 14/24 (58%), dislodgement of a venous catheter in 2/24 (8%), dehiscence of graft site sutures in 2/24 (8%), infection involving a graft or fistula in 2/24 (8%), perforation of an artery following venous catheter insertion in one case (4%), erosion due to an aneurysm involving a fistula in one case, one individual who cut her venous catheter at home presumably with scissors for unknown reasons and one individual who pulled out his active dialysis line from his arteriovenous graft in the dialysis center. The manner of death was classified as accident in 11 of 24 cases (46%), as natural in nine (38%) and as undetermined in four (17%). Of the 22 of 24 cases tested for ethanol, one case tested positive. Of the 13 of the 24 cases tested for drugs, three (23%) tested positive for illicit drugs. The substances identified included cocaine and morphine. In addition to these three cases, one decedent had pseudoephedrine intoxication that was considered a contributing cause of death.

Although the complications related to vascular access sites for hemodialysis are many and varied, the results indicate that death by exsanguination is an important risk for patients. Dialysis centers should educate patients about this potential and instruct them to periodically look for signs of fistula/graft compromise including fistula/graft failure, infection, or aneurysm formation. In addition, dialysis centers should consider encouraging patients to carry a tourniquet at all times after proper training as to its use. Therefore, if a fistula/graft does erode or perforate, one can survive until emergency care can be initiated.

Hemodialysis, Exsanguination, Arteriovenous Fistula/Graft

G54 Potential Errors in Autopsy Reports of Custodial Deaths Temporally Associated With Electronic Control Devices: A Cardiovascular Perspective

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After attending this presentation, attendees will have a better understanding of Electronic Control Devices, such as the TASER® device, and how to better perform an autopsy in such cases.

This presentation will impact the forensic community and/or humanity by demonstrating more accurate autopsies where an Electronic Control Device was associated with a death.

Introduction: Sudden, in-custody death (SICD) events are alarming phenomena that occur numerous times per year in this country. With increasing usage of electronic control devices (ECD), such as TASER® brand devices by law enforcement, the number of SICD events that are

temporally related to ECD applications is growing. The autopsy in such a case presents a diagnostic challenge to the medical examiner, as there are no postmortem tests available to detect past electrical applications.

As ECD technology is relatively new, medical examiners may not be fully aware of what these devices are and are not capable of and may, therefore, be making errors in diagnostic judgment. This study analyzed the probable error rate in assigned causes of death based on a convenience sample population.

Methods: A press search for the years 2001-2005 for cases of an SICD with a temporal ECD association was undertaken and the autopsy reports obtained.

Sudden death from electrical discharge is caused by the induction of ventricular fibrillation (VF) and generally follows this sequence: (1) pulse disappears immediately, (2) there is loss of physical strength for continued resistance, (3) collapse occurs within 5-20 seconds, (4) a VF rhythm is shown on a cardiac monitor, and (5) immediate defibrillation is usually successful. Any material failure to appreciate the above facts was scored as an error.

Other errors were counted if the report reflected hypotheses not supported by known literature. These included: blaming the ECD for cardiac physical changes, inclusion of a publicity sensitive safe comment (e.g., “we were unable to eliminate the role” of the ECD), assuming prolonged ECD applications are more dangerous than other restraint techniques, claiming that ECDs impair breathing, presumption of a lethal synergy between stimulant drugs and the ECD, use of the ECD in the “drive stun” mode only since this involves current passing between two very close electrodes and does not create any major body mass involvement. Finally, the use of the metaphorical “last straw” was scored as an error.

Results: There were 176 SICD events reported over the 60 month period with a temporal ECD association. Twenty-Seven cases where the autopsy reports listed the ECD as a contributory or as an “unknown” factor. As expected, the rate of such reports appears to be growing at 2.6 per year ($r^2=.74$, $p = .06$). Autopsy reports were reviewed for these cases and errors were tabulated. The decedents were all male with mean age 35.6 ± 10.7 years (median = 32) which is consistent with recently reported SICD data.¹ A mean of 3.1 ± 1.2 scored errors per report with a range of 1-6. This rate was very stable across the study period. A sobering finding was the rate at which “last straw” was mentioned as a linkage in lieu of a scientific mechanism. Scored errors are listed in the following table:

Probable Error in Citing the ECD	N
Time to collapse \geq 1 minute	21
Continued resistance after ECD application	14
Rhythm other than VF	11
Publicity sensitive comments	9
Failure of immediate defibrillation	7
Drive stun mode	6
Assumed drug-ECD electrocution synergy	6
Discharge duration or parity	5
“Last straw” metaphor as a mechanism	4
Cardiac damage ascribed to ECD	3
Assumed ventilation impairment	2

Conclusions: While uncommon, autopsy reports involving electronic control devices do appear several times per year with material errors in the area of cardiogenic etiology. The results of this study suggest that medical examiners need to familiarize themselves with the time and causation elements of electrocution, ventricular fibrillation, and ECD technology to avoid this in the future.

Reference:

¹ Ho JD, Reardon RF, and WG Heegaard. Deaths in police custody: an eight month surveillance study. *Annals Emerg Med*, 2005;46 (suppl):S94.

Electronic Control Devices, TASER®, Autopsy

G55 Headache and Sudden Death in a Young Adult: An Unexpected Finding at Autopsy

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After attending this presentation, attendees will have gained a basic understanding of the different ways humans can contract *Taenia solium*, the pork tapeworm, and the different diseases that can develop from infection with this parasite, emphasizing involvement of the central nervous system.

A 33-year-old white female presented with a history of severe headaches, nausea, vomiting, and dizziness. The headaches, which were unassociated with fever, began in February 2006. A work up for meningitis including examination of cerebral spinal fluid was negative, resulting in a diagnosis of migraine headaches. The headaches and accompanying symptoms, however, persisted. Following an episode of one of the headaches, she was found unresponsive in bed and was unable to be resuscitated.

Autopsy examination revealed the presence of cerebral edema with tonsillar herniation. The posterior horns of the lateral ventricles in the temporal region were dilated. The fourth ventricle was dilated and obstructed by a colloidal appearing cystic structure that measured 1 cm in maximum dimension. The remainder of the autopsy examination was unremarkable. Blood cultures were negative, vitreous electrolytes showed a normal postmortem pattern and were unremarkable, and toxicology testing was negative.

Histologically, the brain showed an intense mononuclear infiltrate composed of lymphocytes and plasma cells that surrounded a homogenous amorphous eosinophilic structure in the ventricle. The choroid plexus focally showed a similar intense inflammatory reaction. Ependymitis and mononuclear perivascular cuffing were also present. The cystic structure seen grossly in the fourth ventricle had a wall that was composed of three layers: an eosinophilic outer cuticle with the grapelike appearance, a single layer of subcuticular cells, and a myxoid cytoplasm containing tubular structures. These findings are consistent with intraventricular neurocysticercosis.

Upon further questioning of the family, it was learned that the decedent had immigrated to the United States from Mexico 12 years ago. Her family in Mexico owned a restaurant type business where pigs were raised and slaughtered on the property. Prior to her recent complaints of headache, the decedent had been in good health.

Cysticercosis is the most common parasitic disease affecting the central nervous system. It is endemic in Latin America, India, China, Southeast Asia, and sub-Saharan Africa. It is estimated that up to 90 percent of patients with cysticercosis have central nervous system involvement. Sole involvement of the central nervous system is termed neurocysticercosis (NCC). The disease is reported in all age groups, but most cases present in the third and fourth decades. Reliable data regarding the incubation period are lacking, but it is estimated that months to decades can pass between initial infection/exposure and the subsequent development of neurological symptoms.

The pork tapeworm *Taenia solium* causes the infection. Humans can be either the definitive host or the intermediate host and thus two different diseases are recognized. Infection with the larval form as would occur from eating contaminated undercooked meat leads to taeniasis. The larva hatches in the small intestine and develops into tapeworms. In this situation humans are the definitive host because they harbor the adult form of the parasite – the tapeworm. In contrast, when humans harbor the larval form of the parasite, they are the intermediate host and the disease is called cysticercosis. This occurs when *T. solium* eggs are ingested. Sources of eggs include contaminated food and water, fruit, or vegetables fertilized with contaminated human or pig feces and contact with individuals harboring the tapeworm and shedding the eggs. The disease may be

contracted from fomites because the eggs are resistant to environmental conditions.

In the small intestine the eggs hatch releasing oncospheres. The oncosphere penetrates the intestinal mucosa, travels to the pulmonary circulation, and is disseminated systemically. The oncosphere, which develops into the larval form, may reach several different organ systems, but seem to have a predilection for the central nervous system, skeletal muscle, subcutaneous tissue, and eyes. Central nervous system involvement most commonly involves the parenchyma and may cause seizures.

Involvement in the central nervous system may be extraparenchymal affecting the ventricles, subarachnoid space, eyes, and spinal cord. It is estimated that between ten to 30 percent of patients with NCC have intraventricular cysts. Ventricular cysts can be attached to the ependyma or float freely migrating throughout the cerebral spinal fluid pathways. Unlike parenchymal cysts, which are typically multiple, ventricular cysts tend to be solitary and ventricular involvement typically occurs without accompanying parenchymal cysts. Ventricular cysts are more likely to be symptomatic than parenchymal cysts. Ventricular cysts can cause hydrocephalus either by blocking the flow of cerebral spinal fluid or by producing ependymitis with scarring, obstruction, and ventriculitis. Individuals having involvement of the ventricle most commonly present with signs of increased intracranial pressure such as headache, nausea, and vomiting. These symptoms are commonly attributed to migraine or tension headaches.

NCC is generally a chronic disease whose natural progression includes four stages: vesicular, colloidal, granular/nodular and calcified. Symptoms typically develop as the parasite begins to die losing its ability to control host defenses. The ensuing inflammatory response results in degeneration of the larva and the formation of a granuloma.

Making the diagnosis in a clinical setting can be difficult because the clinical manifestations are variable and nonspecific and depend on the number and location of cysts and the host's immune response. Proposed diagnostic criteria incorporate absolute, major, minor, and epidemiological criteria. Interpretation of the criteria allows for two degrees of diagnostic certainty – definitive and probable.

No reliable information is available regarding mortality rates. Large autopsy series from endemic areas suggests that the majority of cases are asymptomatic making calculation of the true incidence and prevalence difficult. It is estimated that 50 million people are infected worldwide. The disease carries a high cost in morbidity. In endemic countries NCC may be responsible for 50 percent of adult-onset seizure disorders and those with intraventricular and subarachnoid involvement can develop complications such as vasculitis and hydrocephalus. The annual treatment cost in endemic areas is estimated to be close to \$90 million per year. In the United States, there are more cases of imported NCC than in all other developed countries combined, and the annual treatment cost is estimated at \$9 million per year. The disease is generally encountered in the southwest United States and among Hispanic immigrants. The increasing number of reported cases in the United States is most likely due to increased immigration and travel to endemic areas. The long latent period and variable clinical presentations make it go undetected or unrecognized clinically. Although autopsy studies suggest that NCC is most commonly an incidental finding, the disease can result in death. NCC should be considered in the differential diagnosis of calcified, nodular, or cystic lesions of the central nervous system.

Neurocysticercosis, Headache, Central Nervous System

G56 Sudden Death in Duchenne Muscular Dystrophy With Noncompaction of the Ventricular Myocardium: A New Cardiomyopathy or a Compensatory Regression to Fetal Myocardiogenesis?

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The goal of this presentation is to evaluate morphologic changes in the myocardium critically in order to gain insight into their role in the pathogenesis of apparent cardiomyopathies. What may appear initially to be a primary derangement in cardiac muscle (the definition of cardiomyopathy) may in fact be a secondary response to another primary insult.

This presentation will impact the forensic community and/or humanity by creating an awareness of an abnormal morphologic pattern within the myocardium and the spectrum of its association with disease states, particularly the muscular dystrophies.

Noncompaction of the ventricular myocardium (NVM) is a condition describing a rare type of cardiomyopathy believed to be due to an interruption in cardiac development. It refers specifically to persistence of the trabecular network of sponge like cardiac muscle that accompanies mid- to late embryonic development, during which time the myocardial blood supply is provided by direct diffusion from the intertrabecular spaces that communicate directly with the cardiac chambers. NVM may occur either as an isolated condition, in association with other structural heart derangements, or as part of a syndrome of anomalies. NVM has been described as a component of several muscular disorders and mitochondrialopathies, including Barth syndrome, Becker muscular dystrophy, Emery-Dreifuss muscular dystrophy, myoadenylate deaminase deficiency, myotubular and metabolic myopathies, and with mutations in the G4.5 and a-dystrobrevin genes (Xq28 chromosome region), with possible X-linked inheritance. However, until quite recently, an association between NVM and Duchenne muscular dystrophy (DMD) had not been realized. This presentation describes a case of sudden death in the setting of DMD complicated by dilated cardiomyopathy (DCM) in which autopsy revealed a prominent finding of NVM; in doing so, this study attempts to explore a potential causal relationship between the DCM and NVM.

The deceased was a 21-year-old African-American man with DMD (wheelchair-bound) and DCM; a recent echocardiogram documented global hypokinesis with a left ventricular ejection fraction ranging from 20-30%. Five days before his death, he presented with an acute exacerbation of congestive heart failure and tricuspid regurgitation. On the day of his death, his caregiver called 911 for complaints of profound weakness; paramedics recorded a mean blood pressure of 65 mm Hg. He was transported to the Emergency Department and was administered crystalloid intravenous fluids, which restored his blood pressure to 91/51. However, despite being stable for the next few hours, he experienced a witnessed seizure that was followed by a thready carotid pulse, and shortly after, by pulseless electrical activity (PEA). Resuscitative efforts were initiated and were carried out for approximately 10-15 minutes but were unsuccessful and he was pronounced dead.

At autopsy, the deceased exhibited marked flexion contractures of the hips and knees and there was extensive fatty replacement of the calf and psoas muscles. There were unequivocal features of DCM, including a 550-g heart (expected for body weight: 223 g), moderate to marked left ventricular dilatation and patchy but focally confluent areas of dense white fibrosis, individually up to 0.6 cm, involving the posterior and lateral left ventricular walls. In addition, there was marked exaggeration of the trabeculae carnae within the left ventricular chamber, with numerous anastomosing trabeculae that imparted a distinctly "spongy" appearance, particularly at the left ventricular apex. Microscopic cardiac examination

revealed confluent replacement fibrosis and fatty ingrowth within the compact outer myocardial half, while the inner half consisted of an anastomosing network of trabeculae forming irregular "staghorn"-like spaces. The cause of death was certified as complications of DCM (associated with NVM) due to DMD.

In late 2005, NVM was described for the first time in a patient with DMD by a group of investigators in Vienna, Austria. They proposed that in the setting of DMD, replacement fibrosis of the compact myocardium following myocyte loss is the principal pathologic finding and accounts for the clinical spectrum of ventricular dysfunction in these patients, while NVM represents a compensatory response generated by a failing heart to regenerate its nonfunctional myocardium. The case presented case represents the second reported association between NVM and DMD. This study proposes that the precise molecular signals governing the events in embryonic myocardiogenesis may be recapitulated in certain clinical settings, such as this one; identification and isolation of such signals would corroborate this hypothesis and enhance the understanding of such events.

Noncompaction of the Ventricular Myocardium, Dilated Cardiomyopathy, Duchenne Muscular Dystrophy

G57 Death By Giant Cells: Report of Two Cases of Sudden Cardiac Death Due to Giant Cell Inflammatory Processes

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After attending this presentation, attendees will be familiar with the differential diagnosis in cases of sudden cardiac death due to giant cell inflammatory processes involving the myocardium and will understand the roles of histologic examination and immunohistologic studies in arriving at the correct diagnosis.

This presentation will impact the forensic community and/or humanity by elucidating the clinical and pathologic issues involved in distinguishing the subgroup of sudden cardiac deaths resulting from inflammatory processes with giant cells that affect the heart.

The medical examiner or coroner usually investigates sudden and unexpected deaths in individuals without documented disease processes that would provide reasonable explanations for the deaths. These include the unexpected deaths of individuals who have been diagnosed with a known chronic natural disease that was not expected to cause death at that point in time as well as those cases in which the deceased had no known pre-existing natural disease at the time of death. Cardiovascular disorders, most notably arteriosclerotic and/or hypertensive cardiovascular disease, account for the majority of sudden and unexpected natural deaths. Less commonly documented are disease processes directly affecting the myocardium. In these cases, histologic examination of the myocardium is often essential in reaching a diagnosis.

Granulomatous inflammation of the myocardium can occur in the course of a number of systemic disease processes including infectious etiologies such as fungal, mycobacterial and parasitic infections, as well as hypersensitivity reactions and rarely autoimmune disorders. In many of these disorders giant cells comprise a component of the inflammatory infiltrate. Systemic granulomatous processes of unknown pathogenesis, most notably sarcoidosis, may also be associated with involvement of the myocardium. In contrast, giant cell myocarditis, also known as idiopathic myocarditis, a rare, frequently fulminant, and fatal disorder of unknown etiology, is isolated to the heart and lacks systemic involvement.

The majority of systemic granulomatous disorders that involve the heart are diagnosed prior to death due to their protracted clinical course and symptomatology related to the involvement of other organs.

Occasionally, however, these disorders are associated with sudden death due to pathologic involvement of the heart. These cases are likely to be investigated by a forensic pathologist, particularly if the individuals do not have antemortem diagnoses. Because of its isolation to the heart and rapid clinical course, giant cell myocarditis is most likely to be diagnosed at the time of autopsy. Indeed, an individual may be asymptomatic and sudden death may be the presenting manifestation of the disease.

This study reports two cases in which sudden death resulted from giant cell inflammatory processes affecting the myocardium. Both individuals lacked antemortem diagnoses. In one case an 18-year-old man who had been asymptomatic except for a 2 ½ month history of vague abdominal pain was found dead at work. Postmortem examination revealed a semigranulomatous, mixed inflammatory cell process involving the left ventricle that was associated with giant cells and lacked myocardial fiber necrosis and tissue eosinophilia. Numerous well-formed, noncaseating granulomas were found in the lungs, pulmonary hilar lymph nodes and kidneys. The diagnosis of sarcoidosis was rendered. The second case involved a 43-year-old man with a ten year history of intermittent chest pressure and cardiac arrhythmias who collapsed at work. The heart showed a similar mixed inflammatory cell infiltrate that included giant cells, although focal myocardial fiber necrosis and eosinophils were also present. Thorough gross and microscopic examination revealed no involvement of other visceral organs or lymph nodes and the diagnosis of giant cell myocarditis was rendered.

Giant, Cell, Myocarditis

G58 Sudden Death and Keratoderma Associated Cardiomyopathy: An "Affray" of the Heart

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After attending this presentation, attendees will have knowledge of cardiomyopathy associated sudden death and keratoderma as well as the law regarding manslaughter in England.

This presentation will impact the forensic community and/or humanity by discussing issues of interaction of sudden "natural" death and the law pertaining to homicide in England.

A 15-year-old girl was involved in an incident in which she was subject to threats, then blows before running away from the incident. She ran uphill away from the incident, collapsed and died. At autopsy a history was given that she suffered from the skin disorder Erythrokeratoderma Variabilis or possibly Papillon-Lefèvre syndrome and was on antihistamines. At autopsy there was significant thickening of the skin, most obvious of the palms and soles of the feet. The hair was abnormal as were the teeth. On internal examination the heart was clearly abnormal. There was a degree of dilatation of the ventricles and on microscopic examination there was obvious fibrosis, with no evidence of acute infarction or inflammation. A diagnosis of Plantopalmer Keratosis associated cardiomyopathy was made.

There are a number of genetic abnormalities associated with Plantopalmer keratosis. A number of heart conditions may be found including Naxos syndrome and Caravajal syndrome.

A charge of manslaughter, with an additional charge of affray was laid against four teenage defendants. The basis of the manslaughter charge was the charge of affray, except for brain edema and generalized haemostasis. Three of the defendants were convicted of manslaughter and affray. The fourth defendant was acquitted.

On appeal, the convictions for manslaughter were overturned. The convictions for affray were upheld. As well as the unique pathologic features, this case has clarified the law of manslaughter in the English legal system, limiting its extent to an act that is dangerous in the sense that sober and reasonable persons would recognize it as foreseeable.

1 Reference:

R v Carey, C and F (2006) EWCA Crim 17

Cardiomyopathy, Homicide, Keratoderma

G59 Correlations for Expected Heart Weight

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After attending this presentation, attendees will understand the use of correlations with height, weight, and Body Mass Index (BMI) to determine expected normal autopsy heart weight as well as variations in expected heart weight by sex and appreciates the deviation from expected heart weight as an indicator of heart disease.

This presentation will impact the forensic community and/or humanity helping to define abnormal heart weight in sudden and unexpected deaths and will explore the epidemiology of heart disease and the effect of BMI on heart weight.

After attending this presentation attendees will understand that the correlation of height, weight and Body Mass Estimation with expected normal heart weight is important to identify subtle hypertrophy, especially in the analysis of sudden and unexpected deaths with minimal disease. Standard references define normal ranges for heart weight at autopsy and there are published correlations of autopsy heart weight with body weight and body length. Body Mass Index (BMI) is commonly used as an indicator of obesity and obesity has been correlated with heart disease. This study explores the relationship of heart weight at autopsy to BMI as calculated from length and body weight data measured as part of the routine autopsy procedure.

This study reviewed reports of all autopsies performed in 2004 at the Richmond District Office of the Chief Medical Examiner. Data collected from each case included age, sex, race, height, weight, heart weight, and presence or absence of anatomically identifiable heart disease. Cases were excluded where there was extensive decomposition, burning, or other body destruction that could invalidate the height, body weight or heart weight data. While the collected data contained decedents of all ages, the study focused on adults between 18 and 65 years of age.

Correlations of heart weight with body weight in patients without identifiable heart disease were generally good and in agreement with previously published data. Similar correlation lines for patients with heart disease were significantly different with the expected bias toward increased heart weight. Comparison of correlations for men and women also produced significant and expected differences. Surprisingly, correlations of heart weight with BMI were much worse than the correlations with body weight.

Body Mass Index (BMI), Heart Disease, Heart Weight

G60 Gagging, Strangulation By Single/ Double Ligature ...or Incaprettamento?

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After attending this presentation, attendees will learn that some apparent simple cases of strangulation turn out to be complex ones, with more than one form of mechanical asphyxia involved. This presentation

will also point out how important is to know the mechanism of death in these cases to be able to reconstitute the story.

This presentation will impact the forensic community and/or humanity through the familiarization with this particular ritualistic way of committing homicide – the incaprettamento - practiced not only within the community where it was originally described. Additionally the presentation will emphasize the importance of the differential diagnose between the diverse forms of mechanical asphyxia used in a single victim.

Incaprettamento is a typical homicide ritual used by the Italian Mafia as an admonitory significance to traitors and considered a form of vendetta. A rope is tied in a noose around the victim's neck. The other end of the rope is used to tie both hands and feet behind the back. Death is attributed to self-strangulation when, by exhaustion, the victim will no longer be able to support the legs in that forced position. Some authors point out that sometimes, the binding is done postmortem, to facilitate transportation and disposal of the victim.

This research presents a case of a man partially naked, who had been apparently gagged and strangled, with the hands and feet tied at the back, seeming to be a case of *incaprettamento*. He was found in a forest, some meters away from the local road, in a prone position with the head lower than the rest of the body.

The autopsy showed that the victim had been gagged, apart from having two constrictor items around the neck: a ladder belt (which tied simultaneously both hands behind the back, with a twisting device made of a metal part of a bicycle inserted between the rope and the skin) and, underneath it, a synthetic rope. The feet were bound with an electric wire, separately from the hands. Typical ligature injuries were observed, such as asphyxic exuberant signals, osteo-cartilagenous fractures, intimal tear of the carotid artery and bleeding into the muscles and mucosa. A sexual assault was ruled out using a standard protocol for collection and evaluation of the usual specimens.

Taking into account the autopsy diagnoses – gagging and/or a single/double ligature – this paper discusses the real cause of death, and its relation with a case of *incaprettamento*. Finally, this presentation will debate whether this could be considered a real *incaprettamento*, since, contrary to the typical procedure involved in this type of homicide; the feet were bind independently, without being attached to the hands and neck.

Incaprettamento, Strangulation, Gagging

G61 A Case Report of an Unexpected Accidental Electrocution

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After attending this presentation, attendees will understand basic principals of investigating accidental electrocutions and will also have an increased index of suspicion for electrocution in certain cases of sudden, unexpected death.

This presentation will impact the forensic community and/or humanity by increasing awareness of electrocution as a differential diagnosis in certain circumstances and by emphasizing the importance of a multidisciplinary approach to complete scene investigation in cases of possible electrocution. By increasing the detection of cases of electrocution, particularly those taking place in public areas, potentially hazardous or fatal electrical malfunctions, and situations can be detected and corrected before causing death or harm to additional individuals, including the investigators.

Fatal electrocutions are reported to account for a death rate of approximately 0.54 per 100,000, occur most commonly in men, and are mostly accidents (though suicides and homicides by electrocution do occur). The mechanism of death during electrocution varies, but is often due to ventricular fibrillation. Electrocutions can be categorized into direct current and alternating current types, and alternating current is generally regarded as more dangerous than direct current. Electrocutions can also be divided into high and low-voltage varieties (based on voltage greater than or less than 1000 volts), and, though the exact ratio of high versus low-voltage electrocution varies with the study, up to 83% of electrocutions are with low-voltage current. While high-voltage electrocutions are often accompanied by characteristic electrical burns, nearly 50% of low-voltage electrocutions are not accompanied by these burns or other physical evidence, which renders postmortem diagnosis potentially difficult. Indeed, even some characteristic features of high voltage electrocutions, such as the arborescent patterns seen in fatal lightning strikes, may be transient. This lack of specific pathologic findings makes a high index of clinical suspicion very important in certain circumstances, such when a person is grounded and near a source of electricity. Additionally, examination of the victim's clothing for burns and death scene investigation are of critical importance in detecting electrocution. Numerous authors have also stressed both the critical importance of scene safety and of a multidisciplinary approach during the investigations of potential electrocutions. Specifically, electrical engineers or representatives of a local power company are often called upon to examine electrical devices that potentially caused the electrocution.

To illustrate these points, this presentation will describe a case of accidental low-voltage electrocution that occurred in their practice. In this case, a 28-year-old male was found dead in a publicly accessible restroom. The initial report, accompanying the decedent to the county coroner's office, stated the death was believed to be a natural death; however, examination of the decedent revealed burns on the skin and clothing. Based upon these burns, which were believed to be electrical, additional scene investigation was requested by the forensic pathologist. This supplemental investigation disclosed that another individual had complained of receiving a "shock" in that restroom. Also, a representative of the local power company went to the scene and discovered two separate electrical devices that were defective and could have exposed the decedent, or other users of this restroom to low-voltage current, a risk that was heightened by a wet floor with a metal drain. A subsequent report that correlated the scene findings with the pattern of electrical burns on the victim's skin, suggest that both pieces of equipment contributed to the death of the decedent. This case serves to illustrate the potentially occult nature of low-voltage electrocutions and how a multidisciplinary scene investigation as well as expert examination of involved electrical equipment can greatly aid in the detection of such electrocutions, which can have an impact on public safety.

Electrocution, Fatal, Accidental

G62 Death From Truck Tire Servicing: A Report of Three Cases and Review of the Literature

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After attending this presentation, attendees will recognize different blunt force and blast type injuries associated with truck tire servicing accidents.

This presentation will impact the forensic community and/or humanity by helping in the recognition of the different blunt force and blast type injury patterns; and helping the attendee to be better aware of

OSHA regulations and manufacturers' recommendations for proper tire servicing.

Three cases of death from injuries related to truck tire repair and/or handling were identified between 1995 and 2006 at the King County Medical Examiner's Office in Seattle, WA. The decedents, all male, ranged in age from 30 years to 40 years old and had no significant medical conditions. Injuries ranged from blunt force trauma to the head, torso and extremities to blast injuries of the upper airways and lungs.

In the first case, the decedent made an unwitnessed service call to change a tire on a tractor-trailer truck parked in a lot. Evidence suggested the individual had changed the tire and was inflating the new tire when the sidewall blew out. The decedent was struck in the face and fell backward. Autopsy showed contusions to the lungs, esophagus, posterior pharynx, and superior larynx.

In the second case, a warehouse worker was rolling semi-truck wheels and tires onto metal racks. A supervisor witnessed a tire explode projecting the wheel upward into the decedent's head, chest and arms, projecting him backwards. Autopsy showed comminuted skull fractures, cerebral lacerations, multiple rib fractures, and pulmonary contusions.

In the third case, the decedent made an unwitnessed roadside service call to change a dump truck tire on an access road. He was found supine on the ground with the tire and wheel resting across his legs. Examination of the injuries and scene reconstruction demonstrated tire explosion during inflation and upward projection of the wheel. Autopsy revealed a depressed frontal skull fracture and parietal and frontal scalp lacerations with associated cortical contusions and subarachnoid hemorrhage.

Review of the literature revealed well documented patterns of injury and death associated with explosions during tire servicing and handling. The vast majority of fatalities from all tire servicing accidents involve service work on truck tires. Blunt force injuries to the head accounted for the majority of these fatalities, while other common injuries include broken facial and upper extremity bones. Other documented injuries included "blast" or concussive injuries to air-filled organs such as bowel, lung, and tympanic membranes. This study reviewed several manufacturers' standard safety procedures as well as OSHA regulations and found a general concordance on the proper equipment needed when changing a truck tire and on the proper procedure. These include using protective gear and using safety equipment. Proper tire changing procedure was outlined as a multi-step process with clear check points to be met before proceeding onward. The prevention of these types of injuries can best be accomplished by adherence to the tire manufacturers' warnings and recommendations as well as to OSHA's tire service regulations. There is precedent for the levying of fines against businesses not in compliance with OSHA workplace safety standards.

When investigating these frequently unwitnessed deaths, particular attention needs to be paid to scene investigation, noting if proper procedures and equipment were being employed. This is important not only to rule out foul play, but for ease of reconstruction of events leading to death when correlated to injuries found at autopsy.

Blunt and Blast Force Injuries, Truck Tire Servicing Accidents, OSHA

G63 A Rare Injuring Tool in a Dyadic Death

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After attending this presentation, attendees will have a better understanding of cases involving a homicide and suicide (HS). Only few cases of homicide-suicide by carpenter axe are reported in forensic literature. Sometimes it may be difficult for the forensic pathologist to distinguish between a real HS and a double murder. The importance of a thorough forensic investigation, including crime scene evaluation,

analysis of circumstantial data, autopsy findings, toxicological analysis, histological and immunohistochemical studies is emphasized.

This presentation will impact the forensic community and/or humanity by presenting the case of a homicide-suicide, where the murderer chopped his wife with a carpenter axe, and then he hanged himself. The unusual injuring tool and the relevant injuries were studied and analyzed to approach the case of dyadic death. The confocal microscope was utilized to verify the three dimensional appearance of the cutaneous lesions

Homicide-suicide (HS) is defined as that lethal event in which an individual kills another and subsequently commits suicide within one week. International studies report a highly variable proportion of HS in all homicides (from 1.5% of all recorded homicides in USA, to 42% of Denmark). Some authors proposed that the higher is the homicide rate in a population; the lower is the rate of HS. Per capita rates of HS, instead, appears quite constant across different countries and through time, in fact the annual incidence varies from the 0.2-0.6/100,000 in US, 0.07/100,000 in England and Wales, 0.18/100,000 in Finland, and 0.22/100,000 in Hong Kong. In Italy, in an observational period of 15 years, 1985 – 1999 it has been observed that the higher rates concern the Northern Italy (0.85/100,000), followed by the Central Italy (0.68) and the Southern region (0.38). Previous studies have outlined that the HS perpetrators show more similarities with those who commit suicide rather than with those who commit homicide. The vast majority of offenders are male (75-97%), aged 35-51 years, while the victims are generally female (60-85%), aged 30-35 years. Offenders are often apparently free of mental disorders, but some are regarded by relatives and friends as “hot tempered”; a low percentage have a diagnosis of major depression or psychotic disorder. The great majority of HS occurs between intimates (spouses and cohabitant) and family members. The largest group comprises the spousal or lover killing, followed by the homicide of children, and than of other family members. Male offenders usually kill spouses, while female perpetrators generally commit child homicide. The most frequent trigger is represented by the imminent separation or ending of an intimate relationship. Many modes of killing are described like shooting, strangling, stabbing, chopping, gassing, or poisoning, beating, etc. There exists a significant difference between male and female offenders in the method chosen to kill: in fact, while men are more prone to adopt active methods, women tend to use passive methods.

Here is a case of HS, where the husband chopped his wife at the back of the neck, resulting in a complete transection of the cervical spinal cord, and than hanged himself. A boy with a friend came back home and found the lifeless body of his mother lying face down in a large pool of blood. At a distance of two m, they saw the body of the father hanged by a strong nylon rope to the banisters of the mezzanine. Immediately they tried to help him, releasing his head from the slip knot, and called the ambulance, but they were both pronounced dead. In the adjacent room, policemen found a carpenter axe on a table, stained with blood and locks of hair. On the floor beneath the axe a large pool of blood was evident, with extensive blood spatter on the surface of the door and the adjacent wall. This pool of blood started a trail of blood terminating at the woman's body. The postmortem examination of the female deceased showed a deep linear cutaneous wound on the back of the neck, 6.5 cm in length, slightly oblique, with clear-cut divergent margins, exposing the underlying structures, with soft tissue bleeding underneath. A red colored area, 7.5 x 2.5 cm in diameter, surrounded this wound. The body of the second cervical vertebra showed a transverse fracture, passing underneath the dens and the right superior articular facet. The spinal cord was completely transected at the level of C₂. Also a complete section of the left vertebral artery was visible. No relevant injuries were detected on the remained of the body. Autopsy of the male revealed a ligature mark on the neck. In both cases, the histological investigation revealed massive hemorrhages in the cutaneous and subcutaneous tissues. Infiltration of erythrocytes in the dural layers and in the spinal cord was evident, at the level of transaction of the spinal cord in the female victim. Immunohistochemical studies

were performed on the cutaneous specimens collected from the neck lesions for the determination of the vitality. The evaluation of skin samples with confocal microscope allowed researchers to observe the three-dimensional model of the strangulation mark and the chopping wound. Toxicological analyses were negative.

Homicide Suicide, Chopping Wound, Immunohistochemical Study

G64 Independence Day Explosion on Lovers Key

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After attending this presentation, attendees will have an understanding of the unique aspects and hazards involved in the investigation of the scene of a pyrotechnics explosion and in the postmortem examinations of the victims.

This presentation will impact the forensic community and/or humanity by providing an understanding of the unique considerations and hazards that should be taken into account by medicolegal death investigators and forensic pathologists involved in the investigation of deaths due to fireworks-related incidents.

Fireworks, generally recognized as having originated in China, have been popular in the United States since the mid-19th century. They are traditionally used in the celebration of Independence Day on Fourth of July, as well as other holidays. Because injuries due to recreational fireworks-related incidents among consumers are relatively common, the sale of fireworks is regulated by federal law and is also limited by state and local laws. Most injuries occur in children and in individuals actively handling the fireworks and most commonly involve the hands, face and eyes. In contrast, because fireworks display companies are under tight safety regulations, explosions in the professional pyrotechnics industry are rare.

This study investigated the scene and postmortem examinations of the victims of an explosion and resulting fire that occurred on Lovers Key in southwest Florida while a pyrotechnics crew was transferring fireworks from a semitrailer to a smaller truck in preparation for a Fourth of July display. The company had planned to use 853 fireworks shells ranging 3- to 12-inch in diameter and up to 4 feet long. The scene investigation involved eight teams of 80 people from multiple agencies, including the local fire department, the State Fire Marshall's Office, the Sheriff's Office, the Regional Bomb Squad, the Bureau of Alcohol, Tobacco, Firearms and Explosives, OSHA and the Medical Examiner's Office. The 40 hour investigation of the scene presented unique hazards because of flare-ups of the fire, a secondary explosion and because the debris included live firework shells. The potential detonation of live ordnance necessitated leaving the bodies at the scene until a thorough search was performed. The live rounds were marked and left in place until they were later secured in wet sand for removal and destruction. The investigation subsequently determined that the explosion was due to the accidental ignition of the fireworks, although the exact cause was never identified.

Four of the six members of the fireworks crew died at the scene, and later another later succumbed to thermal injuries. Two of the bodies at the scene were relatively intact, while the other two were fragmented. The sixth worker, a woman who was the farthest away from the trucks, jumped into a nearby body of water and survived although she suffered burn injuries and smoke inhalation. The identification of the decedents was made either by dental comparison and/or the comparison of pre- and postmortem radiographs of the axial skeletons. The autopsies also involved unique considerations due to the possible presence of unexploded ordnance in the bodies, necessitating total body radiographs prior to the examinations, because of the possibility of friction causing the detonation of these rounds. Injuries included thermal injuries resulting from the fire as well as blunt force injuries caused by the exploding fireworks and by structural materials from the destroyed vehicles. The

two relatively intact bodies showed penetrating wounds, predominately superficial, containing fireworks pellets and dark burning soot. There were no characteristic injuries to air-containing hollow viscera due to shock wave effects.

Fireworks, Explosion, Fatality

G65 Identifying the “Iceman”

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After attending this presentation, attendees will understand how the use of mtDNA can aid in the identification of missing service members from decades-old skeletal remains.

This presentation will impact the forensic community and/or humanity by providing the attendees with an example of the uses of mtDNA for the identification of human remains exposed to harsh environmental conditions.

The Armed Forces DNA Identification Laboratory (AFDIL) and the Joint POW/MIA Accounting Command-Central Identification Laboratory (JPAC-CIL) work in a combined effort to identify missing or unidentified personnel from past military conflicts. With the use of mitochondrial DNA (mtDNA) testing, skeletal remains are analyzed and compared to references from associated family members in order to make identifications. The following case study from World War II shows how the use of mtDNA can aid in the identification of missing service members from decades-old skeletal remains.

On November 18, 1942, 2d Lt. William Gamber and student Aviation Cadets John Mortenson, Ernest Munn and Leo Mustonen of the 41st School Squadron, departed Mather Field, California, for a 4-hour navigational training flight. Five hours after their departure, and with no communication from the AT-7 aircraft, search crews were sent out to locate the flight team. However, with no position reports during the flight, search crews did not know where to look in the mountainous terrain of the flight's route. After search parties found no remnants of the aircraft or its crew, the United States Army Air Forces (USAAF) abandoned it search. On November 9, 1943, the War Department officially declared all four men as dead.

Almost five years later, on September 24, 1947, two students found portions of an aircraft approximately 120 miles east of Los Banos, California. Search parties came upon widely scattered wreckage, including two engines, embedded in the ice. A data plate from one of the engines matched that from the missing AT-7 aircraft. Remains found at the site could not be identified and were interred in a group burial in the Golden Gate National Cemetery, San Bruno, California.

Decades later, on October 15, 2005, two hikers came upon a body, partially encased in ice in Mendel Glacier in Kings Canyon National Park. No evidence was found to immediately identify the body, but an undeployed U.S. Army parachute was strapped to the body, indicating that of a military service member. The National Park Service then contacted the JPAC-CIL to assist in the recovery. JPAC-CIL removed the remains as well as some material evidence from the body. Historical evidence associated with the loss of the AT-7, and evidence recovered in 1947 and 2005, suggested that these remains were likely one of the four men aboard this aircraft when it was reported missing on November 18, 1942.

The remains arrived at the CIL in Honolulu, Hawaii where a thorough anthropological analysis was made. On November 3, 2005, a small portion of the left tibia was sent to the AFDIL, in Rockville, Maryland, for mtDNA analysis. Blood references from family members

of missing service members were obtained and compared to the data obtained from the left tibia. Exclusionary results, along with evidence obtained from the site, concluded that the missing individual was Air Cadet Leo Mustonen from Brainerd, Minnesota.

The views expressed herein are those of the authors and not necessarily those of the Armed Forces Institute of Pathology, the U.S. Army Surgeon General, nor the U.S. Department of Defense.

Identification, mtDNA Analysis, Frozen Remains

G66 Caddisfly Cases Assist Homicide Case: Determining a Postmortem Submersion Interval (PMSI) Using Aquatic Insects

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The goal of this presentation is to discuss a particular case study that exemplifies the importance of understanding aquatic insect biology to help determine a postmortem submersion interval (PMSI) in streams, rivers, and possibly lakes. This study demonstrates how certain aquatic insects, e.g., caddisflies (Order: Trichoptera, Family: Limnephilidae) can be useful in estimating the time period from a body is submerged to the point of discovery. The attendee will learn that some aspects of aquatic entomology can be useful in criminal investigations by learning how to incorporate life history aspects of aquatic insect biology to estimate a PMSI.

This presentation will impact the forensic community and/or humanity by demonstrating that there are aspects of aquatic entomology valuable to forensic investigations involving bodies recovered from aquatic systems. To date, very little research exists on the use of aquatic organisms to estimate a postmortem submersion interval; this particular case illustrates how aquatic insect evidence can augment traditional techniques used in criminal investigations to develop a PMSI time line.

The determination of a postmortem interval using entomological evidence collected from terrestrial crime scenes has been well documented. A review of the literature found that approximately 85% of studies pertained to terrestrial organisms, while only 15% pertained to aquatic organisms. This dichotomy can be explained simply because terrestrial insects have evolved to feed on carrion while aquatic insects have not. Therefore, because the biology of some terrestrial insects is intimately tied to decomposing animal flesh, where aquatic insect biology does not, this biological difference has facilitated the use of terrestrial insects in criminal investigations. Consequently, many times aquatic insect evidence is ignored from crime scenes in aqueous environments. Since remains are often found in aquatic environments, it is important that forensic scientists and law enforcement personnel visiting such crime scenes have an increased knowledge of the aquatic organisms that could potentially colonize human remains.

Although few indicators of time since death for remains found in aquatic ecosystems are comparable in precision to the insect indicators used in terrestrial cases, there are observations that can be useful in suggesting or ruling out an approximate PMSI. For example, the time intervals needed for certain growth phases of aquatic insects such as caddisflies that may attach themselves to the remains can be used to estimate a minimum PMSI. Approximately eight of the 13 orders of insects containing species with aquatic or semi-aquatic stages are likely to be associated with carrion or remains in aquatic habitats. The evolution of a vast array of physiological and behavioral adaptations in aquatic insects enables these organisms to inhabit virtually all bodies of water.

Portions of a body from an adult male were discovered in a south central Michigan stream. The body was dismembered and portions were recovered from plastic bags floating in the stream. Insects specimens collected from the plastic bags containing body parts consisted of one fly larva (Diptera) belonging to the family Muscidae, and caddisfly larvae (Trichoptera) belong to two families, the Limnephilidae or case-makers and the Hydropsychidae, net spinners. Because of case material type, size of mineral pieces used in the case, and the size of the stream from where they were collected, larvae belonging to the family Limnephilidae were separated into two different species, as well as placed in specific larval instars (or larval stage of development) which helped to age them. Based on the similarities of the behavior, life histories and occurrence of these two species throughout the year, two caddisfly species belonging to the genus *Pycnopsyche* were present, mainly the last developmental larval stage of *Pycnopsyche lepida* and *Pycnopsyche guttifer* were identified. Unique case-building behaviors of these Limnephilid caddisflies found on the remains were used to elucidate a PMSI range consistent with the disappearance of the victim. It is important for forensic investigators to understand that although some precision is lost in estimating a PMSI with aquatic insects, these organisms should not be ignored in gathering evidence from aquatic crime scenes, that in fact, they can provide valuable details in estimating a PMSI.

Aquatic Insects, Caddisflies, Postmortem Submersion Interval

G67 A Standardized Field Protocol for Experimentally Investigating Variability in Entomology-Based Postmortem Intervals Over Multiple Sites and Years: A Proposal

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After attending this presentation, attendees will gain understanding of the key factors that influence variability of entomology-based PMI estimates and the need for forensic entomologists to devise standardized field experiments at multiple sites over several years. Such a protocol will disentangle the combined and interactive effects of these key factors on carcass decay rates and carrion-arthropod colonization, development and succession.

This presentation will impact the forensic community and/or humanity by through the introduction of this collaborative framework and call for a standardized field protocol, the authors will provide the forensic science community several scientific examples, gleaned from the entomological literature, of the need to better understand spatio-temporal variability of entomology-based PMI estimates through the establishment of a small network of field sites.

A multi-site field protocol, modeled after the U.S. Long-Term Ecological Research Network, is proposed for investigating the major

biotic and abiotic factors that influence entomology-based postmortem intervals (PMI), i.e., the time period between insect colonization and body discovery. The study proposes that this goal can only be achieved by a multi-investigator group studying forensically-important (FI) arthropods year-round over several years. Investigators and sites will be chosen from a subset of active and willing researchers (with established track records) whose institutions bracket more latitudes than longitudes in order to reflect the widest range of climates and vegetation types.

The central features of this protocol, which the authors have embraced in their own research and training programs, include the use of pig carcasses as surrogate corpses, fixed sampling stations as mock crime scenes, comparative tests of different field methods, and the integration of photographic, climatic, and arthropod records. The domestic pig (*Sus scrofa* Linnaeus) (of roughly 23-27 kg starting weight) closely resembles a human in its fat distribution, chest cavity, lack of heavy fur, and omnivorous diet. Advantages to using pigs include ease of procurement, reasonable cost, and a low propensity to incite public objection. The pig-as-surrogate claim was recently validated in field trials conducted inside the Forensic Anthropology Center (formerly ARF) at the University of Tennessee, Knoxville, TN, using simultaneously placed human and porcine subjects studied over a 35-day summer period. In that study, exceptionally high overlap in arthropod abundances (>99%) was reported from three subjects (one human, two pigs), indicating that only a few very rare FI taxa were associated with one subject or the other.

Within each site, the initial study design will feature replicated pig carcasses representing the “background” condition (i.e., surface-exposed, unclothed, and vertebrate unscavenged) against which other replicated treatments could be compared in the future (e.g., buried, burned, submerged, clothed, and/or vertebrate scavenged remains). Recent research has shown that when different sampling methods are used to inventory the carrion-arthropod fauna (i.e., aerial nets, hand collections, pitfall traps, sticky traps), results are often species-selective leading to catches of variable species composition which have the potential for affecting PMI estimates. Many other studies have established that carrion-arthropod succession and carcass decay rates are affected by season, temperature, elevation, exposure mode (e.g., buried, burned, submersed, wrapped), presence/absence of predators, and other factors.

Through this protocol, it is hoped to achieve a better understanding of variability and uncertainty in PMI estimates by holding constant both investigator error and exposure conditions. To further this goal this study will work to disentangle the combined and interactive effects of climate, season, and geography on carcass decay rates and arthropod colonization, development, succession, and species composition. To further reduce inter-investigator error, the study will require that each researcher channel his/her voucher specimens to the same taxonomic specialists to insure uniformity and accuracy of identifications across sites. Statistical analysis will focus on testing whether the order and timing of different species of colonizing insects used in both development and succession-based PMI estimates are comparable (i.e., repeatable) across different sites, seasons, and years. Given the critical need to separate pattern from “noise” in forensic entomology and to accurately and precisely estimate time-of-death, which the Law requires to be ascertained, the need for a standardized field protocol that can function at multiple sites for several years becomes clear.

Through the introduction of this collaborative framework and call for a standardized field protocol, the authors will provide the forensic science community several scientific examples, gleaned from the entomological literature, for the need to better understand spatio-temporal variability of entomology-based PMI estimates through the establishment of a small network of field sites.

Forensic Entomology, Postmortem Interval, Field Protocols

G68 Characteristics of Fatal All Terrain Vehicle (ATV) Accidents

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After attending this presentation, attendees will learn of particular concerns to be considered when investigating fatal ATV accidents.

This presentation will impact the forensic community and/or humanity by focusing attention on the circumstances of fatal All Terrain Vehicle (ATV) accidents, particularly the role of alcohol impairment.

The goal of this presentation is to highlight some of the forensically relevant circumstances surrounding deaths that result from ATV accidents. Emphasizing the factors that are common to these cases will enhance the attendee's attention to pertinent issues to be considered when investigating ATV related deaths.

An all-terrain vehicle or "ATV" is defined as any vehicle fifty-two inches or less in width, having an unladen weight of 800 pounds or less, traveling on three or more low pressure tires with a seat designed to be straddled by the rider, intended for, or capable of travel over unimproved terrain. Using national data from 2002-2004, West Virginia leads the nation with an annual average of 1.7 fatalities per 100,000 people; followed by Kentucky at 0.85. The national average for the same period is 0.17 deaths per 100,000 citizens.

The West Virginia Office of the Chief Medical Examiner investigated the fatalities reviewed in this report. Biological samples were obtained from each of the cases during either internal autopsy or external examination of the body. Over a three-year period (2003-2005), a total of 99 fatal ATV-related accidents occurred in West Virginia. Of the fatalities reviewed, 85 were male and 14 were female. The decedents ranged from 7-80 years of age, with 36 being the average age. Overall, October was the month with the highest incidence (14 cases), followed by May and July with 13 fatalities occurring during each. Toxicological testing included blood alcohol analysis by direct injection GC-FID using *t*-butanol as an internal standard. Samples were also tested for drugs of abuse. However, only alcohol findings are included in this presentation. Other significant observations include the following:

- Fifty-eight percent of the accidents occurred on unpaved roads, with 28% on paved roads. The road surface was not specified in the records available for review in the remaining cases.
- Eighty-four of the fatalities were drivers, while ten were passengers. The position of the decedent was not ascertained in five of the deaths.
- There were ten multi-vehicle and 75 single-vehicle accidents. In fourteen collisions, the number of vehicles involved was not specified.
- Only thirteen individuals were wearing a helmet whereas 51 were not; and of the latter, seven were under the age of 18.
- Excessive speed was documented in the investigative reports of 14 fatalities and was not named as a factor or unknown in the remaining 85 cases.
- Forty-nine percent of the fatalities had blood alcohol concentrations exceeding 0.08%.
- The average blood alcohol concentration was $0.19\% \pm 0.09\%$.

Through the first seven months of 2006, 39 ATV-related deaths had already occurred in West Virginia, underscoring the need for addressing the problem of ATV safety by state government.

In conclusion, high blood alcohol concentration is a frequent factor in fatal ATV accidents. It is also important to note that the generally steep terrain of West Virginia is an additional concern when operating vehicles with a high center of gravity, such as an ATV. Other ATV-specific accident factors obtained from police and injury-prevention sources will also be presented.

ATV, Fatality, Accident

G69 Using Ninhydrin to Detect Grave Soil

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After attending this presentation, attendees will understand fundamental effects of cadaver decomposition on associated soil (grave soil) and the methodology required to analyze grave soils for the presence of ninhydrin-reactive nitrogen.

This presentation will impact the forensic community and/or humanity by providing a method to rapidly locate clandestine graves and cadaver decomposition sites.

After this presentation, attendees will understand fundamental effects of cadaver decomposition on associated soil (grave soil) and the methodology required to analyze grave soils for the presence of ninhydrin-reactive nitrogen. This presentation will impact the forensic community by providing a method to rapidly locate clandestine graves and cadaver decomposition sites.

Some death investigations commence without knowledge of the location of a body and/or decomposition site. In these cases it is necessary to locate the remains or the site where the body decomposed prior to relocation. Ideally, the location of these sites would be rapid and require little destruction of the scene, such as that achieved with cadaver dogs. However, few options remain if cadaver dogs are unavailable or prove unsuccessful.

Ninhydrin is a compound that is readily available to most investigative agencies, as it can be used to locate latent fingerprints. This use relies on the color change that occurs when ninhydrin reacts with protein-, peptide-, amino-, and ammonium-nitrogen (collectively known as ninhydrin-reactive nitrogen: NRN) left on a surface contacted by skin. Similarly, the decomposition of an organic resource results in the release of NRN into the soil. Considering that a cadaver can comprise as much as 3% nitrogen, there is great potential for NRN to be detected in grave soils. As a consequence, this study hypothesizes that the decomposition of a body would result in a significant increase in NRN in soil.

A field experiment was conducted at two disparate field sites during the dry season (March 2003). Site 1 was comprised of a loamy sand soil (84% sand, 11.1% silt, 4.9% clay) and was located in Yabulu, Queensland, Australia. Site 1 receives an average rainfall of 140 mm during the dry season (March-October) and average maximum/minimum temperature equals 22.9 °C/16.7 °C. Site 2 was comprised of a sandy soil (97.7% sand, 1.3% silt, 1% clay) and was located in Pallarenda, Queensland, Australia. On average, site 2 receives 120 mm of rainfall during the dry season and the average maximum/minimum temperature is 26.9 °C/16.4 °C. Grasses with scattered trees dominated the resulting vegetation at the two sites, as is typical of a tropical savanna ecosystem. Juvenile rat (*Rattus rattus*: ~18 g) cadavers were buried (2.5 cm) in the centre of a 2 m² plot. Grave soil was collected at 7, 14, 21, and 28 days following burial.

To measure NRN, 2 g soil (dry weight) was amended with 8 ml KCl (2 M) and shaken (150 rpm) for 30 minutes. Following shaking, the solution was filtered through a filter paper (#42) into a culture tube. To 1 ml of filtrate, 0.5 ml ninhydrin reagent [0.8 g ninhydrin, 0.12 g hydridantin, 30 ml dimethyl sulfoxide, 10 ml lithium acetate] was added, mixed, and incubated at 100 °C for 25 minutes. The reaction was stopped with 10 ml 50% ethanol-water (v/v) and absorbance was read at 570 nm. The concentration of NRN was calculated against a leucine standard. To make leucine standard, 0.469 g leucine was dissolved into 1 l distilled water. This contained 50 mcg nitrogen ml⁻¹. Separate 100 ml volumetric flasks were amended with 0, 5, 10, 15, 20 and 30 ml leucine solution, 50 ml of 4 M KCl, and water to make up to 100 ml. These standards contained 0, 250, 500, 750, 1000 and 1500 mcg nitrogen.

Cadaver burial resulted in a 4-6 fold increase in the concentration of NRN in grave soil. This increase was observed within seven days of burial and remained constant until the end of the experiment (day 28), by which time the cadaver had been skeletonized for a minimum of 14 days. This rapid and stable increase in NRN has great potential to become a standard investigative tool, considering that the analysis of NRN in grave soil can be conducted in less than one hour.

Forensic Taphonomy, Decomposition, Nitrogen

G70 Insects and Time Since Death: What Do We Really Estimate?

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After attending this presentation, attendees will gain an understanding of some of the limitations and constraints of time of death estimates based on entomological evidence

This presentation will impact the forensic community and/or humanity by making attendees aware of the problems and constraints associated with time since death estimates based on entomological evidence, the participants will be better able to evaluate the significance of these estimates to their investigations.

Forensic entomology is a powerful tool for use in the estimation of the minimum period of time since death in many cases. There are, however, certain constraints in its application that must be kept in mind. First, what is provided is primarily an estimate of the period of insect activity on the body, rather than an estimate of the actual period of time since death. While these periods are frequently quite similar and the estimate provided is close to the actual time since death, they are not identical. There also exist a number of confounding factors beyond the control of the entomologist and/or crime scene personnel that will further serve to reduce the similarity between the estimate and the actual postmortem interval. These include: concealment of the body, incomplete collection of relevant materials by scene personnel, presence of chemicals on or around remains, seasonal and geographic variations in insect distribution, microclimatic factors, and lack of common sense. Additional problems lie in approaches to interpretations of data, often resulting in estimates produced that can not be supported by the current state of the sciences involved.

Postmortem Interval, Insects, Entomology

G71 Dying of the Cold in a Warm Climate - Hypothermia Deaths in Sydney, Australia

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The goal of this presentation is to describe the features of hypothermia related deaths in Sydney, Australia, a geographic location generally viewed as having a temperate to hot climate.

This presentation will impact the forensic community and/or humanity by highlighting the dangers of hypothermia in the elderly, even in temperate climates. Attendees will be informed of the social circumstances, the death scene and pathological findings at autopsy in this series of cases.

Death due to hypothermia is well known as a significant public health problem in cold climates, affecting predominantly homeless people, drug dependent persons, and the elderly. Hypothermia is generally considered very rare in more temperate climates and there is a general lack of awareness of the problem by both the medical fraternity and the general public. This study examines the problem of fatal hypothermia in Sydney Australia, a city with a reputation of having a year round temperate to hot climate.

There were 24 cases of fatal hypothermia in a five-year period between January 2001 and December 2005. For the purposes of this study, the diagnosis of hypothermia was made by either a temperature measurement at hospital (17%), suggestive autopsy findings (33%), a suggestive history (4%), or a combination of autopsy findings and a suggestive history (46%). The majority of the deaths occurred in winter (46%) as expected, whilst equal numbers occurred in the seasons on either side of winter - spring (25%) and fall (25%). Despite generally hot summer temperatures, one death occurred during summer. This person had become lost in bushland and was found in a state of extreme dehydration.

The mean age was 76 years (range 56 – 92), with a female predominance (63%). Risk factors for hypothermia were identified in 58%, and these included alcoholism mental illness (schizophrenia, bipolar disorder) and developmental delay. All but two decedents lived alone. Nine decedents were underweight (body mass index < 20 kg/m²).

Nineteen cases (79%) were found in a building, a house, apartment, or other premises. Of those, 46% were dead at the scene, while the remainder died either on the way to or in hospital. In the remaining five cases, the decedent was found outside. Three in this group were dead at the scene, while two died subsequently in hospital. This indicates that despite rewarming and supportive care, hypothermia past a certain point is irreversible and fatal.

Four decedents were found naked, four were dressed in minimal amounts of clothing and the decedent was adequately dressed in a further three cases. There was evidence of paradoxical undressing in seven cases. In the remaining six cases, the presence or absence of clothing was not given.

Pathological findings in fatal cases of hypothermia are generally considered non-specific. Gastric erosions were found in 79%. There was one case with acute pancreatitis, and a single case with rhabdomyolysis. The characteristic cutaneous lesions in hypothermia, reddening and abrasion over the large joints of the limbs were present in 16 (75%) cases. In four cases (17%), there were no autopsy findings to suggest hypothermia, although either hospital or environmental features strongly supported the diagnosis. Other significant autopsy findings included atherosclerotic cardiovascular disease (50%), pneumonia (17%), pulmonary congestion and edema (17%), chronic airways limitation (13%) and single cases of glioblastoma multiforme and metastatic bowel cancer. With the exception of two cases where only a raised blood alcohol was detected, all cases had significant pre-existing natural disease processes. Toxicology was performed in 18 cases – alcohol was detected in four cases, and other psychotropic agents were present in four deaths. No illicit drugs were detected.

This study highlights a significant public health problem that is not limited to cold climates. There is little awareness of the hazards of hypothermia in the elderly in Australia and probably other temperate parts of the world. Life-threatening hypothermia does not occur at any one particular temperature, as other factors such as wind movement, clothing, dampness of the environment, and vulnerability of the individual all play a role. Forensic pathologists and other death investigators who have the good fortune of living in warm climates need to remain vigilant of this condition, and not misattribute the death to natural disease processes such as atherosclerotic cardiovascular disease or pneumonia.

Autopsy Pathology, Hypothermia, Environmental Medicine

G72 The Postmortem Picnic

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After attending this presentation, attendees will understand a potentially confusing postmortem artifact caused by the Red Imported Fire Ant (RIFA) and stress the importance of good photographic scene documentation.

This presentation will impact the forensic community and/or humanity by educating forensic scientists about alterations in wounds caused by *Solenopsis invicta*, the Red Imported Fire Ant, which may affect wound interpretation.

Postmortem alteration of wounds by insects is a fairly common phenomenon, especially in decomposed bodies where maggots are frequently encountered. The destruction they produce can be significant, even to the point of complete obliteration of the wound and the underlying wound track. Without damage to the skeletal elements, the trauma may not be discernible. Alterations of wounds in the "fresh" state are not as common; however it is being seen with increasing frequency in the Southern United States, where fire ants have invaded.

Solenopsis invicta (S. wagneri), the Red Imported Fire Ant (RIFA), has infested large parts of the United States, concentrating mainly in the warmer Southern region. States from California to Maryland have documented their presence and the destruction they cause. Lacking predators and parasites, these ants have become a major pest, destroying plants, crops, trees, and even small animals. They are also attracted to electrical currents and subsequently damage electrical boxes, air conditioners and other equipment.

First introduced into the U.S. from its native South America, the RIFA arrived in cargo from Brazil at the port of Mobile, AL in the 1930s. This species has spread rapidly throughout the Southeastern United States and has recently been identified in Australia, the Philippines, Taiwan, and China.

Fire ants are omnivores, feeding on almost any plant or animal. Other insects are their preferred food. Humans become affected by the RIFA when it bites and stings. In response to vibration or movement, RIFAs react quickly and aggressively to disturbances of their colony or mound. A single ant will sting repeatedly, even when out of venom. The RIFA bites with its mandibles to attach itself to the skin, and then it stings with its abdomen, injecting toxic venom. A pustule forms in 24-48 hours, which may get secondarily infected. Some individuals are allergic to the venom, and anaphylaxis may ensue.

For forensic pathologists, RIFAs are creating problems by their rapid appearance on bodies found outdoors. Within minutes, 10-20 ants will arrive at the body, and many more will come after that. Rather than biting and stinging in an aggressive manner, the RIFA just bites, gaining sustenance from the body instead of injecting venom. In contrast to maggots, which prefer open wounds, moist mucous membranes and dark environments, RIFAs will readily eat intact exposed skin. They tend to concentrate at clothing/skin interfaces and prefer the outer surface of the body, rarely entering the body cavities or altering the wound tracks.

Increasingly, RIFAs are being encountered in open wounds, and the changes they leave behind can be troublesome. In general, postmortem artifacts caused by insects are easily distinguished from antemortem trauma. When a wound is involved, however, the changes are not as straightforward. The yellowing, seen with postmortem insect activity is usually lacking or is camouflaged by the actual wound characteristics.

Firearm wounds, in particular, can have a very puzzling appearance when altered by RIFAs. If only a few bites occur around the wound, it may be mistaken for stippling, thereby altering the interpretation of range of fire. On the other hand, if a large number of RIFAs are present and they have been there long enough, determination of entrance versus exit may be completely obscured.

Scene photographs are key in order to verify or deny the presence of RIFA activity. A small number of RIFAs will usually get transported with the body and/or in the body bag. Without scene photographs to review, you may not realize the extent of their involvement in wound alteration. In one case, the edges of a gunshot wound were very irregular, simulating an atypical entrance or possible intermediary target. Scattered areas of postmortem insect activity elsewhere on the body indicated the presence of RIFAs; however, it wasn't until the scene photos were reviewed that it was apparent to what extent they had altered the gunshot wound. In one photo, RIFAs are seen completely filling the wound, something typically associated with maggots, not ants. This large concentration of RIFAs imparted an atypical appearance to the gunshot wound.

In addition to the many other variables that cause alterations of wounds in the postmortem setting, changes induced by RIFAs must be considered, particularly in bodies found outdoors. RIFAs pose an additional hazard at the time of autopsy. Care must be taken when manipulating bodies or clothing containing RIFAs because the ants will act aggressively, biting and stinging those that have disturbed them, possibly inciting an allergic reaction in susceptible individuals. As RIFAs continue to invade the United States, more and more forensic investigators will be left to interpret the trauma they leave behind.

Solenopsis Invicta, Fire Ant, Postmortem Artifact

G73 Applying Statistical Principles to the Entomological Estimation of Postmortem Interval

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After attending this presentation, attendees will understand how four statistical principles apply to the estimation of ambient temperature necessary to enable the entomological estimation of postmortem interval. Specifically, attendees will understand how estimate precision, random variation, sufficient sample size and sampling breadth, and the choice of estimation model (e.g., linear, non-linear) should be considered and taken into account when postmortem interval ambient temperatures are estimated.

This presentation will impact the forensic community and/or humanity by highlighting how the consideration of four statistical principles can inform the estimation, accuracy, and precision of the postmortem interval, as made through entomological techniques.

After attending this presentation, attendees will understand how four statistical principles apply to the estimation of ambient temperature, which is required for estimation of postmortem interval using entomological evidence. Specifically, attendees will understand how estimate precision, random variation, sufficient sample size and sampling breadth, and the choice of estimation model (e.g., linear, non-linear) should be considered when postmortem interval ambient temperatures are estimated.

This presentation will impact the forensic sciences community by highlighting how the consideration of four statistical principles can inform the estimation, accuracy, and precision of the postmortem interval, as made through entomological techniques.

By examining the type and developmental stage of insects found on remains, entomological techniques can provide an estimation of the time since death or the postmortem interval. Insect development is highly dependent on ambient temperature, therefore, estimate using insect evidence require determination of the temperatures that the remains were exposed to following death. While these exposure temperatures can be

readily determined in many cases, in others, when no temperature recordings are available, they must be indirectly estimated, often by examining the relationship between the temperatures at the site where the remains were found and those recorded at a nearby weather station. This relationship can be determined by taking temperature recordings at the site where the remains were found for an extended period of time following their recovery and comparing these with the temperatures recorded over the same period of time at the nearby weather station. Using the statistical techniques of regression, the relationship between these two measures can then be defined by a suitable mathematical equation that, for a given weather station temperature, can provide an estimate of the corresponding temperature at the site where the remains were found.

However, because these temperature estimations are obtained by the mathematical regression modeling of the relationship between two sets of measured values, the application of four statistical principles can enhance the accuracy and precision of the estimated temperatures. First, because both sets of temperature measures are affected by random variation, the resulting regression model will be inherently imprecise—that is, single unique temperature values cannot be precisely predicted but, more realistically, a range of compatible temperature values can be determined. This range of compatible values is identified through the calculation of the “confidence interval for an observation” [1: 275-278] for each temperature estimated.

Second, because the precision of any given model will improve (i.e., the range of compatible values will narrow) according to the number of pairs of measurements available for model development, a sufficient number of temperature pairs should be included in the data collection used to develop the model. Third, it is also important to ensure that a sufficient number of comparative temperature pairs are collected over the full range of expected values (i.e., the range of temperatures that the remains were estimated to be exposed to prior to being found). If this is not done then ‘outlier’ temperatures will need to be estimated by extrapolating the model beyond the range of values that were used for its development. Because such extrapolated estimates assume that the relationship between the two sets of temperatures is the same beyond the measured values as it is within the measured range, erroneous temperature estimates will result when this assumption is not met. Of course, ensuring that the assumption applies in a given circumstance requires that actual temperature measures be collected across a sufficiently broad range of values.

Fourth, while a straight line (i.e., linear) relationship is often expected to best model the relationship between two measures, this is not always the case. As such, to enhance the accuracy of the temperature estimates, the type of relationship between the two sets of temperature measures should be appropriately studied so that the applicable mathematical model (i.e., linear or one of the many non-linear possibilities) for each set of temperature data can be accurately determined. In fact, it is possible that different models may be required for different parts of the same set of data (e.g., day versus night). For example, because of the characteristics of a setting where remains were found, temperatures at that site might be found to be generally higher during the day, but lower at night (in comparison to the corresponding weather station temperatures), thus necessitating the development of two distinct models to be used to estimate the applicable temperatures, according to the time of day.

During the presentation, examples illustrating each of these statistical principles, and their applicability and impact upon the entomological estimation of postmortem interval will be demonstrated and discussed.

Reference:

- 1 Glantz SA. Primer of Biostatistics (Sixth Edition). New York, NY: McGraw-Hill, 2005.

Postmortem Interval, Statistics, Entomology

G74 The Validation of Gene Expression as a Means of Predicting the Age of the Blow Fly *Lucilia sericata*

Aaron M. Tarone, BS*, Department of Zoology, Michigan State University, 203 Natural Sciences, East Lansing, MI 48824; and David R. Foran, PhD, Forensic Science Program, Michigan State University, 560 Baker Hall, East Lansing, MI 48824

After attending this presentation, attendees will understand the use of gene expression in determining the age of forensically useful blow flies.

This presentation will impact the forensic community and/or humanity by helping the forensic community understand how to use gene expression and statistical analyses to better address the requirements of *Daubert* as it pertains to forensic entomology.

Forensic entomology is an established field, with a relatively good track record of predicting a postmortem interval (PMI) through an understanding of blow fly development. However, in the context of *Daubert*, all of the forensic sciences will be expected to provide techniques that have been adequately tested, have laboratory standard operating procedures (SOPs), have undergone publication in the peer-reviewed literature, are accepted by the relevant scientific community, and have known potential error rates. Though forensic entomology can meet most of these criteria, the field will likely be required to establish SOPs and provide information as to error rates and the precision of its methods.

In addition to not yet fully meeting *Daubert* requirements, blow fly based PMI estimates suffer from increasing error as the animal develops (Wells and Lamotte 1995). This stems from the fact that the durations of subsequent developmental stages increase, and the body size traits used by entomologists (larval length or weight) that help refine age estimates in the feeding stages become far less useful in the later stages of immature development. Thus, other characteristics that predictably change during these stages are potential sources of information that could be valuable to investigators attempting to age flies. Gene expression profiles are known to vary significantly throughout the development of all animals, and have been studied extensively in the dipteran *Drosophila melanogaster* (e.g., Arbeitman et al. 2002). To understand how gene expression might be utilized for more accurately aging a forensically useful blow fly, a gene expression profile data set for nine developmentally variable genes was created for the immature life cycle of ~700 individual *Lucilia sericata*. Three regional strains of flies were grown under controlled laboratory conditions and regularly sampled for both size and gene expression levels, creating a high-resolution developmental profile of these cohorts.

Following this, genetic profiles were used in conjunction with developmental stage and body size data to estimate the age of individual blow flies. However, body size and gene expression levels are not easily explained by a simple mathematical function (they are non-parametric) and statistical endeavors that can help investigators (and triers of fact) understand such multivariate and non-linear data must be employed to make predictions of age. To this end, statistical models of developmental age in terms of genetic and phenotypic profiles have been produced. The two most promising forms are principle component analysis and generalized additive models. The former has been used in other forensic sciences to make predictions of class evidence and may be useful with entomological data. With generalized additive models, it is possible to define the percent of development explained by the data, and to deduce the usefulness of different models (and variables within models) through a comparison of generalized cross validation (GCV) scores (Wood 2006). Currently, predictions of age incorporating standard data and gene expression can describe up to 97% of the variation in development, which is an increase of ~10% compared to using developmental stage and body size alone.

However, no mathematical model is useful based solely on its theoretical ability to predict age, thus the models need to be validated on different data sets. To accomplish this, a blind study was conducted with

flies grown under both experimental (in the laboratory using the same conditions as the original experiment) and natural (out of doors) environments. Gene expression and body size profiles of the juvenile flies collected were used to predict the age of the individuals employing the models generated from the aforementioned data set. The validation of the age models and their importance in helping the field of forensic entomology increase precision and meet the requirements of *Daubert* will be discussed.

Forensic Entomology, Postmortem Interval, Generalized Additive Model

G75 Have I Eaten Here Before? Considering Multigenerational Colonization of Remains by Blow Flies

Timothy E. Huntington, MS*, and Leon G. Higley, PhD, University of Nebraska, Department of Entomology, 202 Plant Industry Building, Lincoln, NE 68583

After attending this presentation, attendees will understand that there is little potential for multiple generations of blow flies arising from the same corpse.

This presentation will impact the forensic community and/or humanity by demonstrating a substrate limitation to blow fly colonization of decomposing remains.

Forensic (or medicocriminal) entomology, the use of arthropods in legal investigations, is most frequently employed to estimate the postmortem interval (PMI) of victims of violent crimes or suspicious deaths. The most commonly used method of PMI estimation employs temperature-dependent developmental rates of blow fly larvae (Diptera: Calliphoridae). Retrospective scene temperatures, those temperatures that the insects experienced during development, are used in combination with known developmental rates of the species involved to estimate the age of the insects, which often correspond closely with the time of death of the victim.

One key element entomological analysis is the use of the oldest insects associated with the body, as these represent the closest estimate of the minimum time since death. This facet of forensic entomology consequently leads to questions by investigators and attorneys regarding the potential for multiple generations of blow flies arising from the same corpse. While blow flies continue to be attracted to the carrion well into the later stages of decomposition, the carcass is no longer attractive as an oviposition medium after some point, and it is widely held that the maggots which fed on a set of remains will not normally eclose as adults and oviposit on the same body. Flies in abnormal conditions, however, have been known to alter their behavior as a response to their circumstances. The goal of this study was to investigate whether adult blow flies eclosing into a situation where there is no carrion source other than their larval host would oviposit on this carcass or die without reproducing.

Six freshly killed pig (*Sus scrofa* L.) cadavers (~53 kg) were placed on the soil surface and left undisturbed for approximately 45 hours (75 ADD-B0) to allow for extensive insect colonization. After this time, Lumite® (18 x 14 mesh) exclusion cages (6 ft³) were erected over each pig. After placement of the cage, adult blow flies were physically killed or removed from the cage. Subsequent maggot development into adult blow flies occurred within each cage, resulting in high populations of adult flies that represented the first generation of fly development on the cadaver. Following the emergence of adult flies within each cage, a 'choice'/'no choice' study was conducted by placing a freshly killed pig (~47 kg) in three of the cages and observing for colonization of each carcass.

In this study, each of the fresh pig cadavers in the 'choice' portion of the experiment were colonized readily by blow flies, but none of the

decomposed remains (in either the 'choice' or 'no choice' scenarios) were colonized. This result is not unexpected, but confirms the conventionally held understanding of a single generation of blow flies emerging from a single corpse, even under extenuating circumstances. The fact that blow flies under these conditions die without reproducing indicates the unsuitable nature of a body that has undergone advanced decomposition as larval substrate.

Forensic Entomology, Decomposition, Taphonomy

G76 The Investigation of Animal Tissue as an Analogue for Human Tissue in Decomposition Studies in Soil

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After attending this presentation, attendees will understand the chemical process of decomposition, the compounds released during the decomposition of muscle tissue of different species, and their interaction with the soil environment. The aim of this presentation is to compare the use of animal tissue as an accepted model for human tissue in decomposition trials.

This presentation will impact the forensic community and/or humanity by showing direct comparisons between the decomposition chemistry of human and various animal tissues in a soil environment. The identification of both similarities and differences between the different tissue types will help identify the best animal analogue for future decomposition studies.

Pig (*Sus scrofa*) carcasses are currently accepted as the closest model to human decomposition due to their physiological similarities to humans. For this reason they are commonly used in a range of decomposition studies involving microbial activity and entomology. However from a chemical perspective there are limitations with this model due to variations in the decomposition compounds produced by humans and animals. Furthermore, the behavior of these compounds in soil is unknown with respect to the subsequent nutrient dynamics. The current study was therefore conducted to investigate the chemical decomposition of skeletal muscle tissue in soil and to compare similarities and/or differences between human and animal tissue. The results will assist in determining the most useful animal model in chemical decomposition studies. The research may benefit forensic investigations involving decomposed remains whereby the species determination is in question.

A laboratory incubation method was used to monitor chemical changes during decomposition. The soil in each microcosm was a sand texture adjusted to 50% water holding capacity to provide optimal conditions for microbial activity. Cuboid pieces of skeletal muscle tissue from four different species, namely porcine, bovine, ovine and human, were interred at 1 cm depth in the soil and incubated at 25°C for 37 days. Carbon dioxide evolution was used as an index of soil microbial activity. Aerobic conditions were maintained by opening the microcosms daily to replace oxygen depleted air from the container. The microcosms were destructively harvested at periods of 2, 4, 6, 8, 12, 16, 23, 30 and 37 days. Any remaining skeletal muscle tissue was removed, weighed, and dried to ascertain mass loss. The soil immediately surrounding the site of muscle tissue decomposition (detritosphere) was collected and analysed. The mineralization of nutrients was monitored by analyzing inorganic molecules within the soil using colorimetric methods for ammonium,

nitrate and phosphate, and atomic absorption spectroscopy for potassium levels. The release of long chain fatty acids into the soil was also monitored using GC-MS.

Results have demonstrated that for all skeletal muscle tissues there is an observed increase in pH before a decrease back to the starting pH measured prior to muscle tissue interment. Electrical conductivity also increases for all different types of skeletal muscle tissue. Further results from organic and inorganic chemical analyses will be discussed in the presentation.

Animal models are commonly used for decomposition studies due to restrictions on the use of human cadavers. The results from this study will impact the forensic community by showing direct comparisons between the decomposition chemistry of human and various animal tissues in a soil environment. The identification of both similarities and differences between the different tissue types will help identify the best animal analogue for future decomposition studies.

Animal Tissue, Human Models, Decomposition

G77 ‘Ndrangheta’ Homicide (Executions)!

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After attending this presentation, attendees will learn about ‘Ndrangheta,’ one of the famous “four mafias” a criminal organization from the southern part of Italy. A unique case of ‘ndrangheta’-related homicide/double execution is presented. A detailed scene investigation and a complete postmortem examination were performed; the surface aspects of gunshot wounds were also analyzed by means of confocal laser scanning microscopy.

This presentation will impact the forensic community and/or humanity by demonstrating the rarity of the modalities of this execution makes it peculiar and a complete pathologic investigation (death scene investigation, autopsy performing, and toxicological screening) is strongly recommended to completely investigate this type of homicide.

This unique case of double simultaneous “‘ndrangheta’-related homicide, or execution was discovered in the Tuscan countryside. In the morning of April 10, a farmer noted the presence of bloodstains near the road on his property. The bloodstain course ended in a wooded area where a gun case was detected. He immediately alerted the authorities. An unusual arrangement of the leaves next to the road caught the attention of those searching the area. A few centimeters under these leaves and soil, hands and feet surfaced; at the end of excavations, 160 cm underground, two lifeless bodies were present. They were found kneeling, beside each other. The two bodies were covered with burnt lime, which was cautiously removed. They were dressed only underpants and wore a pair of gloves. Clothes belonging to the deceased were found next to the bodies. Core temperature of the remains, measured by means of bulb thermometer, was 14°C. The external temperature was 17°C. Rigor mortis was partially present and livor mortis was represented by fixed reddish-purple coloration localized on anterior part of the bodies. At external examination the caustic effect of burnt lime on the face and the trunk was observed. A round wound on the left occipital region was detected on each body. A second round wound on the right dorsal region was observed in one of the deceased. Forty-eight hours after discovery, a complete autopsy was performed. A total body CT study confirmed in one case the presence of a metallic foreign body in the first cervical segment while in the second case foreign metallic bodies were observed in the right orbital region and at the mandibular angle. Postmortem examination of the spinal cord was performed according to the Adam’s technique and the deformed bullets

were recovered. A complete histological study was performed. Cutaneous gunshot wounds were also studied by means of confocal laser scanning microscopy. Few days after the examination, a positive identification was made by fingerprint comparison. The victims were two brothers belonging to the criminal association ‘ndrangheta’ under probation in Tuscan countryside. It is well known all over the world of the existence of the “four Italian mafias” that are referred to the “Cosa Nostra” in Sicily, the “Camorra” in Campania, the “Sacra Corona Unita” in Puglia and the ‘Ndrangheta’ in Calabria. The last one is estimated to be Italy’s most powerful organized crime association, surpassing the Sicilian Mafia. Their moneymaking schemes include racketeering, extortion, loan sharking, illegal immigration, money laundering, cigarette smuggling, and arms and narcotic trafficking. In homicides committed by criminal organization the method employed as well as the positioning of the body follow a macabre ritual laden with significance and intending to be a warning to others who interfere with the activities of these organizations.

Ndrangheta Homicide Execution, Burnt Lime, Confocal Microscopy

G78 Pig-Mentation: Postmortem Iris Color Change in the Eyes of Sus Scrofa

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After attending this presentation, attendees will learn that iris color of a deceased individual is not reliable for identification, and will have an appreciation of the implications of this phenomenon within the context of victim identification, particularly in mass fatality incidents.

This presentation will impact the forensic community and/or humanity by demonstrating the protocol for victim description, particularly in mass fatality incidents, should be modified in order to account for the taphonomic phenomenon of eye color change.

Eye color is one of the physical characteristics recorded in a missing person report and in a victim identification report. Software programs are employed, by law enforcement and disaster management agencies, to compare the two sets of data, searching for potential matches and eliminating individuals if the data are inconsistent.

A thorough review of the literature revealed that postmortem iris color change is mentioned in only two forensic pathology texts, by the same author. A study on the preservation of contact lenses using the eyes of *Sus scrofa* (domestic pig) also mentions the phenomenon of blue eyes changing to brown after death.

While experienced forensic pathologists should be familiar with the phenomenon of postmortem iris color change, it is not common knowledge among death investigators. Victim identification forms and disaster victim identification software currently in use in the United Kingdom, Canada and internationally contain a field for eye color. Moreover, recording eye color is standard routine in the external examination in an autopsy.

In order to determine whether Knight’s references (2004 and 1997) are anecdotal and/or whether Jackson (2001) observed an anomaly, a controlled experiment of postmortem changes to isolated *Sus scrofa* eyes was carried out. The eyes (n=137) were observed for three days postmortem at three different temperatures. In addition, a *Sus scrofa* head with *heterochromia iridum* (two different colored eyes) was obtained in order to observe decompositional changes of eyes *in situ*.

All isolated blue eyes in the experiment, at room temperature and higher, changed to brown/black within 48 hours. The *in situ* blue eye, at room temperature, turned brown/black within 72 hours. In fact, the *in situ*

blue eye was indistinguishable from the *in situ* brown eye, and the change occurred prior to decomposition of the eye itself.

Blue eyes kept at a cool temperature exhibited signs of iris color change, but all of the eyes were still recognizably blue after 72 hours.

Drying of the sclerae in isolated eyes also occurred, the result being that the entire globe turned black concomitantly with the iris color. The sclerae of the *in situ* eyes with open lids, however, remained white and fresh-looking, and the blue eye changed to brown/black within 72 hours.

The possible role of the vitreous humour, which also turned black postmortem, is explored. The quantity of free melanin granules in the vitreous increases with postmortem interval. This is likely a result of the degradation of melanocytes in the retinal and choroids layers of the posterior chamber, in a process driven by autolysis. Further histological studies are required, including quantified melanin granule counts of vitreous humor samples using scanning electron microscopy.

Most importantly, further studies are required on human eyes to explore the reliability of this phenomenon and the conditions driving it. If postmortem iris color change occurs consistently in humans, then this taphonomic artifact will have to be taken into account when recording eye color in victim identification reports. This is particularly relevant in cases of mass fatalities, when victims may exposed to the elements for up to several days, and a discrepancy such as eye color in antemortem and postmortem data may delay identification when processed by disaster victim identification software.

Iris Color Change, Postmortem, Taphonomy

G79 Child and Adolescent Victims in Forensic Autopsy: A Five Year Retrospective Study

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After attending this presentation, attendees will have a better understanding of the epidemiological features of child and adolescent victims in forensic autopsy and of the usual characteristics of homicide in the four to 19 years of age population.

Though literature on child abuse investigation of children less than three years of age is quite extensive, the data on forensic autopsy in the older population from four to 19 years of age is more limited. This presentation will impact the forensic community and/or humanity by providing data from a systematic five year retrospective study on this child and adolescent victim population in forensic autopsy.

In the province of Quebec (Canada), all forensic autopsies are performed at a centralized laboratory. During the five year period from 2000-2004, a total of 233 cases of children and adolescents deaths were autopsied in the four to 19 years of age population. Of those, the large majority of cases belonged to the 15-19 age group (139 cases), with the remaining cases equally distributed between the 4-9 and the 10-14 age groups (42 cases each).

Child and Adolescent Victims of Forensic Autopsy: Male victims were more frequently encountered than female ones (148 males for 75 females), this male predominance being more obvious in the 15-19 age group (male:female ratio of 23:19 in the 4-9 age group, 24:18 in the 10-14 and 101:38 in the 15-19). In this population, accident was the most frequent manner of death (44%), followed by homicide (24%), suicide (18%), undetermined (9%) and natural (4%). In the 4-9 age group, manner of death was mostly accident (57%) or homicide (37%). An important gender difference was noted in the manner of death. As a matter of fact, while male were more prone to die from accident (74%) than from homicide (17%), the opposite was observed for female (47% homicide compared to 37% accident). In the 10-14 age group, accident remained the most frequent manner of death (50%), followed by homicide (19%) and suicide (14%). Accidents are more frequent in males (58% of male victims

compared to 39% of female ones) while homicide is more frequent in females (28% of female victims compared to 12% of males). In the 15-19 age group, accident was once again the most frequent manner of death (38%), though less predominant in comparison with suicide (25%) and homicide (24%). In terms of gender, the relative incidences of each manner of death were more similar in this age group.

Homicide Victims: In a total of 54 homicide cases (24 females and 30 males), 13 cases belonged to the 4-9 age group, 8 to the 10-14 age group and 33 to the 15-19. The two most frequent methods of homicide found were firearm and sharp force, each at 27% of cases, followed by asphyxia (23%), blunt force (20%) and intoxication (3%). The gender distribution of homicide cases in the different age groups shows a strong female predominant ratio in the 4-9 and 10-14 age groups (9:4 and 5:3 respectively), while the opposite situation was observed in the 15-19 age group (10:23). An analysis of homicide methods by age group and gender will be presented. Overall, the results for the 4-9 age group are particularly interesting, clearly demonstrating predominance of sharp force in female victims compared to asphyxia in males.

In conclusion, this five year retrospective study gives new insight in the epidemiology of child and adolescent victims in forensic autopsy as well as a better description of homicide cases distribution.

Child Death Investigation, Adolescent Death Investigation, Forensic Pathology

G80 Hemoglobin SC Disease Presenting as Sickle Crisis After Outpatient Surgery: A Case Report

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After attending this presentation, attendees will learn the significant signs, symptoms, and sequelae of Hemoglobin SC disease, and implement the use of postmortem hemoglobin electrophoresis in indicated cases.

This presentation will impact the forensic community and/or humanity by providing information on the importance of recognizing an occult hemoglobinopathy and its possible contribution to the cause of death.

Hemoglobin SC (Hb SC) disease is a hemoglobinopathy with approximately the same incidence as that of Hemoglobin SS (Hb SS) disease in American blacks. The typical presentation of Hb SC disease includes fatigue, dyspnea on exertion, frequent upper respiratory infections, sporadic mild jaundice, and arthralgias. The onset of complications due to Hb SC disease is usually in childhood, but many do not present until the teens or later. Rare reports of aut splenectomy in Hb SC disease exist, but most patients with Hb SC disease have splenomegaly. Unlike Hb SS disease, painful crises in Hb SC disease occur more frequently in the muscles and joints than in the abdomen. Although Hb SC can present with the same manifestations as sickle cell anemia, it is generally characterized by a milder anemia and fewer vasoocclusive crises, with a severity that is intermediate to those of sickle cell disease or sickle cell trait.

A 33-year-old black male who underwent outpatient surgery for arthritis that developed following ankle and foot fractures sustained three years prior when he jumped off a roof while fleeing from an offender. His preoperative medical history and physical were within normal limits, and he had a history of sickle cell trait.

The surgery lasted 2½ hours, with two hours of tourniquet time, and consisted of a right subtalar fusion and arthroplasty of the 2nd-4th right toes, with application of a cast. There were no complications during surgery. Ketorolac and local bupivacaine were given, a dressing was applied, and the tourniquet was removed. His airway device was then removed, and on the way to the recovery room he suffered sudden

cardiopulmonary arrest and was intubated, but expired despite resuscitative measures.

At autopsy, he had a plaster cast on the right leg, beneath which were intact sutured incisions and orthopedic hardware. The lungs were heavy and congested, and the mucosa of the gastrointestinal tract was hemorrhagic and appeared ischemic. The heart, liver, kidneys, and brain displayed no abnormalities. The spleen weighed 4 grams and had light tan, fibrotic parenchyma. Based on the appearance of the spleen, the family was contacted, and they stated that the patient did have sickle cell trait, and not sickle cell anemia.

Postmortem hemoglobin electrophoresis, however, revealed the presence of Hb SC disease. Microscopy revealed pulmonary congestion with prominent sickling of red blood cells within vessels. Sickling of red blood cells was also prominent in the liver, heart, kidneys, meninges, adrenal glands, thyroid gland, and gastrointestinal tract. Sections of the spleen showed prominent fibrosis and calcification, consistent with autopsplenectomy. It is theorized that release of the tourniquet caused a large amount of partially deoxygenated blood to re-enter the circulation and cause a sickle crisis. The cause of death was determined as sickle cell crisis due to hemoglobin SC disease, with ankle surgery following a fall from height as a significant contributing condition. The manner of death was accidental.

Sickle cell crisis in Hb SC disease is rare. Despite the fact that this patient underwent autopsplenectomy, he had previously suffered no symptoms of Hb SC disease and believed throughout his life that he had sickle cell trait. The use of postmortem hemoglobin electrophoresis was invaluable in the determination of cause of death in this case.

Forensic Science, Hemoglobin SC Disease, Sickle Cell Crisis

G81 Hola Camp Massacre Kenya 1959

Maurice G. Rogev, MB ChB, MD*, Zamenhof St.11/1, Tel-Aviv-Jafo, 64373, Israel

The goal of this presentation is to demonstrate where in cases where either living victims of violence or the dead resulting from violent acts' it is important to investigate the medical history of the victim when conducting the clinical examination or the autopsy.

This presentation will impact the forensic community and/or humanity by drawing the attention of the forensic community to the fact that these cases do occur. The complete forensic evaluation that includes a review of the clinical record for all patients undergoing a full autopsy examination should become a routine procedure in such cases.

The "Hola Camp Massacre" occurred on 3 March 1959 in a detention camp run by the British Colonial Government of Kenya during the Mau Mau rebellion. The detention camp, established early in the Mau Mau Kikuyu rebellion that raged from 1952 to 1960 was situated in a remote area of the coastal province of Kenya.

The camp was staffed by Kenyan African warders and commanded by British Colonial prison officers with locally recruited Kenya European civil servants.

The following facts are beyond dispute.

The warders were authorized to use reasonable force to induce resisting camp detainees to work against their will. In the incident under consideration, warders used unauthorized excessive violence with clubs, sticks and body kicks.

Eleven men were killed and some sixty 60 injured. Of these, 26 men were admitted to the camp hospital in a state of surgical shock, with extensive bruising, subcutaneous hemorrhaging and hematoma in many areas of the body surfaces.

Clinical examination revealed signs of severe chronic deficiency of Vitamin C, (Ascorbic Acid).

The eleven bodies were flown to the Medical Research Laboratories in Nairobi, where the author performed autopsy examinations in his capacity as the Police Forensic Pathologist.

The autopsy examination revealed extensive subcutaneous hemorrhages, hematoma and laceration of muscles in the region of the head, neck, torso and the limbs. No serious fractures were found in the bodies, except for a linear fracture in the occipital skull bone in one case. All internal organs were anatomically intact. There were hemorrhages in the respiratory, the gastro-intestinal tracts and in the urinary bladder. There was severe pulmonary edema.

The cause of death in these cases was determined to be due to acute hemorrhagic shock; with complications resulting from their state of severe Vitamin C deficiency at the time they received the multiple beatings with a club-like weapon.

The patients in hospital were diagnosed as suffering from acute traumatic hemorrhagic shock and responded to therapeutic doses of Ascorbic Acid (Vitamin C) and to supportive medical treatment. The clinical diagnoses showed clearly that the detainees were suffering from Vitamin C deficiency or Scurvy when they were subjected to the beatings.

The important principle as illustrated by these cases is that the forensic scientist must evaluate both the complete clinical syndrome presented by the victim of an assault and the autopsy examination diagnosis as a whole concept.

The question arises whether similar blows inflicted on healthy detainees could have produced the acute hemorrhagic shock syndromes that were suffered by the beaten detainees?

This presentation will show that in terms of the above principle, the answer must be negative.

Hola Camp, Massacre, Kenya

G82 Comparison of Wound Severity Between Center-Fire Rifle Projectiles and Shotgun Slugs

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After attending this presentation, attendees will understand how the kinetic energy and fragmentation properties of a missile affect the extent of firearm wounds in a human body.

This presentation will impact the forensic community and/or humanity by contributing to the understanding of the relationship of a missile's kinetic energy and its wounding pattern in actual firearm wounds.

Introduction: Contemporary understanding of wound ballistics relates the severity of wounds to the temporary cavity that a projectile creates as it passes through the body tissues. This cavity is felt to be proportional to the kinetic energy (KE) possessed by the projectile. KE is related to both the mass (m) and the velocity (v) by the well-known formula: $KE = \frac{1}{2} mv^2$. This concept generally fits with ballistic experiments using gelatin, and accords well with general practical experience of forensic pathologists. There is little literature; however, that analyzes this relationship in actual firearm wounds. This study sought to explore this hypothesis using scientific methods on examples from medical examiner cases. A comparison was made of wounds produced by high velocity, center-fire rifles projectiles (CFRP) with those produced by shotgun slugs (SGS). The basis for this comparison is that CFRP have a relatively small mass and extremely high velocity while SGS have a large mass and a relatively low velocity.

Methods: A search was performed of the records at the King County Medical Examiner Office, Washington, for SGS and CFRP wound cases over the last 12 years – from mid-1993 to mid-2005. For these cases, the caliber of the CFRP and gauge of the SGS were obtained from the investigator reports, along with an examination of the weapon, ammunition, and recovered projectile. Only head wounds were used to

compare wounds produced by CFRP and SGS. A grading scheme was developed based on head wounds documented in the autopsy reports, radiographs, diagrams and photographs. Grade I was limited to a skin laceration at the entry site, with minimal fractures or avulsion injuries. Grade II included complex skull fractures and limited avulsion of the scalp, skull, or brain. Grade III involved extensive avulsion of the scalp, skull, or brain.

Results: A total of 80 suicide and homicide SGS and CFR cases were evaluated, the majority of which were contact wounds of the head. In all the SGS cases, the slugs exited the body. Forty-two of 61 CFR cases showed fragmentation in the body. Overall, 64 cases were suicides and 16 were homicides. All of the contact head wounds resulted in extensive destruction of bony and soft tissue structures in the path of the wound with complete or near complete avulsion of the brain. For CFR, both high (e.g., .223, 3030, 30-06 caliber) and intermediate velocity (e.g., .45 caliber) ammunition were considered. Using the KE equation, it was calculated that the extent of the wound of a .223 should be approximately 90% that of a SGS wound. In the majority of SGS cases, slugs exit the body; therefore not all of the KE is transferred to the tissues. The majority of CFR projectiles fragment and remain in the body; however, resulting in the maximum transfer of KE to the tissues.

Conclusion: The results support the general observation that the extent of wounds of SGS is similar to that of CFR wounds. The objective of this study was not to compare the gauge and manufacturers of the weapons, but to provide the results of a general observation of wounding characteristics using scientific methods. CFR bullets fragment because of their high velocity and not because of hitting bone. The majority of the time, SGS do not fragment because of their lower velocities. Fragmentation allows for the dispersion of kinetic energy to the tissues. CFR projectiles possess approximately 90% of the energy of that of SGS; however, because most CFR bullets do not exit, there is more transfer of kinetic energy to the tissues than that of SGS bullets, where majority exit the body.

Firearm Wounds, Shotgun Slugs, High Velocity Center-Fire Rifles

G83 A Comparison of Penetration Distances for Five Ballistic Gelatins to a BB Gunshot Wound to a Live Human Forearm

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After attending this presentation, attendees will see the accidental result of a BB gunshot and learn how ballistic gelatin preparation methodology can affect penetration results.

This presentation will impact the forensic community and/or humanity by demonstrating the only documented case where precise BB gun firing distance is known for a wound to a live human forearm. The penetration distance was determined using X-Rays. This data was then compared with recreated BB gun firings into five (5) different ballistic gelatins to determine which average penetration distance is the closest to this single human case.

Misuse of BB guns causes a significant number of injuries each year. One of the authors was subjected to such misuse and the result was a penetrating wound to the proximal anteromedial aspect of the right forearm. The subject was a healthy, 37-year-old male with fairly well muscled forearms due to years of baseball playing. Fortunately, this accident occurred in a laboratory setting and all parameters were recorded. The gun was a Daisy-brand Powerline Model 1200. This carbon dioxide powered pistol can fire a standard steel BB at up to 420 feet/second. In this case, the muzzle was located precisely 126 cm from the subject's bare forearm and the gun was equipped with a fresh CO₂ cartridge.

Radiographs were made and the BB was noted to have penetrated just over 63 mm into the flesh (after magnification was taken into account). The BB was surgically removed under fluoroscopy. The surgeon noted no involvement of the radius, ulna or major neurovasculature. However, the BB did pierce the interosseous membrane. The wound was irrigated and sutured closed with no significant complications.

It is an extremely rare case when such precise data is known about an actual gunshot wound to a live human being. It afforded the authors an interesting opportunity to compare the BB penetration in this person to a laboratory-based series of experiments utilizing ballistic gelatins.

In order to perform better controlled studies on the damaging effects of various bullets passing through soft tissues, ballistic gelatin was created many years ago. The gelatin is said to simulate the density and viscosity of human and animal muscle tissues. A standard gelatin powder (250 Bloom Type A Ordinance Gelatin) was purchased from Kind & Knox Gelatine, Inc. (Sioux City, Iowa). There are a variety of methods published for the preparation of 10% gelatin blocks. Five were chosen for this study: 1) The manufacturer's directions; 2) The Vyse gelatin utilized by the FBI; 3) A technique in which the maximum temperature never exceeds 104 degrees F; 4) A technique in which the starting water is at 129 degrees F; and 5) A recipe published by Lewis et al. 1982. They appear to have relatively minor differences (mostly related to various temperatures and standing times).

Gels were poured into transparent hard plastic cups. Each cup was placed in a protective firing range and subjected to five BB shots from 126 cm away- using the same Daisy gun. A total of 25 shots were recorded for each of the five gelatin recipes and all penetration distances were measured with digital calipers. The data were stored in Microsoft Excel, then imported to Stata 8.0 (College Station, Texas) for analysis. The mean penetration distance for each recipe was: 1) 62.24 mm; 2) 43.25 mm; 3) 56.13 mm; 4) 64.22 mm, and 5) 40.98 mm. ANOVA testing was significant between all groups but the chi-squared analysis results were <0.05; therefore, variances were not equal and parametric testing was dropped. Kruskal-Wallis tests indicated statistically significant differences between the mean penetration distances for all the recipes. The Mann-Whitney test indicated significant differences between each recipe except when comparing one and four. Interestingly, the mean penetration distances for those recipes were the closest to the actual penetration depth in the live human subject (63 mm).

In summary, a live human subject was accidentally shot in a muscular area of his forearm with a BB gun. The penetration distance compared favorably with two of five ballistic gelatin preparations. Although the live human data consists of a population (n) of one, it appears to be the only such data in the medical literature. Based on this, it seems the preparation method for ballistic gelatin has significant affects on the penetration distance for BB gunshots.

BB Gunshot, Ballistic Gelatin, Live Human Forearm

G84 Suicidal and Homicidal Sharp Force Injury: A Five Year Retrospective Comparative Study of Hesitation Marks and Defense Wounds

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After attending this presentation, attendees will gain better knowledge of hesitation marks and defense wounds pattern in sharp force injury and its correlation to suicidal and homicidal manner of death.

This presentation will impact the forensic community and/or humanity by providing a systematic evaluation of hesitation marks and defense wounds in sharp force injury in the Quebec province (Canada) forensic laboratory from 2000-2004.

In sharp force injury cases, forensic pathologists often have to determine whether the injuries were self-inflicted or not. The presence of hesitation marks or defense wounds, respectively associated to suicide and homicide, has been accepted as useful characteristics in the evaluation of manner of death. However, very few studies in the forensic literature have systematically analyzed the features differentiating hesitation marks and defense wounds.

Over a five year period, in the Quebec province (Canada), all cases of suicidal and homicidal sharp force injury were retrospectively reviewed for the presence of hesitation marks and defense wounds. For each case, data on incidence, gender, age, hesitation marks/defense wounds localization, fatal wound(s) pattern and blood alcohol concentration (BAC) was compiled. Data was statistically analyzed in order to highlight differences between hesitation marks and defense wounds.

Hesitation marks: A total of 58 sharp force suicides (7 women; 51 men) were found, of which 74% (n=43) were positive for hesitation marks. Seventy-one percent of women and 74% of men presented hesitation marks and women showed a significantly higher amount of hesitation marks compared to men ($p<0.05$). Victims were aged from 23 to 83 years with an average age of 43 years for cases with hesitation marks. The three most frequent locations of hesitation marks were neck area in 46% of cases, followed by left thoracic area (44%) and wrists (39%). A positive correlation was found between the amount of fatal wounds and the amount of hesitation marks ($p<0.001$). When only one fatal wound was found, absence of hesitation marks was noted in 39% of cases. No correlation was found between BAC and presence of hesitation marks.

Defense wounds: A total of 149 sharp force homicides (59 women; 60 men) were found, of which 61% (n=91) were positive for defense wounds. A significant difference between male and female incidence was noted (71% compared to 54%; $p<0.05$) and women showed a significantly higher amount of defense wounds compared to men ($p<0.001$). Victims' age ranged from six months to 82 years with an average age of 42 years for cases with defense wounds. In terms of location, defense wounds were most frequently found on hands (78%), followed by arms (48%) and forearms (34%). Victims presenting with defense wounds showed a four times higher average amount of non-defense wounds. Absence of defense wounds was noted in 80% of cases showing only one fatal wound. A negative correlation was revealed between BAC and amount of defense wounds ($p<0.01$). Indeed, the highest amounts of defense wounds were noted in the absence of BAC, while the highest BACs were associated with the absence of defense wounds.

In conclusion, this retrospective study systematically compares features of hesitation marks and defense wounds and gives new insight on medicolegal expertise in sharp force injury cases.

Hesitation Marks, Defense Wounds, Sharp Force Injury

G85 Estimation of Postmortem Interval Using Bioelectrical Impedance of the Human Body

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After attending this presentation, attendees will understand the principles of a new tool for the estimation of postmortem interval, bioelectrical impedance of the human body, in addition to the traditional methods currently used.

The method of measurements using cutaneous bioelectrical impedance may impact the forensic community and/or humanity by becoming a valuable analytic tool for the estimation of the time of death in forensic medicine.

In medicolegal practice, being able to estimate the time of the death is of paramount importance. Particularly in cases of homicides (to accuse or exculpate an alleged criminal), the cases of postmortem manipulation of the remains (occurring especially in the cases of overdose), as well as in civil matters (for example succession rights). The interest to perform a technique to specify more precisely the time of the death in the first part of the postmortem interval lead to the development of a new method, based on the bioelectrical impedance of the human body.

Human body can be compared to an electrical complex circuit, containing water, electrolytes, and cellular membranes. A direct, or alternating low frequency (<5 KHz) current, applied to the body, was used to measure electrical resistance. The alternating current will reflect both the extracellular compartment (electric resistance) and the intracellular compartment (capacitive resistance).

Initially, measurements were made on 34 fresh bodies, with a known time of the death, less than five hours postmortem. Electrodes (patches) were applied on the skin with a distance between patches of 10 cm, on the chest, abdomen, arms and thighs. Bodies were placed in a room at constant ambient temperature (approximately 18 - 20 °C). Measurements were performed using an impedance meter that automatically recorded the values of resistance (R), impedance phase angle (theta), as well as the body temperature (rectal probe) and the ambient temperature. Measurements were recorded every ten minutes during the first 24 hours, then every 15 minutes. The available time for the measurements was dependent on the interval between death and the time of the postmortem examination.

The reactance (Xc) and the impedance (Z) were calculated using the recorded data. These results were compared with the postmortem interval. A variation was observed with the absolute values between the different bodies. On the other hand, with the relative values, a statistically significant arithmetic correlation, was noted between the values of reactance and impedance compared to the postmortem interval.

The method of measurements using cutaneous bioelectrical impedance may become a valuable analytic tool for the estimation of the time of death in forensic medicine.

Forensic Medicine, Postmortem Interval, Bioelectrical Impedance

G86 Postmortem Skeletal Survey Use in Pediatric Forensic Autopsies: A National Survey

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The goal of this presentation is to summarize a national survey of postmortem pediatric radiology practice, as reported by forensic pathologists. This will provide an understanding of current practice patterns and factors that may influence the type and extent of radiologic tools that are utilized in the postmortem evaluation of forensic pediatric cases, and introduce possible consideration for future practice including creative funding sources and community resources.

This presentation will impact the forensic community and/or humanity by assisting the forensic pathology community in analysis of how skeletal surveys are defined, and whether the current practices are providing adequate information in cases of unexpected pediatric death and/or suspected child abuse. In addition, it is anticipated that the results will provide suggestions for alternative techniques and resources, as well as creative funding sources in the area of postmortem radiography. Future research should include a cost-benefit analysis of various protocols.

Radiography is an essential tool in the evaluation of suspected physical abuse in the living child. Postmortem radiological evaluation is often included in the autopsy of a child or infant whose death is unexpected or suspicious for abuse. Just as in the living, discovery of subtle injury at autopsy may be dependent upon ancillary studies. Although the pathologist has the advantage of direct examination of the axial skeleton during the postmortem examination, a routine autopsy does not allow for examination of the appendicular skeleton. Dissection of distal extremities, for instance, may not be performed without radiologic studies that direct the pathologist to the location of potential injury. Previous studies have documented injuries such as metaphyseal fractures that were unsuspected on external examination.

According to the recently approved Forensic Autopsy Performance Standards of the National Association of Medical Examiners, "...The Forensic Pathologist or representative shall X-Ray all infants." In addition, in June 2004 a joint statement of the Society for Pediatric Radiology and the National Association of Medical Examiners was published, advocating the use of high quality radiographs in a postmortem child abuse investigation. The recommended appendicular postmortem survey includes a minimum of frontal views of each arm (two films), paired hands (one film), paired legs (one film) and paired feet (one film).

It has been recognized that the use of radiographs as an ancillary study in postmortem examinations is typically routine. The extent of such examinations, however, is not known. In the case of live children, recent studies suggest that in facilities with fewer numbers of pediatric cases, skeletal surveys are used less frequently and tend to include fewer images per study.

A mail survey of pathologist members of the American Academy of Forensic Sciences was distributed throughout the United States and its territories. The target population was pathologists who conduct autopsies on children \leq 36 months of age. There were a total of three mailings, and a \$2 incentive was included with each initial survey sent. The objective of the survey was to (1) assess adherence to the NAME recommendations for postmortem radiography among pathologists conducting forensic autopsies in children \leq 36 months of age, and (2) to describe the spectrum of postmortem skeletal survey practices in a national sample of pathologists. The response rate was 259/470 (55%). Data were analyzed utilizing univariate descriptive statistics.

Respondents reported handling one to approximately 2,000 pediatric cases per year in a given office. Nearly every respondent (99.96%) indicated that they obtained at least some imaging. The number of postmortem images obtained ranged from none to a "babygram" (i.e., one or two frontal films of the entire body) to a set of 19-30 individual films that include multiple views of the axial and appendicular skeleton, to full body MRI or CT scans. Most commonly, films were traditional X-Ray films although fluoroscopy and other techniques were also reported. Nearly one third of the surveyed pathologists reported routine use of the "babygram" as their sole postmortem radiographic tool.

Most surveys are performed on site, at the location of the autopsy laboratory, and most are funded at the expense of the office. Other funding sources included state budgets, grants and insurance billing.

Respondents reported using skeletal surveys most frequently when foul play or abuse is suspected. Not all pathologists utilize postmortem skeletal surveys in cases of presumed Sudden Infant Death Syndrome, or when foul play is not initially suspected.

Pediatric, Postmortem, Radiology

G87 Near Miss Incidents in Police Custody Suites in London, UK: A One Year Prospective Study

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After attending this presentation, attendees will be able to identify detainees at higher risk of harm while in police custody.

This presentation will impact the forensic community and/or humanity by reducing harm to detainees.

Background: Every year a number of deaths will occur in police custody within the UK. Potentially preventable deaths in police custody include those that involve illicit drugs, alcohol and deliberate self-harm. This study examined near miss incidents (NMI) that did not result in death in order to develop a better understanding of risk factors for detainees in custody. For the purposes of this research NMI have been defined as 'any incidents which resulted in, or could have resulted in, the serious illness, injury or self-harm of a detainee'.

Aims & Methods: A prospective study of NMI was undertaken for one year from May 2005 to 2006. Forensic physicians (FP) providing forensic medical services for the Metropolitan Police Service in London were asked to complete questionnaires on any incident that may have been considered an NMI. The questionnaire proforma was developed following a pilot study. Ethical Committee approval was given for this study. The aim of the study was to identify NMIs and to assess whether such incidents assisted in identifying indicators of increased risk within the police custodial setting. Data about all incidents were anonymised.

Results: 89 FPs voluntarily participated in this study. One hundred twenty-four proformas were returned in the 12 months study period. Ninety-six were returned identifying the FP and 28 were completed anonymously. 9 FPs returned $>$ 2 proformas. Incidents were classified according to a) type and b) whether they were very likely or fairly likely to result in a fatality. Each incident could have more than one type. Of 124 responses, 36% said that if there had been no intervention, the incident was very or fairly likely to result in a fatality. Of the 124 incidents reported, 60 (48%) were related to suicide/self harm [28% likely to result in fatality]; 41 (33%) were drug related [49% likely to result in fatality]; 29 (23%) were alcohol related [45% likely to result in fatality]; 23 (19%) related to a medical condition / existing injury [65% likely to result in a fatality]]; two (2%) were due to injuries sustained during arrest [both likely to result in a fatality]; eight (6%) were reported as being 'other' types of incidents [38% likely to result in a fatality].

Conclusion: This is the first prospective study examining risk factors for NMIs in police custody in the UK. The data will help identify particular groups of detainees at increased risk whilst in custody and will allow lessons to be learned in ensuring that care for such vulnerable individuals in custody is optimised.

Police, Near-Miss Incidents, Death in Custody

G88 Probability and Pathological Findings in Suicidal Versus Homicidal Hanging Deaths: A Case Study in Forensic Epidemiology

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After attending this presentation, attendees will be introduced to the application of weighted probabilities to pertinent pathological or other evidence to forensic decision making in a criminal matter; in the presented case study, the determination in a hanging death of suicide versus homicide.

This presentation will impact the forensic community and/or humanity by demonstrating how probability plays an important yet frequently unrecognized and/or improperly applied role in forensic decision making. This and other concepts of Forensic Epidemiology will be introduced in this presentation, raising awareness for forensic pathologists and others who rely upon population-based data from which to draw conclusions.

Probability is in constant use in forensic settings as a means of weighing the accuracy of specific conclusions, and it is used nearly as often to give weight to conclusions. Opinions that include the terms "risk" or "likelihood," or the expressions "most often" or "would be expected (or not expected)" are all variations of probabilistic assessments. Such opinions imply both an underlying basis in population-based data as well as a methodologically sound synthesis of such data. When probabilistic opinions are proffered in a forensic setting they should be scrutinized carefully for their basis in epidemiologic data, as well as how the data has been interpreted to apply to the case in hand.

A case study is presented in which a 26-year-old Aboriginal man was found hanging from a sheet in a jail cell in Darwin, Australia in February of 1986. The postmortem examination revealed evidence of unilateral neck organ fracture (thyroid cartilage) and was ruled a suicide. The decedent's widow believed that the death was a homicide, and brought forth collateral evidence supporting the charge. An international panel of eight forensic scientists was convened to re-examine the evidence, and it was concluded that there was sufficient evidence to justify a disinterment of the decedent, in part due to the fact that the neck organ injury was thought to be unlikely given the circumstances of the hanging.

In 2004 a civil case was brought against several defendants, including the forensic pathologist who conducted the postmortem examination, charging them with a conspiracy to obscure the murder. One of the theories raised by the defense was that neck organ fractures were common in suicides resembling the circumstances of the death, a probabilistic determination. For this reason, a forensic epidemiologic review of the case was conducted, including a review and analysis of the relevant literature.

A comprehensive review of the published literature on observational studies of hanging deaths in which neck organ injury was the independent variable revealed four validated predictors for the presence of neck organ injury of varying strength (in nine studies describing 1342 cases): Age greater than 30 (strong), duration of suspension (moderate to strong), ligature width of 1-2 cm or less (moderate), and suspension type (weak to moderate support for full versus partial suspension).

Based on the findings in the literature, the features of this hanging (age 26, brief suspension duration [45 minutes], >4 cm ligature width, partial suspension [feet in contact with the ground]) it was determined that the neck organ injuries observed in the postmortem examination were unlikely to have arisen from the observed circumstances of the hanging. Further, out of 1342 cases in the literature, ~180 were in males <30 years of age, and among these there were only ten cases of neck organ fracture. Although the ten cases did not describe the presence of the other three risk factors, approximately 75% of suicidal hangings in which ligature width

is described involve a narrow (<2 cm) ligature, and 25-50% are complete suspensions. It was reasonable conclude that no more than 10, and likely five or less of all of the hangings described in the literature review could have produced the same type of injuries as those seen in this hanging, given the risk factors present. The prevalence of potentially similar cases in the database ranged from 0-0.7%.

Based on the forensic epidemiologic review, it was opined that 1) contrary to the assertion by the defense, the neck organ injuries observed in the decedent do not commonly occur in similar circumstances, and 2) such injuries are rare in suicidal hangings with the predictive variables present in the subject case, as a reasonable scientific certainty. A Bayesian analysis of the evidence will be presented.

Hanging, Probability, Homicide

G89 Accuracy of Death Certification and Medical Examiner Notification in Nova Scotia

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After attending this presentation, attendees will gain an appreciation of the spectrum of problems associated with errors in death certification and medical examiner notification.

This presentation will impact the forensic community and/or humanity by providing the framework for assessing and designing interventions to improve the accuracy of death certification. Improvements in the accuracy of death certification have important implications for accuracy of Vital Statistics, basic science research, public health policy, and civil/criminal law implementation. Most importantly, the accuracy of death certification is important for families, in terms of peace of mind and insurance claims.

Background: Information from Vital Statistics is an important resource utilized by clinical researchers, public health authorities, and officials of the Department of Justice. Major errors in death certification have been identified among physicians in academic institutions, as well as among officials in coroner systems.^{1,2} At the very least, the accuracy of this information has implications for basic medical research, public health policy, and civil/criminal law. Most importantly, the accurate certification of death has important implications for the families of the decedent in terms of peace of mind and insurance claims. As such, it is important to assess and to design interventions to improve the accuracy of death certification on both a regional and national scale.

Hypothesis: The role of the Medical Examiner Service (MES) is to determine the cause and manner of death in circumstances defined by the Fatality Investigations Act (FIA). Under the terms if the FIA, all citizens have the obligation to report a death, although most commonly this is a member of a law enforcement agency or a physician. Despite established guidelines for reporting, physicians often miss cases. There are likely two components contributing to the numbers missed cases.

1. Non-compliance with the established reporting guidelines (not sure when to report)
2. Inaccurate certification of death (not sure how to accurately assign cause or manner of death)

Objectives: The objectives of this study are threefold: 1) to determine the proportion of cases missed during a two year period (2004-2005); 2) to determine the mechanisms by which these cases were ultimately identified; and 3) to determine why these cases were originally missed as medical examiner cases.

Methods: All available case files from the Nova Scotia Medical Examiner Service over a two-year period (January 1, 2004 to December 31, 2005) were reviewed and those classed as “missed cases” were included in the study. The nature of the missed cases was documented with respect to the original certification of cause and manner of death, the final certification of cause and manner of death, the mechanism by which the cases are identified as a “missed case,” as well as various epidemiological aspects of the cases. The results were evaluated using descriptive statistical techniques.

Results: The total number of medical examiner cases for the study period is 1516 (742 cases in 2004 and 774 cases in 2005). Of these, the “missed cases” made up 11% of the total number of cases investigated (total 167 missed cases: 80 cases in 2004 and 87 cases in 2005). The mechanisms by which “missed cases” are identified include cremation approval 56% (93 cases), Vital Statistics 28% (46 cases), hospital personnel 6% (10 cases), Trauma Registry 4% (7 cases), physicians 3% (5 cases), family of decedent 1% (2 cases), policing agency 1% (2 cases), and other 1% (2 cases). In 22% of cases (37 cases) the physician classified the death as unnatural, yet failed to notify the medical examiner service. In 59% of cases (99 cases), the physician misclassified the case as natural when the manner was accidental.

Conclusions: Both non-compliance with the established reporting guidelines (not sure when to report) and inaccurate certification of death (not sure how to accurately assign cause or manner of death) contribute to the numbers of “missed cases.” This study shows that 11% of medical examiner cases are originally “missed,” and are discovered by a variety of mechanisms. This number represents the “tip of the iceberg” in that a significant proportion of “missed” deaths are detected by cremation approval. It is worth noting that burial in Nova Scotia does not require approval by the Nova Scotia Medical Examiner System.

References:

- 1 Pritt, BS, Hardin NJ, Richmond JA, Shapiro SL. Death Certification Error at an Academic Institution. *Arch Pathol Lab Med.* 2005; 129: 1476-1479.
- 2 Parai, JL, Kreiger, N, Tomlinson G, Adlaf EM. The Validity of the Certification of Manner of Death by Ontario Coroners. *Ann Epidemiol.* 2006 (article in press).

Death Certification, Notification of Medical Examiner Service, Missed Cases

G90 Comparative Analysis of Medical Examiner and Coroner Systems of Medicolegal Death Investigation: Is There a Bias Toward Manner of Death?

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After attending this presentation, attendees will become aware of some of the differences between a Coroner’s and a Medical Examiner’s jurisdiction regarding the relative percentages of natural and violent deaths that are investigated by the respective jurisdictions.

This presentation will impact the forensic community and/or humanity by encouraging critical examination of the differences between Coroner- and Medical Examiner-based medicolegal death investigation systems in order to learn more about the motivating factors behind the decisions to investigate various types of deaths; to retain the most positive and beneficial aspects of both systems; and, ultimately, to promote practices that are sound from an investigative standpoint yet also cost-effective.

Background and Objective: In the United States, two different types of medicolegal death investigative systems, namely, the Coroner and Medical Examiner, exist, the former, headed by an elected, often lay official, the latter, by an appointed physician, sometimes a pathologist. The origin of the Coroner system dates back to English common law when the “crown” was purely a political position; not surprisingly, such political overtones have persisted to the present day. The Medical Examiner system, on the other hand, is, at its best, led by a physician, preferably a pathologist, who has formal training in medicolegal death investigation and in the performance of forensic autopsies. The fundamental philosophical differences between the Coroner and Medical Examiner systems exert a substantial influence on the nature of the cases that are selected by the medicolegal official to come to autopsy; specifically, that the Coroner, in an effort to minimize spending and stay within the budget, is more likely to authorize cases for autopsy that will potentially result in a criminal proceeding (or a high-profile civil litigation), most frequently violent (non-natural) deaths, while the Medical Examiner will have a greater tendency to pursue sudden unexplained deaths, the majority of which result in certification of a natural manner of death. The objective of this study was to determine whether this hypothesis was indeed valid by comparing a contemporary Coroner and Medical Examiner system.

Methods: This study reviewed deaths spanning a 14-year period from 1992-2005 that were reported to a coroner’s office (the Charleston County, South Carolina Coroner) and over a 6-year period from 2000-2005 reported to a medical examiner’s office (the State of Delaware Office of the Chief Medical Examiner [OCME]). Data were coded and analyzed using the program SPSS for Windows, Version 14.0.

Results: The breakdown of cases according to manner of death for the two respective jurisdictions is as follows:

Jurisdiction	Number of Deaths	Natural	Accident	Homicide	Suicide	Undetermined
Charleston County, SC	2,638	827 (31.3%)	940 (35.6%)	422 (16.0%)	345 (13.1%)	104 (3.9%)
Delaware	4,608	2,302 (50.0%)	1,437 (31.2%)	230 (5.0%)	529 (11.5%)	110 (2.4%)
OCME						

Comparison of the two medicolegal systems showed a negative correlation ($r = -0.046$ [$P = 0.018$]) for 2,638 subjects. The difference between the means of the two groups was 0.171 (95% CI = 0.107 to 0.235; student’s $t = 5.3$; $df = 2,637$; $P < 0.001$).

Conclusion: The proportion of natural deaths appears to have been substantially greater in the State of Delaware Medical Examiner jurisdiction while the percentage of homicides was significantly higher in the Charleston County, South Carolina Coroner’s Office. While the obviously higher degree of inflicted fatal injury in Charleston County, South Carolina is beyond the scope of this study, the greater percentage of natural deaths in the Delaware OCME supports the hypothesis. More detailed analyses of these respective trends are necessary in order to create the most effective and efficient medicolegal death investigative systems possible.

Medicolegal Death Investigation, Manner of Death, Coroner/Medical Examiner

G91 Preliminary Findings of the Bureau of Justice Statistics 2005 Census of Medical Examiner and Coroner Offices

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After attending this presentation, attendees will gain an enhanced understanding of the nation's death investigation systems. The presentation will be based on findings from the Bureau of Justice Statistics (BJS)-funded Census of Medical Examiner and Coroner Offices (CMEC).

This presentation will impact the forensic community and/or humanity by providing the forensic community with reliable and previously unavailable information on the personnel, functions, resource needs, workload, and specialized death investigations reported by U.S. medical examiner and coroner offices.

Medical examiner and coroner offices serve the public by conducting medicolegal investigations, primarily of unnatural or suspected unnatural deaths, throughout the United States. The 2005 Census of Medical Examiner and Coroner Offices (CMEC) represents the first data collection effort by the Bureau of Justice Statistics (BJS) to focus on medicolegal investigations of death. The goal of the census is to provide accurate and timely information on the capabilities and resource needs of medical examiners and coroners. RTI International, a nonprofit research organization, administered the census on behalf of BJS.

Medical examiner and coroner offices were asked to voluntarily complete the census, which covered a variety of topics, including jurisdictions, budgets, funding sources, staffing, workloads, data and database usage, records and evidence processing and retention, and investigations of infant deaths and unidentified decedents. The collection effort began in October 2005, when the census was mailed to 1,920 medical examiner and coroner offices. As Hurricane Katrina had recently devastated the states of Louisiana, Mississippi, and Alabama, the census was not sent to these states during the first phase of the data collection effort. In February 2006, the census was mailed to 154 medical examiner and coroner offices in Alabama and Mississippi. The data collection effort will be finalized by August 2006.

A multimodal data collection process enabled the death investigation offices to complete the census by mail, facsimile, or Web (<https://cmec.rti.org>). All offices were mailed a unique access code for Web access. In a final effort to improve response, RTI and BJS developed a reduced-length survey instrument that collected basic information about laboratory operations. Currently, the overall response rate for the CMEC is 85%, and the response rate for offices covering populations of 250,000 or more is 92%. Of the 49 states included (Louisiana was omitted), 23 had a 100% response rate across their medical examiner and coroner offices. Overall response rates for medical examiner and coroner offices were similar.

This presentation will highlight similarities and differences in the nation's medicolegal death investigation systems. Variables include the types of systems found across states, expenditures, caseload measures by type of procedures involved, turnaround times for case completion, investigation protocols, and reporting levels for specialized death investigations. For example, the geographical distribution of types of offices, as well as aggregate population and jurisdictional coverage, will be detailed. In addition, the number of accepted cases for 2004 will be presented, with discussion of the various functions performed on a case, such as death scene investigation, autopsy, toxicology, and crime scene processing. This presentation will also summarize the policies for handling unidentified human decedents and infant deaths, as well as the related caseloads and resource needs.

The CMEC provides valuable information on the status and needs of medical examiner and coroner offices in the United States. Information collected in the 2005 CMEC may emphasize specific funding requirements or other areas that require further assessment of the nation's death investigation systems. These preliminary data represent the compiled data that will be available in a comprehensive BJS report on <http://www.ojp.usdoj.gov/bjs>. Understanding these issues will inform the development of plans to improve both the efficiency and functionality of medical examiner and coroner offices.

Medical Examiner, Coroner, Census

G92 Pituitary Macroadenoma Presenting as Hypothermia: A Case Report

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The goal of this presentation is to present an uncommon cause of hypothermia due to a brain tumor and highlight the importance of central nervous system causes that affect body temperature regulation.

This presentation will impact the forensic community and/or humanity by demonstrating an unusual cause of hypothermia.

Hypothermia is diagnosed when an individual's body temperature is below 95°F (35°C). In forensic pathology practice, the most common cause of hypothermia is exposure to low temperatures without adequate warming measures. It is not uncommon for individuals to present to the emergency room having been exposed to extremely cold temperatures and then subsequently to die. In these cases in particular, forensic pathologists must rely on documentation of body temperature within the medical records to assess whether hypothermia may have caused or contributed to death. In cases in which hypothermia is a cause or contributing factor to death, the manner of death is rendered as an accident. The extreme ages of life, those encompassing the very old and young, are most vulnerable to hypothermia because of debilitating disease or lack of self-nurturing skills. The body responds to hypothermia by increased heat production through peripheral vasoconstriction and shivering. Shivering ceases between 85-90°F and the loss of hypothalamic function to regulate temperature ceases below 85°F. Once compensatory measures fail to increase heat production, individuals can experience ventricular fibrillation and death.

Less commonly, and rarely documented in the literature, brain lesions can cause hypothermia.

A 59-year-old black woman who initially came to clinical attention in May 2006 after falling out of her wheelchair and hitting her head on a concrete floor in her room at a nursing home. She had a history of a brain tumor and was on warfarin for deep venous thrombosis. The subject was taken to the emergency room to obtain a brain CT scan, as mandated by the nursing home protocol. En route to the hospital, the patient became hypotensive and was cool to touch. In the emergency room the patient was hypothermic with a temperature of 29°C (84°F) and continued in a hypotensive state. A CT scan of the head was negative for hemorrhage. Once her blood pressure was stabilized with vasopressors, the patient's hospital course was complicated by administration of antibiotics for a presumptive diagnosis of sepsis and subsequent development of anaphylaxis. She was intubated after upper airway swelling and developed adult respiratory distress syndrome, which ultimately led to her demise two days later.

At autopsy, there was diffuse consolidation of all the lung lobes and microscopic examination revealed diffuse hyaline membranes without organization. There was minimal laryngeal swelling. The skull showed evidence of a prior craniotomy site and an organizing subdural hematoma. The sella turcica was markedly enlarged and contained a 2.3 X 1.8-cm pituitary macroadenoma containing a small area of hemorrhage. The

macroadenoma grossly compressed and distorted the overlying hypothalamic area. Microscopic sections of the hypothalamic area revealed a symmetrical compressive infarct consisting of rarefaction of glial tissue, numerous axonal spheroids, and collections of parenchymal hemosiderin. The cause of death rendered in this case was hypothermia due to pituitary macroadenoma and the manner of death was rendered as natural.

This is an unusual case of a macroadenoma causing overlying compression of the hypothalamus. It is concluded that compression of the overlying hypothalamic area by the pituitary macroadenoma caused a disruption in the thermoregulatory function of the hypothalamus, thus causing hypothermia. The fall may have contributed to focal hemorrhage and enlargement of the pituitary macroadenoma with further compression of the hypothalamus and subsequent development of symptoms.

Hypothermia, Pituitary Macroadenoma, Death

G93 Diatoms and Their Forensic Significance

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The goal of this presentation is to demonstrate that diatoms could be critical evidence in criminal investigations when aquatic communities are involved. This research shows that diatoms are a good example of trace evidence and very valuable investigative tools, which can be used to link an individual to a crime scene. Additionally, this study findings support that these microorganisms can be recovered by using a simple methodology; and providing investigators with a reliable and quick technique that could help them determine the presence of diatoms in physical evidence recovered from a crime scene and/or individual.

This presentation will impact the forensic community and/or humanity by showing that diatoms could be critical evidence in criminal investigations when aquatic communities are involved. This study will provide investigators with a simple, reliable and quick technique that could help them determine the presence of diatoms in physical evidence recovered from a crime scene and/or individual. These results can be used to educate crime scene investigators and police officers on what kind of valuable trace evidence should not be overlooked at a crime scene or evidence items that show the presence of soil, mud, or water.

Diatom analysis could help determine if the person was dead or alive when the body is removed from the water. Because of the diatoms vary morphologically and taxonomically depending on their habitat, it is possible to determine the location or site of drowning. Moreover, if there is a possibility of linking a victim to the site of the drowning, there is also a possibility of linking a suspect to a crime scene. It is imperative to try to recover as much evidence as possible from a crime scene, especially; the type of evidence cannot be seen with naked eye such as trace evidence. Therefore, recovering diatoms from a crime scene or from articles of clothing of the victim or a suspect can provide an important evidence for use in criminal investigations. The use of diatoms for forensic purposes in the United States is very limited and under-utilized

Samples used in this study were collected from three different bodies of water; marine (beach shore), brackish (estuarine), and from a freshwater source (lake). Neutralized buffered formalin (NBF 10%) was added to each sample to fix and help in the preservation of the diatoms. The temperature and the pH of the water were recorded at the time the samples were collected, as well as the ambient temperature. Samples were stored at 4°C.

Under restrict sterile condition; the samples were centrifuged for three minutes at 2982 rpm and then re-suspended in a few drops of distilled water. A drop of each sample was placed on a glass slide and a high refractive index mounting medium was used to fix the cover slip to the slide. The samples were observed under the microscope for the

presence of diatoms, identification, and comparison. Images were recorded of the different genera observed under the microscope. The second experiment consisted of manually transferring some of the samples to different articles of clothing, in a spotted manner. The articles of clothing examined were a white cotton t-shirt, white socks, and jeans. Each piece of clothing was cut in small pieces measuring three by four inches. The samples once impregnated with the marine, brackish and freshwater samples were placed in plastic containers (16 oz) used for this experiment. These samples were treated and processed in the same manner as the first experiment.

Diatoms were recovered from all the samples collected, and a qualitative analysis was performed. Diatoms were abundant in the estuarine and freshwater samples. On the other hand, the seaweed sample yielded the least amount of diatoms, and only six different genera were observed. To determine if a common habitat or source could be indicated; comparison of the diatoms from different samples showed a total of 23 genera in all samples collected. For recovering the diatoms of different fabrics such as pieces of t-shirt, sock, and jean material, results showed 66% success. These findings prove that diatoms can be recovered, analyzed and can be categorized as trace evidence.

In conclusion, diatoms have proven to be a powerful tool that can be used as evidence in forensic cases. It was concluded that diatoms could be transferred to different items of clothing, car carpets, sneakers, etc., if an individual comes in contact with an area where diatoms are expected to be present. These results can be used to educate crime scene investigators and police officers on what kind of valuable evidence should not be overlooked at a crime scene or evidence items that show the presence of soil, mud, or water.

Trace Evidence, Diatoms, Crime Scene

G94 Evaluation of NT-proBNP as Marker of Heart Failure in Postmortem Examination

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The goal of this study was to evaluate the new biochemical marker NT-proBNP in postmortem examination as a tool for diagnosis of heart failure in cases related to coronary ischemia.

This presentation will impact the forensic community and/or humanity by showing that measurement of NT-proBNP is reliable in postmortem examination and should be considered as a useful tool for autopsy diagnosis of acute or chronic heart failure, whatever its origin.

Introduction: Natriuretic peptides are synthesized and secreted by cardiomyocytes in response to increases in wall stress and their plasma levels are elevated in patients suffering from myocardial infarction with systolic dysfunction. Many publications consider one of these peptides, BNP, as an excellent marker of heart failure. Recently, in clinical medicine, the amino terminal part of pro-BNP (NT-proBNP) was introduced which is secreted in equivalent proportion to BNP. According to the published studies, this new cardiac marker has a longer half-life and a better stability in comparison to the BNP. Moreover, many authors considered high levels of NT-proBNP as an independent predictor of mortality.

The first goal of this study was to measure the levels of NT-proBNP in patients with coronary syndromes and compare them to a control group. As serum is not always available during postmortem examination, the second goal of this study was to evaluate a correlation between NT-proBNP levels measured in serum, blood, aqueous humor and pericardial fluid.

Material and Methods: This study included 34 cases. 25 patients presented an ischemic heart disease (21 men and four women), in 15 of them postmortem examination revealed an acute coronary syndrome. In a control group were included nine cases (5 men and four women) without cardiac pathology. According to the clinical history and autopsy findings, the cases were classified into four groups. For each case, an autopsy followed by a histological examination was performed. The examination of the heart included a macroscopic examination and the analysis of at least five slides of the myocardium, stained with haematoxylin and eosin, and with von Gieson trichrome. The putrefied cases were excluded from the study.

Postmortem blood samples were centrifuged in order to obtain "serum." The NT-proBNP measurements were performed in serum, blood, aqueous humor, and pericardial fluid using a chemiluminescent immunoassay kit (Elecsys 2010 analyzer, Roche Diagnostics).

Results: The highest serum levels were measured in patients with acute coronary syndrome associated with chronic ischemic disease revealed by a clinical history or detected at autopsy. No significant difference was observed between patients with acute coronary syndrome and without previous ischemic disease in comparison to a control group.

In this preliminary study, the levels measured in blood, aqueous humor and pericardial fluid were in accordance with levels obtained from serum.

Conclusions: Measurement of NT-proBNP is reliable in postmortem examination. In this study, the results obtained for patients suffering from coronary syndromes are compatible with clinical data. NT-proBNP measurement should be considered as a useful tool for autopsy diagnosis of acute or chronic heart failure, whatever its origin.

Natriuretic Peptides, Coronary Syndrome, Heart Failure

G95 An Unusual Case of Sudden Death

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After attending this presentation, attendees will learn the importance of implementing the dissection of the atrio-ventricular node in all necropsies; but particularly in cases of sudden death.

This presentation will impact the forensic community and/or humanity by illustrating the utility of conduction system evaluation and its association with mechanism of death as discovered in conjunction with an unusual breast neoplasm.

A 49-year-old Asian female was found dead in her residence. Two weeks prior to her death, she presented to a local Emergency Room for pain and swelling of her right breast. Clinical examination revealed bilateral breast masses, suggestive of carcinoma. A mammogram was ordered, but never performed due to the patient's demise. Review of medical records reveal a mammogram performed six months prior, which was interpreted as negative. Evidence of a recent biopsy was identified at the time of autopsy; however, despite extensive searching the biopsy results were never located. The autopsy revealed a 7 cm mass in the right breast and a 2 cm mass in the left breast, both of which had an appearance clinically suggestive of carcinoma. The adrenal glands were completely replaced by tumor nodules. The heart weighed 195 gm and the posterolateral left ventricular wall and interventricular septum contained soft, white masses that ranged in size from 0.6 cm to 3.5 cm. There was no pericardial effusion or pericardial thickening. Of note, there were only two (right neck and supraclavicular) enlarged lymph nodes but no axillary lymph nodes; despite the large tumor burden in the breasts. A small

nodule was identified in the right lower lobe of the lung. The remainder of the internal organs were unremarkable. Microscopic examination of the breast masses revealed a primary non-epithelial breast neoplasm with involvement of the heart, lung and adrenal glands. Immunohistochemical analysis of the tumor was consistent with a large cell lymphoma of T-cell origin (CD 45 +, CD 3 +, CD 20 -, pancytokeratin -, CD 57 – and ALK1 –). Myocardial involvement included transmural infiltration, as expected from the grossly visualized masses, as well as focal permeation of the atrioventricular node, which was not associated with a grossly visible lesion. The enlarged lymph nodes were negative for lymphoma.

Primary breast lymphoma (PBL) is a rare form of extranodal non-Hodgkin's lymphoma accounting for less than 1% of all breast malignancies. Of these, the great majority will represent B-cell, rather than T-cell lymphomas. PBL is bilateral in up to 25% of the cases and the clinical presentation is similar to that of carcinomas of the breast, with the exception of slightly larger masses at the time of diagnosis. The growth is rapid, and several cases have been reported with recent negative mammograms, as in this case. Lymphoma has a high predilection to involve the heart, with an incidence of 25%, second only to lung carcinoma. Most cases with cardiac involvement are clinically silent and/or have non-specific symptoms until they present with sudden death.

The mechanism of sudden death related to carcinomas and lymphomas is often not determined, as these deaths generally are not considered 'unusual, unnatural or unexpected' deaths and therefore may not fall under the jurisdiction of the medical examiner or coroner. Known complications such as pulmonary emboli, treatment related problems, such as infection, or overall tumor burden are common enough processes that forensic pathologists typically don't perform autopsies. Even when performed in a hospital setting, it is unlikely that the hospital pathologist will examine the conduction system on such a case. As part of a thorough autopsy in a medical examiners office, the cardiac conduction system (in particular the atrioventricular node), is being examined more often and is occasionally revealing the underlying cause for the sudden death. Any foreign cell population, whether neoplastic or inflammatory in origin, in the atrioventricular node can precipitate an arrhythmia which may result in sudden death. In the presented case, not only were the cause and manner of death determined, but also the mechanism involved.

Breast Lymphoma, Atrioventricular Node, Sudden Death

G96 Use of Beta-APP Stain in a Case of Fatal Dog Attack

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After attending this presentation, attendees will understand the use of beta-APP histopathological stain to diagnose early central nervous system injuries.

Documentation of earliest stages of CNS injury is problematical. This presentation will impact the forensic community and/or humanity by making forensic pathologists aware of the use of beta-APP stain to document mechanism of death in cases where traditional autopsy techniques may be inadequate, and illustrate the use of this technique in a specific case with relatively short survival time.

β -APP is a protein that accumulates in damaged neurons and has been used to identify certain types of central nervous system injury. This study presents a fatal case of a dog attacking a two and one a half-year-old child who was found unconscious by her mother in the dog's mouth with the dog "shaking the child back and forth." The child's shirt was described as soaked with blood, and there was an undetermined, but "small," amount of blood at the scene. There was no active bleeding from wounds upon the arrival of first responders. The child survived unconscious, tachycardic and hypotensive, with minimal bleeding from the wounds, for about 90 minutes during transport to hospital in the ambulance.

Autopsy confirmed soft tissue injuries (bite marks) to the neck, including ligamentous injuries in the posterior nuchal region, a small defect in the left jugular vein and a small epidural hemorrhage at the level of the fifth cervical vertebra. There was no subdural or subarachnoid hemorrhage. Likewise, there were no obvious gross or microscopic injuries to the brain, spinal cord or other internal organs to document the mechanism of death. Positive β -APP staining of axons in the corpus callosum and cerebral white matter was found, often in a perivascular distribution, and there was rather diffuse positive staining of many neuronal bodies. Although axons stained positively in the corpus callosum, the predominantly perivascular pattern of positive β -APP staining suggested diffuse hypoxic injury to the central nervous system resulting from shock and hypotension.

The β -APP stain documented potentially lethal injury to the central nervous system in the absence of other specific anatomic findings, and gives some indication of the mechanism of death. Generally, it is considered that β -APP stain is positive as early as approximately two hours survival time. The documented survival time of one and a half hours is consistent with this, although it is somewhat earlier than often reported. This case illustrates the use of β -APP stain as an early marker of central nervous system injury before more traditional markers of injury may be obvious at autopsy.

Beta-APP, CNS Injury, Dog Attack

G97 The Postmortem Diagnosis of Diabetic Coma

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After attending this presentation, attendees can expect to learn about a histology method that will make it easier to establish the postmortem diagnosis of diabetic coma and with a perspective to the significance of hyperlipidemia.

This presentation will impact the forensic community and/or humanity by significantly improving in the postmortem diagnosis of diabetic coma, but it is equally important to focus on the role of the lipids in the abnormal metabolism of diabetics and alcoholics.

The postmortem diagnosis of diabetic coma has always been difficult as one of the key markers of coma is a high glucose concentration, but this concentration is rapidly decreasing after death. Only few laboratories are able to quantitatively detect ketone bodies, and the diagnosis is usually based upon a combination of the history, the glycated hemoglobin concentration and a semi-quantitative detection of acetone.

It has long been known that in death due to diabetic coma there is a vacuolization of the proximal tubules of the kidneys. This vacuolization has until recently been believed to consist of glycogen, but it is now known that it represents an accumulation of triglycerides.

In a consecutive series of fourteen cases of diabetic coma, lipid staining was performed on cryostat sections of the kidneys. It was demonstrated in all of the fourteen cases that the vacuolization consisted of lipids. The sensitivity was thus 100 percent.

In alcoholic ketoacidosis, the lipid level in blood is high. So far, the authors have been able to perform lipid staining of one case of fatal alcoholic ketoacidosis and found the same phenomenon in the proximal tubules of the kidneys as in diabetic coma.

It is thus likely that the deposition of lipids in the proximal tubules is due to the high concentration per se and not increased permeability of the glomerulus as is seen in diabetics.

There has only been little focus on lipids in forensic medicine. One reason may be the need to do cryostat sections if lipids are to be demonstrated in the tissue. Otherwise they will be disguised as empty spaces due to dissolving in alcohol during tissue embedding.

Both in diabetic coma and in alcoholic ketoacidosis there are high levels of fatty acids and a disturbance of the metabolic balance that is influencing the citric acid cycle.

This study suggest that ketone body analysis should be done in cases of "fatty liver deaths" as there are indications that many of these deaths are due to the increased fatty acid concentrations following a binge and a subsequent development of ketoacidosis.

Diabetic Coma, Hyperlipidemia, Cause of Death

G98 Forensic Diaphanoscopy Imaging: A New Tool in Clinical Forensic Medicine

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After attending this presentation, attendees will understand the principles of a new tool, the forensic diaphanoscopy imaging, and the benefits in comparison with more classical method (forensic diaphanoscopy), illustrated with practical examples of traumatic diagnosis in clinical forensic medicine.

This presentation will impact the forensic community and/or humanity by demonstrating how forensic diaphanoscopy imaging can facilitate the diagnosis of signs of violence on living adult, victims of aggression, or abused children.

The classical forensic diaphanoscopy method has been developed following the observation that there were no valuable methods to diagnose non visible hematomas on living subjects, such as adults who had been assaulted or abused children. This method has been used in Lausanne for over ten years in forensic clinical expertise. It is a complementary method to the clinical examination.

However, the probability of detecting a hematoma with this method (sensitivity) or the probability to diagnose correctly subcutaneous hematomas (specificity) depends on the training and the experience of the examiner. An insufficiently trained person should expect false positive or false negative results. The classical method of forensic diaphanoscopy is based on a subjective interpretation of the examiner. This is the reason why the forensic diaphanoscopy imaging technique, based on objective data, has been developed.

Compared to the classical method, forensic imaging diaphanoscopy has the following characteristics:

1. Use of an annular light source, aimed to integrate a centered video camera, and to increase the diagnostic reliability.
2. An integrated miniature video camera will help maintaining a database of analyzed traumas, and offer a source of pictures to be processed later by digital systems (computers).
3. The digital processing of the acquired picture will improve both sensitivity and specificity in detecting non-visible subcutaneous hematomas.
4. Automatic adaptation of the light source intensity, based on subcutaneous tissues thickness (not depending on body mass and corporal topography) and skin pigmentation.
5. Automatic exclusion of opaque zones due to intravascular blood.
6. Hematoma documentation using digital processing.

Forensic diaphanoscopy imaging represents a major advance compared to the classical method to diagnose traumas on living subjects. The technique is more user friendly and reliable, due to the use of technological assistance and computer information processing. Creating legal documentation is easier and images from the system can easily be

integrated in reports. This reliable investigation method can easily complete a clinical examination by making or confirming the diagnosis of suncutaneous hematomas that are not readily visible. This method is also useful in excluding this diagnosis. It is a non-invasive and easy to use tool. It is particularly useful when child abuse is suspected, when examining dark skinned persons where hematomas can be confused with skin color, or even among obese persons where deep hematomas do not appear or only appear after a significant period of time on the skin surface.

The aim of forensic diaphanoscopy imaging is to facilitate the diagnosis of signs of violence on living adult, victims of aggression or abused children.

Clinical Forensic Medicine, Diagnostic Imaging of Trauma, Invisible Hematoma

G99 “Drop Dead”: An Epidemic of Intravenous Fentanyl Deaths in Cook County, Illinois: 2005 to Present

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The goal of this presentation is to understand that fentanyl has suddenly appeared as an intravenous drug of abuse, and that medical examiners, public health officials, and emergency physicians should realize that clusters of sudden death may appear as an epidemic of fentanyl intoxications.

This presentation will impact the forensic community and/or humanity by demonstrating the response of the medical examiners office to a sudden onset and ongoing epidemic of sudden unexplained death, subsequently found to be from illicit intravenous fentanyl abuse. This has implications for public health in monitoring and quickly diagnosing clusters of sudden unexpected death in an urban population.

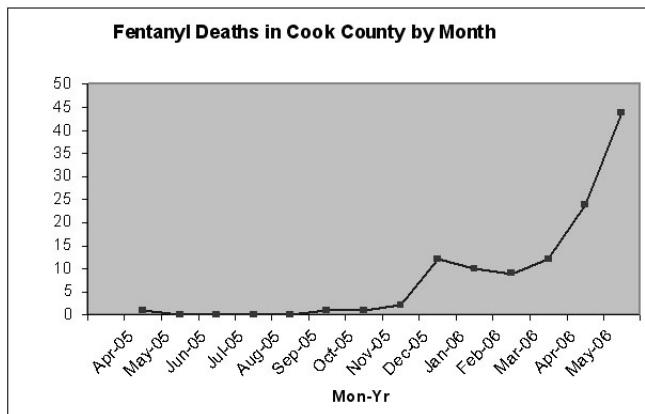
In November 2005 in Cook County, Illinois, an epidemic of intravenous fentanyl deaths began and quickly accelerated, and has not slowed as of June 2006. This epidemic of fentanyl intoxication in Cook County has not been previously described. Prior to 2005, fentanyl intoxication fatalities, or fentanyl-related deaths, in Cook County were almost exclusively from abuse or misuse of fentanyl transdermal delayed-release patches. Fentanyl is approximately 50 times more potent than heroin, and is a synthetic opiate used clinically during invasive medical procedures and for outpatient pain control through a transdermal patch delivery system. Some of the more unusual fentanyl intoxications in Cook County have been previously presented (Wu Chen, N, et al. Suicide by transdermal patch, AAFS abstract K19, Orlando, FL, 1999).

Cook County, Illinois, is a compact major metropolitan area of approximately 5.5 million people within an area of 950 square miles that surrounds and includes the city of Chicago. In December 2005 hospital emergency rooms began to report an increase of tight clusters of overdoses initially concentrated in the Near South Side of Chicago. In the emergency department setting, some of the survivors' urine toxicology testing results was positive for opiates from heroin, but some were not, even though all showed clinical signs and symptoms of a rapid acute opiate overdose. At the same time, fatalities occurring in these small clusters of apparent opiate intoxications were brought to the Cook County Medical Examiners Office for examination.

Death scene investigations and histories of these fatalities often showed a rapid collapse after the injection and the term “Drop Dead” was coined on the street to describe this new “tainted heroin.” The police used

the local media to warn the public about a deadly heroin product mixed with fentanyl. Syringes found next to the victims were sent by the Chicago Police to the Illinois State Police Crime Laboratory for rapid testing, revealing the presence of fentanyl. The fentanyl was purchased from street corner drug sellers as a white powder, in amount and consistency similar to heroin. Prior to this epidemic, fentanyl was not routinely tested for in the Cook County toxicology laboratory. A fentanyl testing protocol was begun for all suspected drug intoxication deaths after the epidemic was discovered, and then tested for retrospectively to September 2005.

Data of fentanyl intoxication deaths were retrospectively collected for the years 1995 through early 2006 from the Office's database. As numbers of fentanyl intoxications accelerated in 2006, data was collected and analyzed prospectively for entry into a real-time CCME Fentanyl Intoxication Database. For January 1995 to November 2005, the CCMEO averaged four cases per year (range 1 (1995, 2000) to ten (2002)). Criteria for certification for fentanyl intoxication deaths were similar to the office's criteria for opiate-related deaths. Intravenous fentanyl intoxication deaths from April 2005 through May 2006 are shown:



Fentanyl-related deaths initially appeared in November (2), accelerated in December (12), stabilized in January (10) and February (9), but then accelerated again through March (12), April (24) and May (44). Initial June data shows this upward trend is continuing. Of the fatalities from April 2005 through May 2006, 96 were male and 20 female. The average and median ages were 40 years, with a range of 16 to 61. The average concentration of fentanyl in postmortem peripheral blood was 23 ng/ml (median 17; range 0.9 to 134). These 116 fentanyl epidemic deaths through May 31, 2006, were further subcategorized as fentanyl intoxication without other drugs (43, 37%); fentanyl and opiate intoxication (20, 17%); fentanyl and cocaine intoxication (29, 25%); fentanyl, opiate and cocaine intoxication (6, 5%); fentanyl, opiate, cocaine and alcohol intoxication (3, 3%); fentanyl and alcohol intoxication (6, 5%); fentanyl, alcohol and opiate and intoxication (5, 4%); and fentanyl, cocaine and alcohol intoxication (4, 3%). This data shows that fentanyl is being sold in Chicago predominately as a single drug, not as a so-called “tainted heroin” product. But it also shows that fentanyl is being abused in combination with heroin or cocaine, although less frequently. Other drugs detected with fentanyl could either represent the purchase of a combined product, or the concurrent use of each individual drug. The origin of this illicit white powder fentanyl and the reason for its rapid and continued influx into the Chicago land area is currently under intense investigation by numerous government agencies.

Fentanyl Intoxication, Sudden Death, Cook County, Illinois

G100 Bidding for Poison: The New Availability of Poisons and How to Use Them

Rebecca A. Irvine, MD, University of New Mexico, Office of the Medical Investigator, MSC 11 6030, University of New Mexico, Albuquerque, NM 87131-0001*

After attending this presentation, attendees will have an awareness of the facilitative role of the Internet in obtaining and using deadly poisons and the impact this will have on forensic investigators, pathologists, toxicologists, and computer criminologists.

This presentation will impact the entire forensic community by highlighting the ease of access to deadly poisons and guidelines for lethal use on the Internet. In cases of an apparently negative autopsy and/or vague allegations of poisoning by family, the threshold of suspicion has been raised by almost universal access through the Internet. Strychnine, the poison inadvertently obtained for this study, should also be considered in unexpected death in athletes.

An online bid was placed on a collection of antique pharmaceutical bottles, some of which were known to have originally contained strychnine sulfate, and which were purchased for an extremely reasonable sum.

The bottles arrived by UPS Ground, left on the doorstep. While this seemed unusual at the time, the seller was clearly paying homage to the prohibition of sending toxins through the USPS. There were several bottles of strychnine sulfate, most of which unexpectedly contained the pure substance, a fact verified by the Toxicology office associated with the Office. The seller had no knowledge of the author's occupation or intent for the purchase. There was no communicated warning.

Strychnine has a long and colorful history, becoming available in the early 19th century as a "tonic" for people and a poison for pests (and, arguably, for people). It binds at stimulatory receptors in the central nervous system as well as the inhibitory receptors, resulting in a massive over-transmission of signals. Although caution has always been recommended with its use, the therapeutic applications were myriad and included impotence, alcoholism, constipation and prolapsed uterus. It may have had a limited clinical role in the treatment of surgical shock and congestive heart failure. It is to this day on the list of banned substances for athletes, having been implicated in the win of the 1904 marathon (along with raw egg and brandy, which carry their own risks). Eventually, of course, it was recognized that the risk far exceeded the therapeutic benefit and its use was abandoned. It is currently available to athletes as the herbal *nux vomica*.

It is hardly a perfect poison for homicide because of its bitter taste and short delay in causing respiratory muscle paralysis. Acute poisoning may be treated symptomatically. It is, however, one of the most potent poisons known and may be administered through multiple routes, including dermal. The horrific terminal phase of convulsions may be attractive to those with homicidal intent.

Strychnine is tightly regulated but widely available as a rodenticide. The latter would be particularly unpalatable in the volume required for homicidal intent. The safety recommendations for underground rodenticide use are comparable to biosafety standards for autopsy.

In his classic and arguably still relevant chapter on homicidal poisoning, Adelson cites both access and knowledge of use as prerequisites for the poisoner. Both are within reach of those accomplished in the use of the Internet.

A disturbing study was conducted by the California Poison Control System (Look what I found! Poison hunting on eBay, *Clin Toxicol* (Phila). 2005;43(5):375-9)). Over a 10-month period, 125 individual products too dangerous for commercial use were identified on online auctions; 24 were "supertoxic," including strychnine. Even a cursory search identifies guides to poisoning, including books in the popular press, some intended as a reference for crime novelists.

All medical examiners have undoubtedly had cases that were frustratingly negative for a cause of death. In addition, almost all have

likely had cases where relatives alleged poisoning, although no access or specific substance was implicated.

Medical examiners, previously protected by the obstacle of access to deadly poisons, need to lower their indices of suspicion for cases of poisoning. Courtesy of the Internet, access and knowledge of use are widely available. Not only must appropriate toxicological analysis be considered and performed but also law enforcement investigators with computer crime experience must be involved in a timely fashion.

Poison, Access, Internet

G101 Cluster of Fentanyl-Tainted Heroin Deaths in a Three-Week Period in Maryland

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After attending this presentation, attendees will understand the public health significance of cooperative efforts between the Office of the Chief Medical Examiner (OCME), the Maryland Drug Early Warning System (DEWS) at University of Maryland's Center for Substance Abuse Research (CESAR), the Maryland Poison Center (MPC), and the Maryland State Police (MSP) in the ability to detect a cluster of fentanyl-tainted heroin deaths in a short period of time.

This presentation will impact the forensic community and/or humanity by presenting the problems of detecting fentanyl by routine opiate screens and by emphasizing the importance of drug surveillance systems to detect emerging drug trends.

Fentanyl is a fast-acting, highly potent synthetic opioid agonist that is approximately 50-100 times more potent than morphine. Overdose effects occur rapidly and death occurs primarily from respiratory depression. Regional outbreaks of "super potent heroin" have been reported in the past. The outbreak in April and May 2006, of which this presentation is a part, included over 120 deaths in the Midwest, Northeast, and Mid-Atlantic regions. The primary markets included Chicago, IL, Detroit, MI, Philadelphia, PA, and Camden, NJ. In May 2006, authorities seized a fentanyl laboratory in Toluca, Mexico and this was the suspected source of the tainted heroin. A by-product of illicit fentanyl manufacture by the "Siegfried Method" is 4-Anilino-N-Phenethyl-Piperidine (4-ANPP).

Fentanyl is available by prescription as a transdermal patch, an oral lozenge and an injectable form. It is manufactured illicitly as powder or tablets. Fentanyl is abused in any of the prescribed or illicit forms. More creative forms of abuse include, wearing multiple patches, scraping the drug off the patches and snorting or injecting it, and chewing and/or swallowing the patches. Fentanyl is not detected using standard urine opiate immunoassays. As a result, negative tox screen results do not rule out a fentanyl overdose. Without performing a specific fentanyl immunoassay, the accepted detection methodology for the blood or urine is gas chromatography. However, detection can be problematic in that fentanyl is a late eluter and is usually present in very low concentrations. At the OCME, fentanyl was detected in the biological specimens following an alkaline extraction and analysis by gas chromatography-nitrogen phosphorus detection. Fentanyl was confirmed by full scan electron ionization gas chromatography-mass spectrometry (GC-MS). Fentanyl was quantitated by GC-MS, selected ion monitoring.

There were 15 fentanyl related deaths in the State of Maryland from 1/1/06 until the writing of this report and most were a result of the abuse of the patch. A cluster of five fentanyl-tainted heroin deaths occurred from

4/22/06 to 5/12/06. The MPC and CESAR initially reported to the OCME a series of 6-8 possible fentanyl-tainted heroin overdoses from the Eastern Shore of Maryland two days after the autopsy of the first suspected death. That individual survived for two days in the hospital where opiate confirmation was negative. Analysis of evidence from this scene by the local MSP crime lab revealed fentanyl and procaine. These results provided the first solid evidence that fentanyl was involved in this outbreak. At that time the OCME toxicology lab was alerted to look specifically for fentanyl. At a later date, the MSP crime lab also confirmed 4-ANPP in the same evidence. Thus far there are five confirmed fentanyl related deaths and three other suspected cases are currently under investigation. The age range of the deceased was 22 to 32 years old, four of five were Caucasian and four of five were male. Fentanyl concentrations ranged from 0.001 to 0.049 mg/L. One of five cases was positive for fentanyl only, three of five were positive for heroin, four of five had morphine in their system, four of five had cocaine in their system, and five of five scenes had intravenous drug paraphernalia. The areas of the state involved included Wicomico (1), Somerset (1), and Howard (1) counties, and Baltimore City (2).

Medical Examiner/Coroner's offices need to be aware of the limitations in detecting fentanyl and in cases where investigation points to a drug death and routine toxicology is negative, the toxicology lab needs to be informed of the possibility of fentanyl. A cooperative effort between the Medical Examiner/Coroner's offices and state drug surveillance systems is critical in order to detect emerging drug trends of public health significance.

Fentanyl, Heroin, Tainted

G102 Suicidal Caffeine Overdose

Wendy M. Gunther, MD, Tidewater District Office of the Chief Medical Examiner, 830 Southampton Avenue, Suite 100, Norfolk, VA 23510; Connie M. Luckie, PhD, Department of Forensic Sciences, Commonwealth of Virginia, 830 Southampton Avenue, Suite 400, Norfolk, VA 23510; and Karen B. Looman, DO, Tidewater District Office of the Chief Medical Examiner, 830 Southampton Avenue, Suite 100, Norfolk, VA 23510*

After attending this presentation, attendees will learn of an approach to the evaluation of a multi-drug overdose suicide by history and presentation. Recognition of the symptoms and signs of caffeine poisoning in a case of suicidal overdose.

This presentation will impact the forensic community and/or humanity by recognizing the existence of the abuse of caffeine in a suicidal overdose, how to assess the signs and symptoms of caffeine overdose, and recognizing the signs and symptoms of other drugs when assessing a multi-drug overdose.

A 44-year-old woman with a history of eight previous psychiatric hospitalizations and multiple previous suicide attempts was brought to the emergency room by her daughter at 9:20 p.m. on the day before her death. Her daughter related that she had made a suicide attempt by taking a number of prescription and nonprescription pills.

She was alert when she arrived, but her daughter gave the history for her. She said her mother had taken large but unspecified amounts of Cymbalta (duloxetine, an antidepressant), Vistaril (hydroxyzine, an antihistamine with central nervous system sedative properties), Relacor (a dietary supplement chiefly composed of water-soluble vitamins and alleged to regulate fat metabolism and homocysteine production), Seroquel (quetiapine, an antipsychotic sometimes used as an antidepressant), and an over-the-counter diet medicine, Stacker 2 (a diet medication composed of camellia sinensis white and yellow leaf polyphenols, yohimbine alkaloids derived from Pausinystalia Yohimbe bark, 6', 7'-dihydroxybergamottin, capsaicin, and anhydrous caffeine [150 mg per pill]). It was believed that she might also have taken trazodone (an antidepressant medication commonly sold under the brand name Desyrel).

She accepted PO charcoal while she was still alert, but rapidly became unresponsive and went into respiratory failure, requiring emergent intubation. In short order, her hypotension became so profound that she required a dopamine drip. Her pupils were symmetrically dilated to 4 to 5 mm. An initial episode of pulselessness at 0005 AM resolved with cardiopulmonary resuscitative efforts. Levophed (norepinephrine bitartrate, a sympathomimetic vasoconstrictor) and dopamine were maximized to maintain a mean arterial pressure of 65 mm Hg. At 0153, she became pulseless again, and remained in pulseless electrical activity during resuscitation until 0217. She maintained a pulse for thirteen minutes, but became pulseless again at 0230; with the administration of 40 mg of vasopressin, she regained a pulse at 0233. Following this third cardiac arrest, with her pupils dilated and minimally reactive, the family requested full resuscitative measures be discontinued. She survived in that condition until her final cardiac arrest at 0726. She was pronounced dead at 0736.

At autopsy, she was a well developed, moderately obese (68", 220 lb) woman with pale conjunctiva, without congestion of the face and neck. Numerous dental caries were visible on limited examination of the oral cavity. An abdominal scar correlated with internal signs of a remote cholecystectomy and gastric bypass. There were no external wounds and no wrist scars. Internal visceral examination was significant only for diffuse fine renal cortical granulation in the absence of significant heart hypertrophy (heart weight 359 gm), and a 3" abdominal fat layer, measured 2" below the umbilicus. Two quarter-inch foci of subgaleal hemorrhage were identified, and a thin film of subarachnoid hemorrhage coated the left cerebral hemisphere and both occipital lobes.

Histologic examination showed evidence of old ischemic disease in the form of delicate, ramifying collagenous replacement of subendocardial myocardium, to a degree surprising for the gross exam of the heart. There was slight emphysematous change of the lungs, sclerotic glomeruli of the renal cortex, and superficial subarachnoid hemorrhage confirmed in the brain, without evidence of any arteriovenous malformation. No etiology for the subarachnoid hemorrhage was determined.

Toxicology performed on hospital admission blood was reported negative for trazodone, quetiapine, methamphetamine or byproducts, cocaine or byproducts, opiates, or alkaline extractable drugs. Ethanol was reported positive at 0.05% by weight by volume. Diazepam was present at a concentration of 0.07 mg/L without nordiazepam. Caffeine was present at the extremely high level of greater than 180 mg/L.

Caffeine poisoning is a rare cause of fatal overdose. Caffeine use is extremely widespread, to the degree that many toxicologic laboratories do not test for it in routine specimens. Caffeine toxicity without fatal poisoning is frequently reported. The signs and symptoms of fatal caffeine poisoning in light of this case, and, in comparison to opiates, cocaine, and antipsychotic and antidepressant drugs, will be discussed.

Discussion: Review of this cases will illustrate the forensic methods used to elucidate multiple drug death with overlapping signs and symptoms.

Suicide, Caffeine, Multi-Drug Overdose

G103 Abuse of Prescription Narcotics: A Look Beyond Prescription Monitoring Programs

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After attending this presentation, attendees will have a broader understanding of the widespread problem of prescription narcotic abuse. Additionally, the attendee will understand the liability of physicians, pharmacists and pharmaceutical companies with regard to the dispensing of schedule II narcotics. Finally, the attendee will be introduced to an alternative means to prescription monitoring programs for dealing with narcotic abuse.

This presentation will impact the forensic community and/or humanity by informing the forensic community of the ongoing problem of schedule II narcotic abuse in this country while offering an alternative to currently utilized prescription monitoring programs used in some states. This issue affects physicians, attorneys, law enforcement, and the community as a whole.

Prescription narcotics enable individuals to undergo surgery and relieve pain for millions of Americans who suffer from legitimate chronic pain. While millions of people suffer legitimately from pain, many others obtain prescription narcotics for illicit purposes. This non-medical use of prescription medications is a widespread problem and a serious public health concern. In order to combat the illegal use of prescription narcotics, many states have established prescription monitoring programs (PMPs). These programs collect data on the dispensing of certain narcotics from physicians and pharmacies and disseminate it to regulatory and law enforcement agencies. While these state run PMPs are an asset to the investigation of illegal narcotic use, various professional and special interest groups voice concerns about the application of prescription monitoring programs.

This presentation will offer an alternative to the prescription monitoring program after a discussion of the factors involved in dispensing prescription narcotic medications. An overview of narcotics and their potential use and abuse will be addressed, as well as sources of illicit prescription narcotics for abuse. The physician duty of care owed to patients being treated for pain will be discussed. Included in this section will be an overview of the widespread problem of the under-treatment of pain in the United States, as well as the serious consequences of prescription drug abuse in this country.

Deaths due to the use/abuse of prescription narcotics account for an alarming number of deaths in many areas of the country as evidenced by the autopsy results from Jefferson Parish, LA where in 2005, 22% of autopsy cases were due to the acute effects of drugs - many involving Schedule II narcotics often in combination and usually accidental. Additional data on these cases will be presented. A third component of this presentation will assess the duty owed to patients by pharmaceutical companies who manufacture prescription medications. This section will address the liability of drug manufacturers for failure to warn, as well as liability for negligent marketing. The duty of care owed by pharmacists to patients will also be discussed including the scope of the pharmacist's duty, in addition to recent developments in the approach to pharmacist liability.

An overview of current prescription monitoring programs will be provided with particular attention to issues of privacy and confidentiality of medical information. This section will also encompass the successes and limitations of these programs and federal initiatives regarding prescription monitoring programs. Finally, improvements to the current system of state prescription monitoring programs will be suggested including a proposed alternative method of addressing prescription drug abuse in the United States.

Narcotic, Prescription Monitoring Programs, Abuse

G104 Murder By Poison: Experiences of a Medical Examiner's Office

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The goal of this presentation is to review the number and nature of homicidal poisonings encountered by the San Diego County Medical Examiner's Office during the last 20 years. The audience should gain a better appreciation of the complexities of investigating homicides resulting from poisoning and the circumstances and nature of such deaths.

This presentation will impact the forensic community and/or humanity through a better understanding of the types and frequencies of homicidal poisonings encountered in a large Medical Examiner's Office.

These experiences may be helpful in future investigations of murder by poisoning.

Despite the common portrayal of murder by poisoning in movies and television, deaths from homicidal poisoning are rare. Since the scene and findings can be subtle, the investigation of such deaths may be challenging. The purpose of this paper is to present the nature and findings of homicidal poisonings seen in a large Medical Examiner's Office over a period of 20 years. The San Diego County Medical Examiner's Office covers a population of approximately three million people.

Poison can be defined as a substance that causes injury, illness or death primarily by chemical means. As such, a poisoning could involve any type of chemical, drug or medication and could be ingested, injected, inhaled or even absorbed through the skin. The Medical Examiner's database from 1986 to 2005 was searched to identify all homicides that involved some type of poisoning, overdose or intoxication. This was done in several ways, including homicide queries for key words and visual scanning of the causes of death. Cases in which the cause of the death was not a direct result of a poison, medication or drug administered by another person were excluded. Also excluded were law enforcement restraint deaths and other deaths in which the victim was intoxicated or under the influence of a drug or medication at the time they were killed by other means. In addition, cases of fire related deaths and deaths in hospice patients given high doses of medications for end of life care were excluded.

During this time period, there were a total of 3601 homicides. Only 12 cases were identified that were the result of some type of drug, medication or chemical overdose or intoxication. This represents 0.33% of the homicides and is consistent with previous reports of 0.14 - 0.5%.

Homicidal poisonings in general will be briefly discussed, and the history and circumstances of the 12 cases will be presented along with the toxicologic findings. A variety of substances were used, and in some cases more than one agent was administered. The nature of the perpetrators and outcome of the cases will also be reviewed.

Homicidal poisonings are rare, but by their very nature tend to grab the attention of the public and news media. From an investigative standpoint they may be difficult to detect, and one may wonder how many cases are missed. These cases reveal a variety of circumstances, substances and perpetrators indicating that there is no stereotype for murder by poison.

Murder, Poison, Homicidal Poisoning

G105 Vaccine Death: A Rare Case of Anaphylactic Shock After Hexavalent Immunization

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After attending this presentation, attendees will learn of a rare case of fatal anaphylactic shock after hexavalent (against diphtheria, tetanus, pertussis, poliomyelitis, Haemophilus influenzae type B and hepatitis B) immunization in a three month-old female white infant is presented. The aim of the paper is to alert scientific community on reactogenicity of recent hexavalent formulation of vaccine.

This presentation will impact the forensic community and/or humanity by demonstrating that any death that occurs within a few days of vaccination to be autopsied using immunohistochemical stainings, toxicological analysis on urine and blood specimens and detection of femoral blood concentration of mast-cell Beta-tryptase to rule out anaphylactic shock.

This case presentation concerns a first-born child, delivered at the 41st week of gestation by caesarean delivery, with a birth weight of 3.400 g and Apgar scores of 9-10. The mother related no significant family history, an unremarkable pregnancy and good health of the baby, who was bottle-fed. At three months of age the female infant received a hexavalent immunization during a morning clinic visit. The mother stated that a few hours after the immunization the baby had difficulty feeding. Early in the afternoon the clinical condition of the baby got worse with the onset of severe dyspnea, so she was immediately taken to the emergency department of the local hospital. A state of shock with critical acute respiratory failure was diagnosed. The baby appeared pale and unresponsive. The baby was hypotensive (systolic pressure 50 mmHg) and tachycardic (180 bpm) with an undetectable diastolic pressure. Laryngoscopy was unremarkable. Laboratory tests revealed the presence of hyper-eosinophilia and metabolic acidosis (pH 7.154) with blood desaturation (pO₂ 75.9 mmHg) and compensatory hypocapnia. Repeated administrations of adrenaline by aerosol were given along with intramuscular corticosteroids. Despite the aggressive intervention the infant died two hours after arriving at the hospital.

A complete postmortem examination was performed two days after the death. External examination was unremarkable, except for the immunization puncture site on the left thigh. The body was of a three month old, well-developed and well-nourished, white infant with a body weight of 4930 gr and body length of 55 cm. Internal examination was unremarkable except for lungs presenting white foam in the main bronchi. Histological examination revealed mild cerebral oedema, and a shock histomorphology of the main organs (lungs, liver and kidneys). Immunohistochemical analysis revealed the presence of numerous degranulating mast-cells in the pulmonary parenchyma. Toxicological analysis of blood and urine specimens for therapeutic and non-therapeutic drugs were unremarkable. Postmortem measurement of mast cell β-tryptase in femoral blood was determined using the AA5 antibody ELISA; high concentrations, more than 10 ug/l were recorded (11.3 ug/l).

Adverse events following immunization are defined as medical incidents that take place after an immunization. Serious adverse events after vaccination have generally been defined as those adverse events that result in permanent disability, hospitalization or prolongation of hospitalization, life threatening illness, congenital anomaly or death. They are generally associated with the inherent properties of the vaccine (vaccine reaction) or some error in the immunization process (program error). The event could also be totally unrelated but only temporally related to immunization (coincidental event). The use of combination vaccines is an ideal way to simplify the simultaneous administration of multiple vaccines, reducing the number of injections, and may also be the most effective way of ensuring high compliance rates to complex immunization schedules. Recently, parental concern about polivalent vaccines has become increasingly prevalent. Hexavalent vaccine has been developed for primary booster vaccination of infants against diphtheria, pertussis, tetanus, poliomyelitis, Haemophilus influenzae type B and hepatitis B. Post marketing study confirmed the safety and immunogenicity of hexavalent vaccine as an alternative to other licensed vaccines. Members of the European Agency for the Evaluation of Medical Products in 2003 investigated whether there might be a link between hexavalent vaccines and some cases of sudden infant deaths occurred after immunization. It was concluded that there was no significant benefit/risk profile of these products, and, therefore, no changes in the present conditions of use were recommended. SIDS, viral infection, metabolic disorders, allergic reactions or airway obstruction were plausible but were not definitely proven to have been the cause of death. Vaccine associated anaphylaxis is a rare occurrence with only few cases reported despite the million of doses administered, giving a relative risk of 0.65 cases per million doses. It is not always clear which component of vaccine is involved in the anaphylactic reaction (antigens, preservatives, adjuvants, manufacturing residuals). Postmortem measurement of mast cell β-tryptase in serum is the only possible means of diagnosing or confirming death due to anaphylactic

shock because autopsy findings after acute anaphylactic death are generally non-specific; a cutoff value of 10 ug/l has been established to be optimal, with a sensitivity of 86% and specificity of 88%.

Hexavalent Vaccination, Mast-Cell Beta Tryptase, Anaphylaxis

G106 Pattern of Injury in Child Fatalities Resulting from Child Abuse

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After attending this presentation, attendees will understand some of the contributing factors and demographic characteristics in child fatalities due to abuse.

This presentation will impact the forensic community and/or humanity by assisting the forensic community/humanity in identifying key elements in maltreatment child fatalities.

When evaluating injuries in young children, physicians should consider nonaccidental trauma as an etiology of trauma. According to the U.S. Department of Health and Human Services, in 2002, an estimated 1,500 children died of maltreatment. Of these, 36 percent were as a result of neglect, 28 percent were victims of physical abuse, and 29 percent were due to multiple types of maltreatment. In 2003, children younger than four years old accounted for 79 percent of all maltreatment fatalities, with 44 percent of these deaths occurring in infants (DHHS 2005). The purpose of this study is to further examine the pattern of bony injuries in child maltreatment fatalities, with an emphasis on the prevalence of antemortem fractures and the presence of associated perimortem fractures. The sample was 130 male and female children, ages 0 to six years of age. The majority of the data were collected from the case files of the NC Child Fatality Prevention Team at the Office of the Chief Medical Examiner in Chapel Hill North Carolina (n = 120). An additional ten cases were included from the Charleston County Coroner's Office, Charleston, SC. Six age categories were used in this study: 1 (0 - 3 months), 2 (4 - 6 months), 3 (7 - 9 months), 4 (10 - 16 months), 5 (17 months - 2 years), 6 (2 - 6 years). Each individual's lesions were documented and categorized into one of four general body loci (1 = craniofacial, 2 = thoraco/abdominal, 3 = other, 4 = multiple). The prevalence of trauma and distribution of injury patterns were tested for independence and significance for biological and demographic categories (e.g. age, sex, race, month of death) using simple frequencies and Chi-square tests. In this study, the peak age categories of death were 0-3 months (23 %) and two – six years (21.5 %), with 50 percent of deaths occurring in infants nine months old or younger. The two different age categories could reflect newborn stress and coincide developmentally with toddlers seeking independence, respectively. Black males were the most numerous victims. Deaths occurred most often in the month of December. The body locus most frequently affected was the craniofacial area, 55 percent, usually the result of blunt force trauma (abusive head trauma). Notably, ante- or perimortem fractures were not usually associated with known abuse deaths. In this study, eighty percent of the cases did not show any antemortem fractures. Thus in cases of suspected abuse, radiographic skeletal surveys may not be an effective method for identifying or predicting the possibility of abuse, which suggest that current detection techniques need to be reevaluated.

Child Abuse, Fatalities, Injury Pattern

G107 Histopathology of Antemortem Infant Bone Fractures: Estimation of Time Since Insult

Murray K. Marks, PhD, University of Tennessee, Department of Anthropology, 250 South Stadium Hall, Knoxville, TN 37996-0720; and Darinka X. Mileusnic, MD, PhD, Regional Forensic Center, University of Tennessee Medical Center, 1924 Alcoa Highway, Knoxville, TN 37920*

After attending this presentation, attendees will understand the gross, radiologic and histological signatures of antemortem (chronic) and perimortem (acute) infant bone fractures associated with child abuse and apply a general timetable to better estimate “time since insult” for wounds.

This presentation will impact the forensic community and/or humanity by providing a means of accurately dating antemortem fracture times, the pathologist and investigating team serving the pathologist can better pinpoint the association of a victim to suspect. This association (or lack thereof) will provide a date line to when wounds may have been received prior to death and help establish a history and pattern of abuse.

Autopsy protocols that allow only macroscopic and radiological evidence fail to provide adequate information about wound diagnosis and time since insult. The obvious importance of recognizing and evaluating evidence of this violence in cases of suspected child abuse is necessary to gain an appreciation a clear understanding of vulnerable bone, fracture site biomechanics and wound healing processes crucial to causation and response. Klotzbach and coworkers (2003) first qualified the radiological and histological signatures relevant to “time since insult” indicators and this research follows that protocol and the procedures of Marks and coworkers (2005) by expanding those diagnostic criteria of for microscopically qualifying and quantifying osseous apposition rates at various postmortem intervals. The rich cellular osteogenic environment characteristic of growing bone demonstrates a unique response when compared with static adult bone, regardless of location.

Twenty antemortem “healing” and five perimortem occult (hidden) and acute fractures from ribs and various appendicular bones from four infant victims were radiographically and histologically assessed for degree of bony response. The specimens were seized at autopsy and represent various stages of healing. All were prepared as undecalcified dry thin sections using normal petrographic methods. Both dissecting and light microscopy and SEM were utilized to document, diagnose/qualify and quantify defects.

Longitudinal and cross sections taken through wound sites reveal telltale structural remodeling correlating to chronology. These include the location and degree of woven “blastic” bone proliferation during conversion and obliteration of the comminuted byproducts of the hematoma soon after trauma, subsequent manifestation of the transformation of the initial solid callus into bone and finally, full mineralization and “clastic” remodeling of the callus. Besides recognition of these qualitative events, the ability to recognize, document and radiograph the wound at autopsy are described with a method for harvesting, processing for histology and the manner of embedding and sectioning for light and scanning electron microscopy. Finally, while validation of these results was performed using light and SEM, utilization is made by dissecting microscopy.

Like previous research, this study demonstrated a detailed continuum of bone healing in rib and diaphyseal fracture calluses and among diaphyseal surface woven bone proliferation. These data may imply one of three isolated or correlated scenarios: differential inter-bone response to similar forces causing breakage/trauma, differential wounding forces or chronological specificity in wound appearance.

Histology, Child Abuse, Bone Fracture

G108 The Likelihood of Inflicted Injury Is Better Evaluated by the Use of Inconsistent Histories With the Constellation of the Triad of Findings: Subdural Hemorrhage, Brain Swelling, and Retinal Hemorrhages

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After attending this presentation, attendees will learn the value of the use of inconsistent histories obtained by investigation as well as autopsy findings in determining the likelihood of inflicted injury in children.

This presentation will impact the forensic community and/or humanity by confirming that evaluating histories and autopsy findings is a reliable method of ruling in and ruling out many possibly inflicted injuries in children.

Hypothesis: The reliability of the methods used to identify inflicted injury deaths in children has been called into question in the global community. Reviewing a series of child deaths can test the use of the constellation of inconsistent histories with autopsy findings to diagnose such deaths.

Synopsis: Correctly distinguishing inflicted from inadvertent injury and from natural disease is critical to the criminal justice system. Certain patterns of injuries found clinically or at autopsy have been proposed to identify injuries inflicted on children. An observational study of the neuropathology of inflicted head injury in infants and children by Geddes et al in 2001 reported the frequent finding of: subdural hemorrhage, increased intracranial pressure, and retinal hemorrhages. Others have advocated use of this triad of findings to make the diagnosis of inflicted injury. A nursing education website asserts, “The triad of subdural hematoma, cerebral edema, and retinal hemorrhage represents a diagnosis of SBS (Shaken Baby Syndrome)”.

Histories have been important in identifying inflicted injury. Inquiry into the phenomenon of absent or fluid histories in the presence of subdural hemorrhages and extremity fractures led to the original recognition of battered children.

A study of 169 child deaths compared the patterns of ocular and systemic findings in children dying as the result of inflicted injury with those found in injuries from motor vehicle collisions, falls, and various asphyxial deaths and in natural disease. Inflicted injury was distinguished from accidental injury, undetermined causes, and natural disease by investigation of medical and social history, and circumstances surrounding collapse as well as autopsy findings.

The validity of using a limited subset of histories and a limited subset of autopsy findings (the triad) to identify inflicted injury was assessed using data from the study. The immediate causes of death included: 76 (45%) intentional injuries, 36 (21%) inadvertent injuries, 47 (28%) natural causes, and 10 (6%) undetermined causes.

The triad of findings of subdural hemorrhage, brain edema, and retinal hemorrhages was seen in 47 of the total 76 (62%) inflicted injury deaths and in eight accidental deaths of the total 36 (22%). The triad was not seen in any of the 46 natural deaths or any of the 10 classified as undetermined deaths.

The sensitivity of finding inconsistent histories with the presence of the triad was 80%. The negative predictive value of finding a consistent history when the triad was absent was 88%. The relative risk of the triad being found with an inconsistent history was 4.56 with confidence limits of 2.53-8.20 and a P-value << 0.01.

Finding the triad with more than one injury history showed good sensitivity (85%). The negative predictive value of the finding was 87%. The relative risk of the presence of the triad with more than one injury history was 3.49 with confidence limits of 1.77-6.90 and a P-value << 0.01.

In these subsets, consistent histories included confessions as well as impartial information about events preceding injury. Specificity in these cases was 69% and the positive predictive value was 56%.

Similarly, certain unusual "multiple histories" became clear when further investigated. Since "more than one history" was used in defining the subset, these unusual cases yielded a calculated specificity of only 48% and positive predictive value of 44%.

Summary: Subsets of histories and autopsy findings can be reliably used to identify deaths which are more likely to be the result of inflicted injury - deaths with an inconsistent history and the autopsy findings include the triad of subdural hemorrhage, brain edema, and retinal hemorrhages. With a consistent history and no triad, inflicted injury is unlikely. With an inconsistent history, or multiple histories, and the presence of the triad, inflicted injury is likely. Thorough investigation and complete autopsy findings must be used to establish whether or not a particular child's death was caused by inflicted injuries.

Triad (SDH, Brain Edema, RH), Inflicted Injury, Retinal Hemorrhages

G109 Compressional Asphyxia Due to Prone Restraint Hold in a Child

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After attending this presentation, attendees will learn the dangers of prone restraint with compression, particularly in children, and how to approach the autopsy and investigation of such cases.

This presentation will impact the forensic community and/or humanity by helping forensic scientists question the role of prone restraint for behavior modification in children and consider alternative restraint procedures and monitoring for combative children.

This presentation reports a case of compressional asphyxia due to a prone restraint maneuver that occurred in a day treatment facility for children with behavioral problems. The decedent was a 7-year-old female with a history of aggressive behaviors since the age of two. She was enrolled in the treatment facility for approximately one month, during which time several disciplinary actions, including prone restraint, were employed for behavior modification. During extended prone restraints, staff noticed she would appear to "fall asleep" after calming down, but was easily awoken. On the day of the fatal restraint, she was displaying improper table manners and reportedly "gargling" her drink during lunch. After repeatedly ignoring staff requests to cease the behavior, she was taken for a five minute "cool-down" in a separate room. She became aggressive, and was placed in a prone restraint control hold on the floor. A small towel was placed under her head and two staff members employed the restraint with one laying across the calves and holding the left wrist, with the other staff semi-prone across the back controlling the right arm and torso and monitoring the head.

The two staff initiating the restraint were each relieved by another staff member at different times. The entire restraint was longer than an hour. The second staff controlling the torso was a 240-pound male who relieved his co-worker 30 minutes into the restraint. He noticed the child to be combative and resisting when he took over. The child claimed she needed to use the bathroom, and that she felt like she was going to throw up. It was apparently not uncommon for restrained children to make such claims, and this child had recently vomited during a previous prone restraint. The restraint continued uninterrupted, and the child calmed down, apparently falling asleep. It was noticed that she had urinated in her pants. After a reported period of about 30 minutes of no resistance, the staff began processing the release. The child was not responding, and when turned over she appeared blue around the mouth and lips. Resuscitative efforts were employed, and the child was air lifted to a

children's hospital from the local emergency room. She showed no neurological recovery and was removed from life support approximately 50 hours following the restraining incident.

At autopsy a 67 pound, normally developed female child was examined. A recent abrasion to the left face and healing abrasions to both knees were seen. Serosal petechiae of the thymus and hilar visceral pleura were present. An area of localized intra-abdominal serosal hemorrhage involved the mid transverse colon, distal stomach and pancreas with intrapancreatic extension. These findings were interpreted as possible manifestations of compressional force, but may have resulted from aggressive or misguided resuscitation. Early bilateral bronchopneumonia was also identified.

Deaths during prone restraint are generally associated with police custody, with elements of excited delirium or illicit drug toxicity as potentially contributing factors. The importance of this case lies in the fact that the restrainee was a child, with significant weight and size disparity from the restrainers. This restraint protocol placed significant weight over the torso of the child, and did not allow adequate visualization of the face to monitor breathing and consciousness.

Prone Restraint, Compression, Asphyxia

G110 Combined Types of Violence in Child Abuse: Report of Three Cases

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After attending this presentation, attendees will learn how different types of injury and neglect may contribute to child death in abuse, evaluate the differential contributions of neglect and battering in child homicides, recognize two or more distinct contributing causes to death in child homicide, and evaluate impact of such recognition on courtroom testimony.

This presentation will impact the forensic community and/or humanity by demonstrating overlapping and concurrent types of injury contributing to death in cases of child abuse, assessing relative contributions of injury and neglect in child homicide, and considering judicial outcomes and defense strategies in child homicides due to combined types of injury.

Forensic autopsy on battered children often identifies characteristic findings such as evidence of head impact with and without shaking, beating with and without patterned injury, fractures of ribs and long bones in various stages of healing, liver lacerations and other visceral injuries, and burns. Forensic autopsy on neglected children frequently reveals starvation, untreated medical illnesses, growth retardation, and dental caries. Neglect may also be diagnosed at autopsy when a caretaker has allowed a child to suffer injury through inattentiveness, such as when an unwatched child drowns.

The concurrence of neglect and battering is less common. This case series presents two children who came to forensic autopsy because of a combination of fatal neglect and fatal injury on the part of caretakers, and one child whose fatal injuries were due to two unusual overlapping kinds of violence, smothering and shaking/impact. Defense strategies and judicial outcomes for these cases are reviewed.

Case 1. Drowning and battering. A 3-year-old girl was left alone in a bathtub filled with water for what the mother described as ten minutes. The mother stated that the girl was underneath the water when she returned, lifeless. Emergency medical services found the child lying on a couch in the livingroom, with a large amount of water on the couch. The

girl had numerous bruises, lacerations, and abrasions over the back, chest, and extremities. Autopsy showed pulmonary edema with abundant froth in the tracheobronchial tree, supportive of drowning. There were also healing fractures of the left clavicle and of a left rib, and numerous scars of the head, trunk, and extremities; some of the wrist scars were due to ligatures. Malnourishment was diagnosed by the weight (less than 5th percentile for a normal girl of the same age) and height (less than 25th percentile), with a weight-to-height ratio less than the fifth percentile. Death was certified as due to drowning, with the manner homicide.

The mother was charged with felony second-degree murder in the setting of felony child abuse and neglect. Defense strategy included the argument that there was no connection between the abuse and the drowning. The mother was convicted. At the time of conviction, she was pregnant. The sentence of 16 years reflected the judicial decision to maintain her incarceration until all her five surviving children (including the fetus) should grow up.

Case 2. Smothering and shaken impact. His father found a 23-month-old boy dead in his bed, with obvious injury to the face and abdomen. The child had been in the care of his girlfriend before he was put to bed. Autopsy showed that the child had severe blunt force trauma to the head, torso, and extremities. This included bilateral subdural hematomas with retinal hemorrhages and optic nerve sheath hemorrhages, consistent with shaking, and multiple subgaleal hemorrhages and a brain contusion due to impact. There were multiple contusions and abrasions of the abdomen, including patterned injury, with contusions of the bowel and contusions and laceration of the mesentery, and right perirenal hemorrhage. There were multiple abrasions and contusions of the extremities without fractures. However, there was also evidence of smothering, including abrasions and contusions of the face, chin, and lips, and petechiae of the conjunctiva, face, scalp, and oral mucosa. Death was certified as due to acute blunt force head injury and asphyxiation from smothering, with the manner homicide.

The girlfriend was charged with felony child homicide. Defense strategies included the allegation that the caretaker was not the batterer, but that the child's 21-year-old developmentally challenged brother had fatally injured him during rough play on the floor; and that if the defendant had smothered him accidentally against her clothing, she had done so while holding a fatally battered child. The defendant was found guilty. The brother was not charged. Sentencing is pending at the time of this abstract.

Case 3. Starvation (neglect) and battering/shaking. An 8-week-old infant girl was found dead in her crib. A history was given that she had not been eating well for three weeks, but there had been no contact with medical professionals since birth. At autopsy, the child was dehydrated and severely malnourished (autopsy weight 5 lbs; birth weight 7 lbs 10 oz). The eyes were sunken, and the contour of the ribs was visible through the skin. The thymus had atrophied. The gastric pouch was empty, the duodenum and small bowel were nearly empty of chyme, and there was very little stool in the colon. There were bruises of the right forearm and left elbow, and on internal examination, there were multiple rib fractures in varying stages of healing. Examination of the head revealed multiple subgaleal hemorrhages, a linear right parietal skull fracture, and multifocal subdural hematomas of varying ages overlying recent and old brain contusions. Histology showed a dense neutrophilic inflammatory response in the subdural hematomas and the meninges of the brain and spinal cord, and multiple autopsy cultures grew out a single organism, *Salmonella arizona*. Death was certified as due to meningitis, due to infected subdural hematoma, due to inflicted traumatic brain injury, with starvation contributing; with the manner homicide. The mother pled guilty. Sentencing is pending at the time of this abstract.

Review of these cases will illustrate the forensic methods used to elucidate multiple overlapping types of injury and neglect that may contribute to complex cases of child homicide.

Child Abuse, Child Neglect, Combined Types of Violence and Injury

G111 Brainstem Axonal Injury and Retinal Hemorrhages as a Substrate for Sudden Death in Second Impact Syndrome: A Case Report

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After attending this presentation, attendees will gain an assessment of central nervous system at autopsy for axonal injury, and globes at autopsy for retinal hemorrhage.

This presentation will impact the forensic community and/or humanity by increasing the awareness of the pathology and pathophysiology of so-called second impact syndrome. Moreover, it will raise the much needed concept that retinal hemorrhages, while a useful "marker" of abuse, are not diagnostic of abuse, and that a degree of circumspection is required in assessing accidental vs. nonaccidental trauma in children.

Second impact syndrome is an ill-defined syndrome in which presumably trivial head injury, following a concussion or other significant head injury is associated with sudden death. The pathophysiology of this process is unclear, although diffuse cerebral swelling has been implicated.

An 18-month-old boy who suffered a closed head injury from fall from a balcony, following which he underwent a short period of rehabilitation and was discharged with a helmet. The helmet was prescribed because the child's motor skills had slightly deteriorated. Four weeks following the fall from the balcony, the child suffered a fall from a coffee table witnessed by both a parent and another adult, after which he immediately became unresponsive and expired several days later with cerebral swelling and nonperfusion. He was not wearing the helmet at the time of the fall from the coffee table. At autopsy, marked edema with diffuse bilateral ischemic necrosis was present throughout the cerebrum, cerebellum, and brainstem. In addition, the right lateral brainstem as well as the corticospinal tract at the pontomedullary junction showed axonal shear injury, including numerous swollen axons and microglial activation that were temporally consistent with the initial closed head injury. Bilateral retinal hemorrhages and bilateral optic nerve sheath hemorrhages were also present. This case demonstrated that this subject may have been predisposed to sudden decompensation following trivial head injury because of pre-existing brainstem axonal injury and a vulnerable brainstem cardiorespiratory center. Close examination of the brainstem for evidence of axonal injury is warranted in subjects who expire following trivial head injury, especially in the case of previous head injury. This case further highlights the lack of specificity of retinal hemorrhages in terms of accidental vs. non-accidental trauma, and that careful assessment of individual cases is necessary before concluding injuries were inflicted by another.

Second Impact Syndrome, Axonal Injury, Retinal Hemorrhage

G112 Sexual Abuse: Hymenal Findings in Girls With a History of Vaginal Penetration

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After attending this presentation, attendees will understand that hymenal lesions at colposcopic examination are seldom seen in late disclosure of sexual abuse in children with vaginal penetration.

This presentation will impact the forensic community and/or humanity by assisting professionals in understanding that hymenal lesions are seldom seen in sexually abused girls who report vaginal penetration.

The Institute of Forensic Medicine, University of Aarhus, at the request of the police, performs colposcopic examination of children suspected of being sexually abused.

From January 1, 1996, to September 2002, 482 children living in Jutland, Denmark, were investigated (1.48/10,000 children from birth to 16 years).

This study focuses on hymenal findings in cases of a history of vaginal penetration given either by the child or by the perpetrator or both.

Results: Two hundred twenty-six girls reported vaginal penetration at least once, and of these 116 were penile penetration.

The median age of the girls was 12 years (range 2-14 years).

Forty-nine girls (22%) were examined within 24 hours after the last sexual assault, 27 (12%) less than a week and 116 (51%) more than a week later; and in 34 cases (15%) the time since the alleged penetration was unknown.

The hymen was normal in 155 girls (55%), showed erythema in 18 (8%) and lesions in 20 (9%); the rest had other irrelevant findings or were unknown.

Hymenal clefts were found in 50 girls (25%), but only 17 girls (38%) had a complete hymenal cleft and of these 15 were above 12 years of age (median age 14 years). In a nine-year-old girl an anteriorly located cleft was observed.

The incidence of hymenal clefts (both incomplete and complete) in the 426 girls investigated increased with increasing age. Thus, 78% of the clefts were found among the oldest girls (above 11 years).

Eight of the girls with a hymenal cleft had used tampons on a regular basis. One hundred and nineteen cases were prosecuted and of those 102 suspects (86%) were convicted. Eight perpetrators admitted vaginal penetration, and the victims in these cases all had a complete posterior hymenal cleft.

No significant correlation was found between hymenal clefts and appearing at court or being convicted, nor between complete clefts or conviction at court.

There was, however, a relationship, although non-significant, between the age of the girls and the probability of the perpetrators to appear at court; the age of the girls in cases resulting in a conviction was significantly higher than in those resulting in acquittal ($p=0.02$).

Conclusion: In cases of late disclosure of sexual abuse, the history from the child and the perpetrator, not physical findings, remains the single most important feature in evidence of sexual abuse.

Child Sexual Abuse, Vaginal Penetration, Hymenal Lesions

G113 A Chest Full of Blood: Hemothorax as a 26 Year Delayed Consequence of Repair of Transposition of the Great Vessels

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After attending this presentation, attendees will learn about an uncommon consequence they may see long after surgical correction of transposition of the great vessels.

This presentation will impact the forensic community and/or humanity by providing useful information about a potentially lethal delayed complication of a common surgical procedure to correct a congenital heart problem; describing newer procedures that do not have this kind of problem; and illustrating signs and symptoms to look for in a similar autopsy case.

A 27-year-old woman had been born with transposition of the great vessels (TGV), a congenital heart disorder that was always fatal before corrective surgery was developed. In TGV, blood oxygenated by the lungs never reaches the rest of the body, and blood returning from the body never reaches the lungs. This occurs because, in TGV, the pulmonary artery is attached to the left side of the heart and the aorta is attached to the right side of the heart.

Twenty seven years ago, a standard treatment for this disorder was the Mustard procedure, in which the pulmonary veins are detached from the left atrium and surgically reattached to the right atrium, and the superior and inferior vena cava are detached from the right atrium and reattached across an "atrial baffle" to the left atrium. This procedure allows oxygenated blood to flow to the body, and deoxygenated blood from the body to return to the lungs. It also allows the coronary arteries to remain in their native position in the aorta. It has the disadvantage that the right ventricle is responsible for pumping blood to the body, which causes it to hypertrophy, and the left ventricle pumps blood to the lungs, under too much pressure.

The patient's Mustard procedure was performed at 11 months of life. She recovered well and lived for twenty-six more years. Approximately three months prior to her death, she was diagnosed with pneumonia, and was treated with antibiotics. The day before her death, she complained of chest pain. The night of her death, while talking on the phone, she had a fit of coughing. The expectorant contained blood. She went to the emergency room, and during the initial work-up, collapsed and died.

At autopsy, external examination revealed a slender, gracile and nearly cachectic female who had pallor of the face and body. There was a midline chest scar as evidence of her previous cardiac surgery, but no recent injuries or surgical procedures. Blood for toxicology was hard to obtain by inguinal or subclavian puncture.

Internal examination revealed a right hemothorax with 1700 cc of blood and clots, visceral pallor, and depletion of the vascular tree. The heart showed evidence of the Mustard procedure, with all anastomoses intact. However, there were bilateral pulmonary artery aneurysms. The right ventricle showed evidence of extreme hypertrophy, with the wall measuring up to 1.5 cm thick. The right pulmonary artery showed a 10 cm aneurysm at the hilum that extended into the lung. The left pulmonary artery revealed a 3cm aneurysm. A fresh rupture was found in the right pulmonary aneurysm near the hilum, creating the hemothorax and causing the young woman's death.

Extensive recent and older thrombosis of pulmonary artery branches leading from the aneurysm into the right lower lobe was noted, suggesting this might have prompted the diagnosis of pneumonia. Thrombosis of these vessels might have been responsible for raising the pressure in the aneurysm, ultimately leading to rupture.

The Mustard procedure has been known to extend victims' lives for ten years or more. However, pulmonary artery aneurysms, although rare, have been reported in the literature as a long term sequela. Commoner

problems with the Mustard procedure include cardiac arrhythmias and baffle leaks. Transposition of the great vessels is now treated by a different procedure, the arterial switch.

This case report will compare the long term complications and advantages of the arterial switch to the Mustard procedure in light of this catastrophic delayed result. This will aid forensic personnel in the future when they have a case for forensic autopsy with a history of surgical repair of transposition of the great vessels. They will know what to expect on heart dissection from these surgeries, and to anticipate the possible long term problems that can accompany these types of techniques.

Transposition of Great Vessels, Aneurysm, Sudden Death

G114 Suicidal Hanging of a Postpartum Woman Who Discontinued Anti-Depressant Medication During Pregnancy

Gregory L. Hess, MD, Jeffery M. Jentzen, MD, and Russell T. Alexander, MD, Milwaukee County Medical Examiner Office, 933 West Highland Avenue, Milwaukee, Wisconsin 53233*

The goal of this presentation is to review a case of postpartum suicide in a woman with a history of major depression who discontinued her psychotropic medications during the first trimester of her pregnancy. The current controversies surrounding the treatment of depression during pregnancy and in the postpartum period will be reviewed.

This presentation will impact the forensic community and/or humanity by discussing the risks and benefits of treating depression in the puerperal period.

The decedent was a 30-year-old female who hanged herself with a dog leash 45 days after the uncomplicated vaginal delivery of her third child. Three days prior to death she began expressing depressive symptoms reported as sleep disturbance, restlessness and obsessive preoccupation with her youngest child. The day before her death she sought medical attention at a local walk-in clinic for depression and was prescribed sertraline (Zoloft). The next evening she fashioned a noose from a dog leash and using a cut log as a step stool, fully suspended herself by the neck from a tree in the back yard of her home. Scene investigation revealed copious emesis in the kitchen trash, and an empty bottle of sertraline.

She had a history of two previous inpatient hospitalizations for major depression, the first of which was an involuntary hospitalization manifested by self induced starvation and dehydration. During the first hospitalization, five years prior to her terminal event, she tried to hang herself by her bra strap three times. A second depressive episode, approximately one year before her suicide, was punctuated by her threatening to kill herself with a kitchen knife. Neither of these depressive episodes appeared related to her prior pregnancies. Her psychiatric medications prior to her third pregnancy consisted of sertraline and quetiapine on which her symptoms appeared well controlled. She discontinued her medications during the first trimester of the last pregnancy in consultation with her obstetrician secondary to the unknown teratogenicity of these medications (both are pregnancy category C). She had not restarted her medications immediately after delivery because, according to her husband, she had not felt depressed and she was breastfeeding.

At autopsy a dried ligature abrasion partially encircling the neck crossed the neck anterior midline over the superior edge of the thyroid cartilage. No petechiae were identified on the conjunctivae of the eyes, facial skin, lips or oral mucosa. A layer-wise anterior neck dissection did not reveal hemorrhage or injury within the strap muscles of the neck, the hyoid bone, or the thyroid cartilage. No pill fragments were found in the stomach. Postmortem toxicology testing revealed an elevated level of sertraline (0.24mg/L), but no additional drugs or alcohol in iliac blood.

Approximately 10% of women develop depression during pregnancy or in the postpartum period, and a previous history of major depression is a risk factor. The previous held belief that pregnancy offers "protection" from major depression has been challenged by a recent study showing a significantly higher rate of relapse amongst women who discontinued anti-depressant medication compared with those who continued treatment (Cohen et al., 2006). Selective serotonin reuptake inhibitors (such as fluoxetine, sertraline, and paroxetine) have been recommended for the treatment of depression during pregnancy due to their efficacy, as well as historical data suggesting they are not associated with birth defects (Kahn et al., 2001). Although sertraline is the most commonly prescribed anti-depressant in breastfeeding women, controversy still exists over the adverse effects it exerts on breastfed infants of mothers taking this medication (Gentile, 2005; Whitby and Smith, 2005). Concerns of fetal teratogenicity and infant toxicity due to intrauterine or breast milk exposure to anti-depressants must be balanced against the documented adverse effects that pregnancy related depression imparts on fetal and infant outcomes (Bonari et al., 204; Mian, 2005). A rare though dramatic outcome of pregnancy related psychiatric illness is maternal suicide or infanticide. Postpartum psychosis affects approximately 1% of women and may increase the risk of maternal or infant death.

This case presentation highlights the risk of discontinuing anti-depressant therapy during pregnancy for a woman with a history of major depression and previous suicide attempts. Medical examiners and investigators need to seek out a history of discontinuation of psychiatric medication in women who kill themselves or their children during pregnancy or postpartum. Only by being aware of the current controversies surrounding the treatment of depression during pregnancy and in the postnatal period will medical examiners be able to offer informed opinions when suicide or infanticide occurs in these settings.

Pregnancy, Depression, Suicide

G115 A Simple Model for Teaching Postmortem Monocular Indirect Ophthalmoscopy

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After attending this presentation, attendees will understand the enhanced potential for skill acquisition in postmortem monocular indirect ophthalmoscopy using a simple and inexpensive model simulating the ocular fundus.

This presentation will impact the forensic community and/or humanity by demonstrating a teaching model that can be used to enhance skill acquisition in postmortem monocular indirect ophthalmoscopy and be assessed to accurately identify and describe fundal abnormalities of pathological significance such as retinal hemorrhages.

Postmortem examination of the fundus oculi has relied on direct ophthalmoscopy or ocular evisceration, but recently the techniques of postmortem ophthalmic endoscopy and monocular indirect ophthalmoscopy have been delineated. Direct ophthalmoscopy has been used to attempt estimates of postmortem interval and identify retinal abnormalities but its usefulness is hindered by postmortem corneal clouding (swelling), inherent limited field of view, an inability to view the peripheral retina and lack of stereopsis. In most medical examiner/coroner jurisdictions ocular enucleation is not a standard autopsy procedure unless child abuse is suspected, thus invariably inuring observational bias when citing the prevalence of certain fundal findings (e.g., retinal hemorrhages). Postmortem endoscopic funduscopy permits viewing and documentation of retinal abnormalities; however, the equipment is costly and training necessary to gain expertise in operating the endoscopic equipment and subsequent image acquisition. The material necessary for postmortem monocular indirect ophthalmoscopy (PMIO) is inexpensive and when

compared to direct ophthalmoscopy the technique is less affected by corneal clouding, cataracts, or vitreous hemorrhage. Other advantages include a relatively large field of view, high resolution and an ability to visualize the peripheral retina. Disadvantages include low magnification and a projected aerial image that is inverted and laterally reversed.

A valuable skill for forensic pathologists, the technique of postmortem monocular indirect ophthalmoscopy can be challenging for pathology residents and forensic pathology fellows to master. Indirect ophthalmoscopy is not routinely taught in most medical schools so with the exception of ophthalmologists-in-training most residents and fellows have a limited exposure to the technique. Because the projected aerial image is inverted and laterally reversed precise descriptions or recording of fundal abnormalities can be challenging. Since the image cannot be viewed simultaneously by the instructor and student, learning PMIO can be intimidating because the more experienced forensic pathologist must teach the technique and describe the orientation of any fundal abnormalities observed.

To facilitate skill acquisition in PMIO, a simple and inexpensive teaching model can be constructed from hinged, cylindrical plastic containers having an internal diameter of 35 mm and a depth of 30 mm. A 9-mm hole drilled in the center of the hinged lid from a 1-oz cylindrical plastic canister creates an artificial pupil. Fundal images depicting hemorrhagic retinopathy printed on 8 x10-inch matte photographic paper are cropped into 3.5 mm circles with available imaging software. Trimmed images from the photographic paper are fitted into the canister's base. The lid of the canister marked as to the appropriate eye and correct orientation completes the model. Using a procedural headlight and an aspherical indirect condensing lens, the resident or fellow can practice viewing the simulated fundal image. Multiple funduscopic abnormalities with retinal hemorrhages can be created for teaching with variations in the number, location (preretinal, intra-retinal, subretinal), distribution and orientation relative to the optic disc. Using this simple teaching model, the pathology resident or fellow can be assessed as to his/her ability to accurately identify and describe the number, location, distribution and orientation of retinal hemorrhages and various other fundal abnormalities of pathological significance.

Postmortem Monocular Indirect Ophthalmoscopy, Ocular Fundus, Retinal Hemorrhage

G116 A Case of Fatal Water Intoxication in a Toddler

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After attending this presentation, attendees will have reviewed the physical and chemical signs and symptoms of water intoxication, thereby broadening the differential diagnosis in cases of sudden death particularly in pediatric practice.

This presentation will impact the forensic community and/or humanity by demonstrating the clinical signs and symptom of water intoxication as well as the differential diagnosis of this condition so that it might be a consideration in cases of sudden unexpected death particularly when environmental conditions include exposure to water.

This presentation concerns a case of fatal water intoxication in a toddler after a day of swimming and a review of the literature on pediatric water intoxication.

A 2.5-year-old, 12 kg, previously healthy female presented to a community emergency department with profoundly altered mental status. Her caregiver reported the child had been at a home pool for several hours

and on leaving had been "fussy" and may have fallen "onto her bottom" on the way to the car. She had one episode of copious clear emesis. Immediately after this she became progressively lethargic and unresponsive.

On presentation to the emergency department, her vital signs (HR 67, RR 35, O₂ saturation 64% on room air, BP 145/84) were consistent with Cushing's triad. She was emergently intubated and her vital signs normalized. Neurological exam revealed response only to painful stimuli. Her pupils were sluggishly reactive. Initial laboratories (prior to administration of any fluids) revealed a serum Na⁺ 128, Cl⁻ 95, K 3.3, CO₂ 15, BUN 15, Cr 0.2, and Glc 259. A bolus of 400cc of normal saline was ordered and transfer to a tertiary care pediatric hospital was arranged. Inadvertently, a bolus of D5W was reportedly administered instead of normal saline.

Initial labs at the tertiary care facility revealed a serum Na⁺ of 120. Her pupils were fixed and dilated and she had no respiratory effort. Physical exam was normal with the exception of her neurological exam and specifically did not reveal any evidence of rashes or signs of trauma. Her neurological exam revealed she had no doll's eye reflex, corneal response, cough or gag. She did withdraw minimally to painful stimuli. An emergent head CT demonstrated diffuse cerebral edema with herniation and no radiological evidence of intracranial hemorrhage, although the differential diagnosis included trauma. She was admitted to the Pediatric Intensive Care Unit and fluid resuscitation was initiated. Within hours she developed central diabetes insipidus, with high urine output (8 cc/kg/hr), urine specific gravity or 1.000, and a rapidly increasing serum sodium (maximum Na⁺ 155), despite changing intravenous fluids to 0.45 normal saline. Vasopressin therapy was initiated. Ophthalmologic examination ten hours after initial presentation showed splinter retinal hemorrhages in the posterior poles bilaterally. Over the next three days, her neurological exam deteriorated until she no longer withdrew to painful stimuli. At that time, her family elected to withdraw life support. A postmortem skeletal survey was negative for fractures.

The case fell under the coroner's jurisdiction and a forensic autopsy was ordered. At autopsy, no external signs of trauma were identified. Her thoracic and abdominal cavities were normal with the notable exception of cardiomegaly (76 g) and splenomegaly (90 g), neither of which were noted premortem. Cranial contents were consistent with diffuse cerebral edema and uncal herniation without intracranial hemorrhage. Cerebral spinal fluid collected using sterile technique was noted to be xanthochromic and somewhat gelatinous but not frankly purulent. Culture of the CSF grew *Klebsiella pneumoniae* in the broth only. No organisms were identified on gram stain of the CSF.

Local law enforcement officials conducted an investigation including interviews of all parties who had contact with the child. Her adult caregivers on the day of her presentation reported that she had been in a floating toy in a backyard above ground pool for several hours during the day. Both adults present at the time did not recall the child becoming submerged at any time. One caregiver indicated that the adults and older children present at the pool had been jumping in from the edge creating "tidal waves" repeatedly. Repeated interviews with the caregivers revealed consistent histories of the events of the afternoon.

The cause of death was cerebral edema due to hyponatremia due to acute accidental water intoxication. The manner of death was determined to be accidental.

A review of the English language literature on accidental water intoxication reveals five cases in the pediatric population with symptoms similar to this case. With timely, appropriate fluid resuscitation a full recovery is possible, even when the presentation includes a comatose state. It is most likely that this child swallowed a large volume of pool water, which acutely dropped her serum sodium that resulted in her symptoms, with subsequent irreversible cerebral edema and herniation.

Water, Intoxication, Pediatric



Pathology/Biology

G1 Otologic Injury as a Consequence of Blast Trauma; Evaluated by Postmortem Otoscopic and Computed Tomography Examination

Carol J. Solomon, MS, MD, Louis N. Finelli, DO, and John M. Getz, BS, Office of the Armed Forces Medical Examiner, 1413 Research Boulevard, Building 102, Rockville, MD 20850*

After attending this presentation, attendees will recognize the pattern of middle ear injury from blast trauma and its correlation with postmortem otoscopic findings and computed tomography results.

This presentation will impact the forensic community and/or humanity by providing a systematic evaluation of middle ear structures injured as a result of primary blast trauma. Techniques evaluated are intended to augment the routine gross and microscopic examination of victims of blast injury. The results of these studies will aid in the evaluation of patients status post injury and possibly assist in preventive measures in the appropriate setting.

The ear is one of the most frequently injured organs affected in an explosion. Otologic injury is a far more prevalent problem than has been previously reported. A more thorough evaluation of victims combined with an increase in both the number of civilian and military blast injuries cause us to recognize the extent of the problem. The short and long term sequelae of this type of trauma may include findings such as hearing impairment, tinnitus, and vertigo and cholesteatoma formation. A clearer understanding of the pattern and etiology of injury should benefit survivors in the planning of treatment strategies to optimize outcome. The techniques utilized in this study have enabled us to evaluate the mechanism and extent of injury to otologic structures.

Evaluation of middle ear injuries, postmortem, has been a laborious process. The current study provides two techniques that will provide additional information in the assessment of blast trauma. These techniques are useful in the evaluation of tympanic membrane perforation, hemorrhage into the middle ear and ossicular damage.

A series of cases is presented demonstrating the application of postmortem otoscopic examination and computed tomography to evaluate middle ear structures. These findings are correlated with the results of the corresponding circumstances of death.

Blast Injury, Otologic, Computerized Tomography Scan

G2 Natural Central Nervous System (CNS) Causes of Death: A Ten Year Retrospective Review (1994-2003)

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The goal of this presentation is to explore the incidence and specific demographic information (age/sex) for natural CNS deaths in Pima County, AZ from 1994-2003.

This presentation will impact the forensic community and/or humanity by reviewing the incidence and demographics for natural CNS deaths in Pima County, AZ from 1994-2003. Forensic pathologists and other forensic scientists may find this information useful to compare with the incidence of natural CNS deaths in their own practice.

Sudden unexpected natural deaths of CNS etiology are not an uncommon finding in many medical examiners offices. The authors performed a retrospective review of 262 cases of natural deaths attributed to a CNS etiology over a 10-year time period to compare the cause, incidence, and demographic profiles of such cases. Natural deaths were sorted from 11,152 total autopsies performed at the Pima County Forensic Science Center between 1994 and 2003. These natural deaths were then screened for a primary CNS cause of death (COD) excluding systemic diseases with CNS manifestations if the CNS pathology could not be determined to be the primary mechanism of death. COD and demographic information on each case was then tabulated with particular attention to the top three causes of death by year. Primary CNS deaths accounted for an average of 7.2% of natural deaths in this ten-year review. The majority of these (28% of CNS totals) were attributed to unexpected death in patients with a clinically documented seizure disorder with a slight male predominance (1.6:1 male: female ratio) and an average age of 38 years. The second most common cause of death (27% of CNS totals) was hypertensive stroke. The average age of this population was older as compared to the patients with seizure disorders and with a slight male predominance (average age 59 with a 1.4:1 male: female ratio). Ruptured aneurysms in various CNS anatomic locations were the third most common cause of death (16% of CNS totals) occurring in middle age with a male predominance (average age 48 with a 1.5:1 male: female ratio). Infectious meningitis, most commonly of bacterial or viral etiology, was also a frequent cause of CNS death (14% of CNS totals with average age 35 years with a 1.3:1 male: female ratio). Infectious etiologies were the most age variable COD ranging from 4 months to 69 years of age. Other, less frequent, COD, in order of descending frequency, included primary brain neoplasm, idiopathic intracerebral hemorrhage, congenital anomalies, progressive neurodegenerative dementias, and idiopathic encephalopathies. These findings are felt to be representative of a typical forensic autopsy population with an over representation of sudden death (seizure disorder, stroke, and aneurysm) and under representation of chronic CNS pathology (neurodegenerative dementias, neoplasm) than what would be expected in the general population.

Central Nervous System, Natural Death, Review

G3 Frequency of Cases of Fatal Gunshot Wound Victims With Retained “Old” Projectiles From Previous Penetrating Gunshot Wounds

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After attending this presentation, attendees will learn the importance of considering “old” projectiles in assessing a gunshot wound homicide.

This presentation will impact the forensic community and/or humanity by increasing awareness of the “old” projectile as a possible pitfall in the multiple/complex gunshot wound case.

When considering multiple gunshot wound cases, the simple equation of number of entrance wounds equals the number of exit wounds plus the number of bullets lodged in the victim is always an excellent starting point in the forensic examination. However, when there are intermediate targets, atypical entrance wounds or fragmented projectiles the situation can be more complex. The equation can be further complicated by individuals

who have sustained a penetrating gunshot wound in the past, survived the injury, and for medical or personal reasons elected not to have the projectile removed. These "old" projectiles can be easily distinguished from acute projectile injuries based on their gross appearance with lack of acute hemorrhage and usual encasement within an area of fibrosis, but when plain film radiographs are used in the original accounting process, this old retained projectile can complicate the equation.

A review of all of the victims of fatal gunshot wounds at the Arkansas State Medical Examiner's office from January 1, 2000-December 31, 2004 was performed to determine the frequency of cases in which an "old" bullet was discovered in addition to the acute, fatal, gunshot wound or wounds. A total of 703 gunshot wound homicides were reviewed; twenty-five of which had evidence of remote gunshot injury and retained projectiles or fragments identified on radiologic exam and internal examination. Individuals with evidence of remote gunshot injury were further classified based on anatomic location of the remote projectile, bullet caliber (large or small), or bird-shot pellets. This classification allows a discussion of possible reasons for leaving the "old" bullet in the patient; either for difficulty/futility of retrieval or the patient's desire to retain the bullet for show as a "souvenir" bullet.

In this retrospective study, four percent (4%) of the cases of gunshot wound homicides at the Arkansas State Crime Laboratory had retained projectiles from previous gunshot wounds. The frequency of these cases points out the importance of considering the possibility of old bullets when approaching complex gunshot wound cases. One should always remember that every projectile on the x-ray may not be from acute injury.

Gunshot Wound, Homicide, Old retained Projectiles

G4 Small Cell Carcinoma of the Lung Contributing to Pulmonary Barotrauma With Air Embolism in a Recreational Diver: A Case Report

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The goal of this presentation is to review the pathophysiology of pulmonary barotrauma in the setting of SCUBA diving fatalities and to discuss the potential contribution of local bronchial obstruction to the development of pulmonary barotrauma.

This presentation will impact the forensic community and/or humanity by demonstrating how divers would benefit from consulting a qualified medical professional about the risks of diving with an intrinsic lung disease prior to engaging in this sport.

SCUBA diving is a popular sport in the United States and approximately 90 deaths are reported each year, mostly from coastal states. Drowning is the leading cause of death in diving related fatalities but a host of injuries unique to diving may contribute. This presentation will impact the forensic community and/or humanity by increasing awareness of the potential danger of recreational SCUBA diving in those with obstructive pulmonary processes.

A 45-year-old man was SCUBA diving with a partner in seawater at a spot familiar to both of them. He was an experienced rescue-certified diver with over 450 dives. The dive lasted approximately 29 minutes with a maximum depth of 84 feet of seawater. During the decompression stop the divers became separated in murky water. The partner surfaced then resubmerged and recovered the decedent from the bottom approximately 25 feet below the surface. The decedent was removed from the water and resuscitation was attempted in the field prior to the pronouncement of death. No central lines or other procedures invasive to the central vascular bed or chest were attempted.

The SCUBA gear was examined by a Diving Safety Officer. All components were in good condition and in working order with adequate unadulterated air in the tank. The diving computer was interrogated and a depth/time histogram was produced. At approximately 23 minutes into the dive the histogram has a spike-like irregularity after which the depth remains steadily at approximately 25 feet until the data terminates.

Prior to autopsy an anterior-posterior radiograph of the chest in the left lateral decubitus position was obtained. Air fluid levels in the right and left sides of the heart, gas in the central vascular structures of the chest and neck, and pneumomediastinum were observed. Opening the myocardium under water produced a gush of bubbles. No gas emboli were grossly apparent in the coronary or cerebral arteries. There was no substantial heart disease.

A 3.0 centimeter white subcarinal mass, histologically confirmed as small cell carcinoma, extended into the hilum of the left lung. It caused subtotal obstruction of the left upper lobe bronchus and encased the pulmonary artery. The pulmonary parenchyma distal to the obstruction was hemorrhagic and atelectatic. Metastases were present in the mediastinal lymph nodes and liver.

Medical records revealed that the decedent had been diagnosed with metastatic lung cancer approximately six months before his death. He underwent chemotherapy with shrinkage of his metastatic lesions. Chronic cough caused him to undergo bronchoscopy approximately one month prior to his death, which revealed partial obstruction of the left upper lobe bronchus by the neoplasm. He received two fractions of palliative radiation to that area, the last on the morning of the fatal dive.

We hypothesize that 1) the presence of a carcinoma obstructing a bronchus resulted in fatal barotrauma in an experienced diver, and 2) filling of the central vascular bed by gas resulted in unconsciousness while submerged, in the absence of cerebral and coronary artery gas emboli.

Divers would benefit from consulting a qualified medical professional about the risks of diving with an intrinsic lung disease prior to engaging in this sport.

Scuba Diving, Air Embolism, Postmortem Radiograph

G5 Serum Levels of Pulmonary Surfactant Associated Proteins A and D (SP-A & SP-D) in Some Causes of Death

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After attending this presentation, attendees will recognize the potential benefits of testing for pulmonary surfactant proteins in certain types of sudden deaths, especially those occurring with an asphyxial or intoxication mechanism.

This presentation will impact the forensic community and/or humanity by demonstrating research that may be considered as a step in determining the potential diagnostic role of surfactant proteins in post-mortem settings.

It has been suggested that surfactant proteins A and D (SP-A, SP-D) may be useful markers of lung injury in the clinical setting. In this present study, cadaveric serum samples were analyzed by specific enzyme linked immunoassays for the levels of SP-A and SP-D in certain causes of death, such as mechanical asphyxia, drowning, fire, sudden unexplained deaths, carbon monoxide intoxication, narcotics abuse, and organophosphate poisoning. Results in these types of cases were compared to the serum levels in a group of healthy volunteers, which served as the control group. No significant differences were observed in the median serum SP-A and SP-D concentrations among the groups of volunteers, sudden unexplained death, mechanical asphyxia, and carbon monoxide intoxication groups. Significantly increased SP-A levels compared to controls were found in deaths caused by fire, drowning, narcotic abuse, and organophosphate poi-

soning. Similarly, increased SP-D levels were observed in fire, drowning, organophosphate poisoning, and narcotic related deaths, when compared to controls and cases of natural sudden death. A positive correlation was found between the levels of SP-A and SP-D. These results suggest that analysis of serum surfactant proteins may be useful in estimating the intensity of alveolar functional damage at autopsy.

Cause of Death, Autopsy, Surfactant Proteins

G6 Gliomatosis Cerebri as a Cause of Sudden Death in a Young Woman

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After attending this presentation, attendees will be made aware of gliomatosis cerebri as a rare yet potential cause of sudden natural death.

This presentation will impact the forensic community and/or humanity by providing a well-illustrated example of an uncommon disease entity that can be a cause of sudden death that has not heretofore been well described in the forensic science case literature.

This central nervous system (CNS) neoplasm is briefly reviewed, which follows a typical premortem course, demonstrated in this case. The report is richly illustrated with premortem neuroradiographic images, postmortem images of whole and cut brain, and photomicrographs. In particular, the gross and microscopic postmortem findings provide an excellent example of the kind of subtle changes one may encounter in the postmortem neuropathologic evaluation of cases of gliomatosis cerebri. The pathogenesis of sudden death in the context of gliomatosis cerebri is discussed vis-à-vis changes in the permeability of the blood-brain barrier.

Sudden death due to undiagnosed primary intracranial neoplasm is uncommonly encountered by the forensic pathologist. In a recent review [1] of nearly 55,000 autopsies performed over a twenty year period at the Chief Medical Examiner of Maryland, undiagnosed primary CNS tumors comprised 0.02-0.05% of sudden deaths. Glial tumors, particularly astrocytomas and glioblastoma multiforme, were the most frequent tumor types in these cases, and mechanisms of death included seizure, acute hemorrhage, and herniation. In all of the reviewed cases, discrete CNS tumor masses were identified at the time of autopsy.

Gliomatosis cerebri is a rare brain neoplasm characterized macroscopically by enlargement, often subtle, of affected brain regions with preservation of native CNS architecture and absence of a discrete tumor mass. Microscopically, the tumor consists of proliferating malignant glial cells which diffusely infiltrate large areas of the CNS, involving more than two lobes [2], and often involving both supratentorial and infratentorial brain regions. The majority of patients diagnosed with gliomatosis cerebri are relatively young (median age 44 [3]), and experience insidiously progressive symptoms, which can include headaches, alteration of mental status and cognition, dysphasia, visual deficits, hemiparesis, and seizures. Often these cases present significant diagnostic challenges to clinicians, and final diagnoses are not made until postmortem examination. Invariably the mechanism of death in cases of gliomatosis cerebri is compressive sequelae from expanding intracranial mass.

This presentation describes a case of sudden death in a young woman due to previously undiagnosed gliomatosis cerebri. The patient, 40 years old, had a several month history of intermittent headaches that were gradually increasing in frequency and severity. Over this period the patient underwent multiple clinical evaluations, which were unremarkable, apart from nonspecific white matter enhancement and mass effects by magnetic resonance brain imaging. The patient's headaches were effectively controlled with mild analgesia and she remained fully active up until her death. This witnessed event occurred suddenly, shortly after the characteristic onset of episodic headache. General autopsy was unremarkable.

Neuropathologic examination showed changes consistent with acute transtentorial herniation as a mechanism of death. Subtle mass effects and white matter expansion were noted on gross and cut brain examinations. Histologic evaluation revealed malignant glial infiltration diagnostic of gliomatosis cerebri. Immunohistochemical staining of lesion tissue suggests the pathogenesis of sudden death in cases of gliomatosis cerebri may be related to catastrophic failure of the blood-brain barrier vis-à-vis its permeability regulatory function.

References:

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Gliomatosis Cerebri, Tumor, Death

G7 Death in a Confined Space

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After attending this presentation, attendees will understand the pathogenesis of confined-space asphyxia through the study of three forensic cases. Confined-space asphyxia is a quite rare event, caused by a lack of environmental oxygen that becomes inadequate to sustain life. This occurs when individuals find themselves trapped in airtight or relatively airtight enclosure, causing depletion of the oxygen supply and they asphyxiate.

This presentation will impact the forensic community and/or humanity by demonstrating the forensic approach in investigating cases of death due to confined-space asphyxia, thereby avoiding confusing this entity for a natural death.

Asphyxia due to a confined space is a quite rare event, caused by a lack of oxygen that becomes insufficient to allow normal respiration. This happens when a person is trapped in airtight space without exchange of air, as breathing exhausts the available oxygen, beginning the asphyxiation process.

The Department of Health, Education, and Welfare defines a confined space as "a space, which, by design, has limited openings for entry and exit combined with unfavorable natural ventilation." Examples of confined space are caves, refrigerators, tunnels, pipelines, sewers, silos, tanks, pits, mines, trenches, holds, vaults, excavations, manholes, and chimneys. In the past, this kind of accident usually involved people working in building, shipyard, and other manufacturing and service industries. As society changes, the causes and modalities of confined space deaths are different. In fact, the illegal immigration phenomenon and the search of new ways to reach Europe have become one of the main causes of these accidents in these last years. People try to enter a country travelling hidden among the cargo of trucks. If the trip is long and the space is very narrow, the deficiency of oxygen could become serious and fatal for the illegal passengers.

This paper presents two cases, occurring in two different Italian regions, describing the deaths of three men by confined space asphyxia during the travel to reach Italy illegally.

The first report concerns the death of two Kurdish men. They were found in the refrigerator van of a truck, completely loaded with watermelons, coming from Greece by a motor-ship and arrived to the port of Brindisi. The autopsies of the two deceased's did not show any remarkable pathology, and histological and toxicological tests were negative. The most

significant anatomic-pathological findings of the autopsy were cyanosis of the face and fingernails, copious and deep reddish-purple postmortem hypostasis, visceral congestion, brain and lung oedema, conjunctival petechiae (in one of the two corpses) and fragmentation of myocardial fibres. All these findings were compatible with the diagnosis of death by asphyxia and the discovery of the two bodies in the truck trailer. The circumstances of the deaths confirmed that they were due to confined space asphyxia.

The second report regards a stowaway found in a truck trailer near Trieste. When he arrived to the local hospital he was in coma, with cutaneous temperature at 43°C and completely dehydrated. He died after few hours because of progressive deterioration of general health conditions and massive bleeding from his stomach and bronchi.

On basis of all the clinical symptomatology, the results of laboratory tests and review of the medical records, and the external examination, it was established that the death was due to a "heatstroke". This diagnosis was confirmed by the circumstances of the discovery of the body, and the high environmental temperature (about 40°C). Also in this case, the confined space where victim had been in hiding for prolonged time, without any ventilation, had a key role in causing the death. The lack of oxygen in this confined space, and the overheating within the van of the truck became a lethal combination for this man.

These two reports bring to attention the serious problems of clandestine immigration occurring within a confined space. Confined space asphyxia has caused trouble in the past with occupational deaths, and now seems to come back under a different aspect.

The contribution of the medical examiner to these investigations should be to identify the correct cause of death due to confined space asphyxia. As the few and non-specific anatomic-pathological findings of this kind of diagnosis is difficult to determine without history, it is very important to carry out a careful analysis of the circumstances of the death. A correct diagnosis in these types of cases requires scene information coming from an "on-the-spot investigation."

Confined Space Asphyxia, Death Investigation

G8 Primary Hyperoxaluria: A Case Report and Review of the Literature

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The goal of this presentation is to discuss a case of the rare metabolic syndrome primary hyperoxaluria (PH), with a literature review. The attendees will learn about the inherited form of the disease, its systemic manifestations, genetic alterations and the potential mechanisms of death. PH is relevant and important to the medico-legal and public health fields to identify such cases, especially because it can lead to sudden death in affected patients, who are mostly children and young adults.

The presentation will impact the forensic community and/or humanity by identifying and discussing the etiologies of the disease, its renal and extra-renal manifestations, current therapeutic approaches, i.e. combined liver-kidney transplantation, and the common causes of death in these individuals. The entity is a surgical and anatomic/forensic curiosity, with remarkable gross and histological findings.

Primary hyperoxaluria is a rare autosomal recessive metabolic disorder, caused by the deficiency of the liver-specific peroxisomal enzyme, alanine: glyoxalate aminotransferase (AGT). AGT normally converts glyoxalate to glycine, but when absent, results in an increase of the glyoxalate pool, which is converted to oxalate.

This presentation will discuss the clinico-pathologic features, post-mortem gross and microscopic findings of a fatal case of primary hyperoxaluria.

Case Report: The patient MS, a 24-year-old female with end-stage renal disease, presented to *Beth Israel Deaconess Medical Center* institution with gross hematuria of one month duration. She was eight months old when diagnosed with a rare metabolic disorder, Primary Hyperoxaluria (PH). The patient had two failed renal transplants (one in 1981 at eight months of age, and another in 1991). She began hemodialysis in 2000 and continued the treatment until presenting in January 2005, with gross hematuria. A CT scan also revealed a mass in the left renal allograft. Therefore, a nephrectomy was performed, and pathology ruled out post-transplant lymphoproliferative disorder, and revealed chronic allograft nephropathy, with extensive deposition of calcium oxalate crystals. The patient was discharged, with no complications, and returned to the institution one month later for a combined left kidney/liver transplant. Shortly after the procedure, the patient suffered thrombosis of the hepatic artery-aorta conduit, which was repaired the following day. During repair, it was noted that the liver allograft was necrotic *in vivo*, and a liver biopsy showed massive necrosis consistent with ischemic-type injury (left lobe). The patient quickly became hemodynamically unstable, developed supra-ventricular tachycardia, and after attempts at resuscitation had failed, was pronounced dead.

At autopsy, the body was that of a jaundiced female of small build with kyphosis, and a large abdominal surgical wound, covered by mesh. There were many adhesions throughout the peritoneum. The transplanted liver was partially necrotic (40%), and a hemorrhagic infarct was found in the left lower lobe of the lung. The left, newly-allografted kidney was anteriorly placed, and had a dusky hue. The right, previously (1991) transplanted kidney, was significantly atrophic, and could not be identified. The heart (280 gms) revealed no acute or remote infarcts. The abdominal aorta had an intact stent in place.

Histologic findings of the liver revealed necrosis in the majority of the left lobe, and marked bile stasis in the remaining tissue. The heart had abundant polarizable oxalate crystals in the myocardium, with associated fibrosis. The kidney showed pigmented tubular casts, and focal calcium oxalate deposition. The final autopsy diagnosis was death due to thrombosis of the hepatic artery and aortic conduit that led to massive liver necrosis/failure, and hemodynamic instability. Pre-mortem cardiac conduction defects were most likely due to the diffuse deposition of calcium oxalate crystals within the myocardium.

Primary hyperoxaluria (PH) is a rare metabolic disorder due to a functional deficiency of the enzyme alanine:glyoxalate aminotransferase (AGT). There are at least 20 documented mutations in the gene encoding AGT (AGXT), but two mutations are associated with about 30% of the disease alleles in PH. More specifically, these mutations are associated with mitochondrial mistargeting and defective peroxisomal uptake of the AGT protein. Symptoms develop in 15% of children less than one year of age, and by five, 50% of patients are symptomatic. Infants may suffer from chronic renal failure and parenchymal oxalosis, and older children may have symptoms of urolithiasis, or complete ureteral obstruction. The kidney is the primary organ of involvement, since one of its functions is to excrete oxalate. Renal failure ultimately occurs, and subsequently, the oxalate crystals deposit in other organs, such as the heart, bone marrow, and soft tissues (systemic oxalosis). Chronic renal failure (uremia) leads to secondary hyperparathyroidism, which in a growing individual can cause marked skeletal abnormalities. Possible causes of death are end stage renal failure, cardiac conduction deficits, or a multitude of complications from surgical intervention. Combined liver-kidney transplant is the recommended treatment for these patients, along with hemodialysis, maintaining a high urine output, and thiazide diuresis.

In conclusion, in the presented case, the clinical picture and autopsy findings demonstrate a case of primary hyperoxaluria. The disease entity has numerous clinical manifestations, including renal failure and cardiac conduction defects, and has a high-risk management, (combined liver-kidney transplant); all of which can lead to early, sudden death in these mostly young patients.

Primary Hyperoxaluria, Calcium-oxalate Deposition, Combined Liver-Kidney Transplantation

G9 Planned Complex Suicide: Report of Two Cases

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Planned complex suicides usually present a challenge to the forensic pathologist and the police in determining the manner and mechanism of death. After attending this presentation, attendees will learn the importance of a careful evaluation of all elements to reconstruct the lethal chain of events.

This presentation will impact the forensic community and/or humanity by improving knowledge of planned complex suicide in the forensic practice.

Case report: Two cases of planned complex suicide are reported. In the first case (ingestion of sodium hypochlorite bleach with associated razor blade wounds), a 27-year-old unemployed female was found dying in the early hours of the day in the bedroom of her apartment, lying in a pool of blood. Her forearms had been incised at wrist level. A blood stained razor blade was found near the body. Traces of blood were evident on the floor in the hall between bathroom and bedroom. She also presented clinical signs of caustic substance ingestion: the lips were burnt, the interior of the mouth was eroded, and the tongue was swollen. A bleach bottle (hypochlorite bleach, 5.25% sodium hypochlorite, pH 11.4) was found in the bathtub. Upon external examination, numerous recent incised wounds were found on the left forearm, most probably inflicted by the razor blade found near the body. These wounds were parallel and superficial, with deeper wounds appearing on both wrists, which had lead to significant blood loss. Autopsy revealed oral, pharyngeal, esophageal, and gastric mucosal erosions. Stomach contents contained blood and had the smell of bleach. All the internal organs were pale. Toxicologic analysis revealed sodium hypochlorite in gastric contents. Death was ascribed to razor blade wounds followed by ingestion of sodium hypochlorite bleach. In the second case, an 86-year-old man was found dead in the bedroom of his apartment. A blood stained razor blade was found on the bed, next to the left arm. A nylon cord, similar to that used for a clothesline, was found bound tightly around the neck several times. The left arm and chest showed multiple superficial incised wounds. There was marked facial congestion and numerous petechial hemorrhages in the skin of the face. Petechial hemorrhages were also prominent in the conjunctivae and oral mucosa. Numerous, recent cuts were found on the chest. These cuts were superficial and parallel to each other, indicating tentative or hesitation cuts. Numerous (68) recent cuts were found on the left forearm, inflicted by the razor found near the body. Most of them were superficial cuts of sizes ranging from 2.5 to 3 cm. Upon autopsy, recent hecatomb was noted to the muscles of the neck, especially the stern mastoid muscles. The tongue showed a recent hemorrhage. Fresh blood was found in the larynx and trachea. The lung showed mild congestion. Toxicological analysis did not detect any drugs or alcohol. Death was ascribed to asphyxia due to strangulation by ligature with associated razor blade wounds.

Complex Suicide, Razor Wounds

G10 Effect of Toilet Detergent on Morphological Change of Spermatozoa

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After attending this presentation, attendees will be able to identify and appreciate the morphological changes that occur to spermatozoa when exposed to toilet detergent.

This presentation will impact the forensic community and/or humanity by showing how toilet detergent can affect changes in spermatozoa, helping the criminalist determine the length of spermatozoa exposure to the detergent, and providing further assistance in identifying perpetrators of sexual assault.

Human semen is an important specimen in forensic casework. A girl was killed at her own home and found approximately ten days after death. Five persons were suspected as the killer. A condom containing human semen and filled with toilet detergent was found in the toilet chamber pot. Results of DNA identification matched the specimen to one of the suspects. However, the problem was to determine the time when the semen was discarded. For this reason, the following experiment was designed and performed. Human semen samples were collected from fifteen healthy volunteers, and the samples were confirmed to be normal by routine semen examination. The semen samples were mixed in two concentrations of the toilet detergent (0.2 mg/ml and 0.02 mg/ml), or in water as control. All preparations were kept at room temperature and were examined periodically under a microscope. The Oppitz method was used for spermatozoa staining. In the first five days, no definite change in shape of spermatozoa was observed in all the samples. The major change of spermatozoa was separation of the tail and the head, which was clearly observed after ten days under 400 × magnifications. In samples mixed with 0.2 mg/ml solution of toilet detergent, dissociation of the tail and head was observed in approximately 40% of the spermatozoa by ten days, 80% by twenty days, and 98% by thirty days. When mixed with 0.02 mg/ml of toilet detergent, the corresponding proportions were approximately 40%, 70% and 95%, respectively. In the water control, only 25% showed separation by 10 days, and the percentage by 20 and 30 days was similar to 0.02 mg/ml detergent. Increase in bacteria was observed after 20 days. However, when magnification was increased from 400 to 800, approximately 70% of the spermatozoa in toilet detergent solution were found to possess a tail up to 30 days, whereas very few spermatozoa in the water control maintained a tail. The authors find is that after immersed in toilet detergent for a long time, many spermatozoa maintain the head and tail, but the tail becomes thinner and shorter.

Spermatozoa, Toilet Detergent, Morphological Change

G11 An Unusual Death of a Child at the Obstetrician's Office

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After attending this presentation, attendees will be presented with a case of a 13-month-old child who died after his pregnant mother accidentally fell on him while she was at her obstetrician's office. The goal of this presentation is to illustrate the severity of injuries that may result from such a seemingly innocuous event.

This presentation will impact the forensic community and/or humanity by increasing awareness of the potential for fatal injuries in a case where the severity of injuries was in excess of what might have been expected given the history and, had the event not been witnessed, might have been mistaken for child abuse.

A witnessed case of a 13-month-old child whose mother fell on top of him at her obstetrician's office is presented, resulting in severe head injuries that, under different circumstances, might be mistaken for abuse.

A 31-year-old, 5-foot 8inch, 180-pound woman in her 8th month of pregnancy was at her obstetrician's office with her two children, a 3-year-old girl, and a 13-month-old boy. While the woman was being weighed on a scale, the 13-month-old boy walked behind her. Not noticing her child behind her, the woman stepped backward off the scale and onto her child, losing her balance and falling on top of the boy. According to a statement to police, her "tailbone hit her son's head." The height of the scale was 4 inches from the carpeted floor. The event was witnessed by the doctor's nurse; whose statement corroborated that of the mother's and further indicated that the left side of the boy's face was down against the carpet when his mother landed on him.

The boy, who immediately became unresponsive, was taken to the hospital where his Glasgow coma scale on arrival was 4-5 and he was exhibiting decerebrate posturing. Computed tomography scans of the head showed a depressed frontal skull fracture, bilateral subarachnoid hemorrhage (left greater than right), left subdural hematoma (without midline shift), and elevated intracranial pressure. No funduscopic examination was performed. Despite medical intervention, he died the next day and was brought to the Harris County Medical Examiner's Office for autopsy.

At autopsy, external examination revealed diffuse, right-sided scalp hemorrhage and right periorbital ecchymosis. Internally, a gaping 7-1/4" linear skull fracture involved the parietal skull bilaterally, anteriorly extending to and involving the coronal suture. Dura and brain matter herniated through the fracture. Approximately 20 milliliters of subdural hemorrhage were present bilaterally (right greater than left). Bilateral parasagittal subarachnoid hemorrhage and bilateral tonsillar herniation were also present. Coronal sections revealed contusions of the right frontal and parasagittal contusions. No other injuries were noted.

In the United States, an estimated 1,400 deaths due to child neglect and abuse occurred in 2002; of these, 30% were due purely to physical abuse. The majority of pediatric homicides occur within the first two years of life, and the cause of death most commonly involves blunt force injuries to the head or abdomen. Typically, fatal injuries in children do not occur as a result of minor mishaps during ordinary activities of daily living. The discrepancy between the history provided by the caregiver and the severity of the injuries themselves is often the initial indication of abuse. Such stories may describe the decedent rolling off of a bed, falling from the arms of the caregiver, or the caregiver falling while carrying the child. Had the events described in the case above not taken place at the doctor's office and been witnessed, the "discrepancy" between the story and the severity of the injuries sustained by the decedent would likely have raised serious suspicions of child abuse.

Fall, Head Injuries, Child Abuse

G12 Methadone Treatment and Drug Overdose in Geneva, Switzerland, From 1994 to 2003

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After attending this presentation, attendees will learn how lethal methadone intoxications while on methadone treatment are very rare and probably due to a lack of strict medical oversight.

This presentation will impact the forensic community and/or humanity by demonstrating why it is important to collect good information regarding drug and clinical history when considering lethal methadone intoxications. In this study, most of the decedents were not enrolled in methadone programs. Wide access to methadone treatment with good medical oversight does not lead to an increase of lethal methadone intoxications and may be responsible for a large decrease of overall drug intoxication deaths.

This presentation will show that methadone treatment is safe when well controlled medically and that methadone overdoses are in most cases due to diverted methadone. It will extend an earlier study reported in 2000, covering the years 1994 to 1998, showing that in Geneva, the wide access to methadone treatment did not lead to an increase of lethal methadone intoxication and may be responsible for a large decrease of overall drug intoxication deaths.

It is hypothesized that the decrease in the number of lethal drug intoxications that started in 1995 had continued through 2004 because of the wide access to methadone treatment, which provides treatment to most of the heroin addicts in Geneva. In 2000, the estimated number of addicted drug users in Geneva, including users of heroin, cocaine, cannabis, and benzodiazepines was 2500. The number of methadone treated patients in 2005 is 1356 and the new heroin users asking for methadone treatment is dropping steadily. From 1 January 1994 to 31 December 2003, the authors studied systematically all toxicological data from all cases in which methadone and/or morphine was found. Cases were selected on the basis that the only cause of death was a potentially lethal drug concentration in the postmortem blood sample. For each case in which methadone was found, information regarding drug and clinical history was collected from police sources and from the Health Authority for each registered methadone-treated patient.

It was discovered that the drop of lethal drug intoxications starting in 1995 continued until 2003. Methadone lethal intoxications remain stable and low - around five cases per year. Most of them are due to illegally diverted methadone used by a person not in treatment. Cocaine overdoses have increased since 2002. Most of the lethal overdoses have other drugs present in the blood, the commonest being benzodiazepines and alcohol.

In conclusion, methadone treatment has been very successfully implemented in Geneva since the 1970s and has been widely available since the 1990's, with a dramatic decrease of heroin overdoses. This can be explained by the fact that almost all heroin addicts have easy access to treatment. The wide access to methadone treatment has not lead to an increase of lethal methadone intoxications. The lethal methadone intoxications while on methadone treatment are very rare and probably due to a lack of strict medical oversight. It is important to note that most of the decedents were not enrolled in methadone programs.

Methadone, Addiction, Overdose

G13 Pathological Changes Associated With Aortic Valve Stenosis

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After attending this presentation, attendees will understand the pathology of aortic valve stenosis (AVS). Aortic valve stenosis is a cause of sudden cardiac death in older individuals and young athletes.

As such, this poster will impact the forensic community by highlighting major pathological features of degenerative and bicuspid aortic stenosis as well as the underlying pathogenesis of these diseases.

An analysis of the morphological features and pathogenesis of this common heart valve disease will aid pathologists and researchers in understanding its role in sudden death. As the incidence of aortic stenosis increases, the rate of sudden death due to this disease does as well. This presentation will impact the forensic community and/or humanity by assisting in the understanding of the environmental and genetic determinants of its pathogenesis, which will aid those conducting pathological examinations to better understand the underlying features of the morphological changes seen at autopsy.

Aortic valve stenosis is the most common valvular heart disease among adults in the western world, and continues to increase in prevalence as the average lifespan of the population increases. As such, AVS has become a focus of intense investigation at the James Hogg iCAPTURE Centre in Vancouver, British Columbia, Canada.

Aortic valve stenosis may be due to congenital malformation of the valve, rheumatic fusion of commissures, secondary calcification of a congenital bicuspid valve, or primary degenerative calcification of an otherwise normal three cuspid valve. While the exact pathogenesis of AVS is unknown, several genetic and environmental determinants are most likely responsible.

AVS is characterized by narrowing of the aortic valve due to scarring and calcification, changes which create an obstruction to blood flow out of the main pumping chamber of the heart into one's circulation. Symptoms can include chest pain, fainting, or heart failure. If left untreated, the outcome of patients with AVS is poor. Once treated, however, mainly by valve replacement, the patient survival rates and well being greatly improve.

This poster will demonstrate some of the pathological changes associated with aortic valve stenosis with a discussion of its possible pathogenesis.

Aortic Stenosis, Cardiovascular Pathology, Sudden Death

G14 Fatal CO₂ Suicidal Poisoning

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The goal of this presentation is to recognize that the cause and manner of death requires deliberate consideration, even when the circumstances may lead to an initial obvious, but misleading, direction. It is important to consider the case, the crime scene, and the autopsy findings, especially if the death is non-natural.

This presentation will impact the forensic community and/or humanity by demonstrating an interesting case for the forensic pathologist and forensic toxicologist. It is important that these two disciplines work together and to share the findings to go to the truth.

Introduction: The authors describe a case of suicide in a workplace. A 45-year-old man who worked in a vegetable and fruits packaging business was found dead in his workplace. Because of the scene circumstances, analysis of an arterial blood sample taken with an airtight syringe at the scene revealed absence of carbon monoxide but high levels of carbon dioxide (CO₂). Autopsy found no significant injury and police investigators found a handwritten note of intent, describing a recent personal crisis. Therefore the authors concluded that the cause of death in this case was a suicide by carbon dioxide intoxication. This means of suicide is rare, with cases previously described in the literature as accidental carbon dioxide intoxications. This is the first case of suicide by CO₂ intoxication within a closed-space tank in which the atmosphere is modified for the package of fruits and vegetables.

Case report: A 45-year-old male who worked as a packager of vegetables was found dead on the floor in his workplace. The location of the death was a confined room used for packaging vegetables, fruits, and apples. External examination showed no sign of struggle and the victim had no history of psychiatric disorders. The rescue team thought that cause of death could be carbon monoxide intoxication. In the residence of the deceased, police investigators found a handwritten note of self-destructive intent, describing a recent personal crisis.

Autopsy findings: An autopsy was performed by a board-certified forensic pathologist. The external examination of the body was significant for an absence of cherry red lividity, which is normally a good indicator of CO₂ intoxication. Autopsy found no significant injury and no traumatic lesion.

Toxicology: Toxicological analysis was carried out, including blood ethanol levels and screening for common drugs and illegal substances. Surprisingly, carboxyhemoglobin was positive only at 2% saturation. The cause of death was unclear. The forensic pathologists had the idea to perform the quantification of PCO₂ and PO₂ in the arterial blood. An analysis of the airtight arterial peripheral blood sample found an oxygen saturation of 34.1%. The partial arterial CO₂ level was 204 mmHg and the O₂ 38.6 mmHg. The normal range of partial arterial CO₂ extends from 40 to 60 mmHg; the normal range of partial arterial O₂ extends from 95 to 60 mmHg.

The cause of the death was attributed to asphyxiation caused by CO₂ intoxication and especially the depletion of oxygen in the room. The manner of death was determined to be suicide. In spite of a suspected rapid postmortem increase in PCO₂ and because of the context of death, assessment of the PCO₂ level was performed in this case. The results of the PCO₂ were elevated to such a degree, that it was possible to conclude that the cause of death was CO₂ intoxication.

Discussion: the mechanisms of toxicity of CO₂ are discussed. Carbon dioxide is produced when organic material decomposes or ferments. Asphyxiation from CO₂ exposure has occurred in workers entering grain elevators (cereal stocking), the holds of cargo ships, and brewery vats. It occurs accidentally when these spaces are not aerated or ventilated, or when the ventilation system dysfunctions. Sub acute toxicity may be caused by the body's failure to eliminate endogenous CO₂, as it occurs in hypoalveolar ventilation resulting from chronic obstructive pulmonary disease, opioid poisoning, or other causes of respiratory failure. Clinical signs of CO₂ intoxication are presented and compared with the concentration in mmHg found in this case. Other sources of CO₂ exposure are detailed. The most frequently encountered causes of CO₂ intoxications are accidental and occur in the occupational setting. Examples of these types of cases are also presented. Deaths by intentional carbon dioxide intoxication are rare. Generally, such cases are suicide by intentional inhalation of automobile exhaust gases with low carbon monoxide emissions within an enclosed garage.

CO₂, Occupational Suicide, Asphyxiation

G15 Case Report – Sudden Death Due to Cystic Tumor of the Atrioventricular Node

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The goal of this presentation is to show the importance of including cystic tumors of the atrioventricular node as one of the main differential diagnoses in cases of sudden death, especially in the context of congenital heart block with the adjunct of performing a thorough examination of the cardiac conduction system.

This presentation will impact the forensic community and/or humanity by demonstrating how this type of tumor will be missed if routine sections of the AV node are not submitted in cases of sudden death, especially those involving young, healthy individuals, and it should always be considered in cases of sudden death in the context of congenital heart block.

Cystic tumor of the atrioventricular (AV) node is a benign, congenital, cystic mass located at the base of the atria septum in the region of the AV node. Although cystic tumor of the AV node is the most common intracranial tumor causing sudden death it is considered a rare neoplasm with less than 100 cases reported in the literature to date.

A case of a woman in her 30's who was diagnosed as an infant with complete heart block is reported. A permanent pacemaker with epicardial leads was subsequently placed. She functioned normally with the exception of exercise related shortness of breath. She underwent several pacemaker changes throughout her life. She had a very active lifestyle. She was in her usual state of good health when she experienced a sudden witnessed collapse at her workplace. Her initial cardiac rhythm at the scene was pulseless electric activity with appropriate pacemaker discharge. She was pronounced dead at the hospital after unsuccessful resuscitative measures.

At autopsy, examination of the cardiovascular system disclosed a 550-gram heart. The coronary arteries had a normal distribution and were free of atherosclerosis. The pacemaker leads were appropriately positioned. No gross lesions were visible on examination of the cardiac conduction system.

Microscopic examination of the myocardium showed hypertrophic myocytes, focal interstitial fibrosis, and focal contraction band necrosis. Sections from the region of the AV node showed a proliferation of cells forming nests, cysts, and glands of variable size and shape measuring a minimum of one centimeter. The cell population ranged from those resembling transitional cells and those with squamous differentiation to cuboidal cells and clear, sebaceous-appearing cells.

Cystic Tumor of the Atrioventricular (AV) node has been called one of the "smallest tumors causing sudden death." When symptomatic the majority of patients present with complete heart block. The diagnosis of heart block in patients with AV nodal tumors may be made at birth or as late as the ninth decade of life. It has a female predominance. The majority of known cases are diagnosed at autopsy although a few reported cases have been diagnosed during life and treated. Pacemaker is the first line of therapy; however they are not always effective, as seen in this case. Although rare and histologically benign, cystic tumors of the AV node are the most common intracardiac neoplasms causing sudden death. They are located in the AV nodal region because this is an area of embryologic fusion and therefore prone to accidental incorporation of embryologic structures. The mechanism of death is related to its intracardiac location, which can precipitate conductive and hemodynamic abnormalities. Cystic tumors of the AV node are rarely seen grossly, but when visible it is seen as an elevated nodule above the septal leaflet of the tricuspid valve. Most of the time they are first identified microscopically. This lesion is characterized by multiple microcysts, gland like structures, and nests of epithelioid (occasionally squamoid) cells within a fibrous stroma. Previously thought of as a mesothelioma of the AV node, this lesion has since been shown convincingly to represent an endodermal heterotopia.

The tumor will be missed if routine sections of the AV node are not submitted in cases of sudden death, especially those involving young, healthy individuals. It should always be considered in cases of sudden death in the context of congenital heart block and congenital fibrosis of the AV node.

Cystic Tumor of the AV Node, Sudden Death, Heart Block

G16 Sudden Death in a Healthy 37-Year-Old Man While Driving: Spontaneous Dissection of the Posterior Segment of the Right Coronary Artery

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After attending this presentation, attendees will recognize spontaneous coronary artery dissection as a cause of sudden death, and as a discrimination between auto accident injury and natural cause of death. Review of the epidemiologic, gross, and histologic features and characteristics of this rare disorder will be presented to forensic pathologists

This presentation will impact the forensic community and/or humanity by increasing the awareness of the existence, characteristics, gross presentation, and histology of a rare natural disorder which frequently presents with sudden death, and which may complicate deaths in motor vehicle accidents.

A 37-year-old man with no history of heart disease, including no family history, was driving down a state highway when his car ran off the left side of the road, struck a sign, veered across the median across the oncoming traffic lane, and struck a utility pole. There was no attempt to brake, according to witnesses, and no skid marks. No other cars were involved in the accident. The victim was wearing his seat belt and shoulder belt, and the airbag deployed. A witness said the victim showed signs of life after the car came to rest. Emergency medical personnel who reached the scene noted there was no visible injury, but the victim was unresponsive and asystolic, and they believed him dead. Attempted cardiopulmonary resuscitation at the scene and in a local emergency room was unavailing.

At autopsy, the victim measured 68" tall and weighed 198, with a muscular body habitus with no evidence of obesity. External signs of injury were limited to several small bruises on the left side of the shoulder at the base of the neck, consistent with a shoulder harness. There were no xanthomata of the eyelids or elbows. The heart weighed 375 grams, less than five percent of estimated lean body weight; there were no signs of hypertrophy. The renal cortices were smooth. The coronary arteries had normal takeoffs, without atherosclerosis other than proximal fatty streaks. There were no coronary anomalies or previous infarcts. There were no significant internal injuries.

On sectioning of the ventricles, a "red dot" was noted in the epicardial fat over the posterior septum. Examination with a hand-held magnifying glass confirmed hemorrhage both inside and around the posterior septal segment of the right coronary artery. A delicate layer of coronary wall could be seen creating an S-shape between foci of hemorrhage.

On histology, the coronary artery had dissected through the outer plane, and a mixed inflammatory infiltrate including eosinophils surrounded the adventitia, and infiltrated the wall. No other area of the heart or coronaries showed eosinophils. There were no foci of lymphocytic myocarditis. No myocardial scarring, myocyte hypertrophy, or small vessel disease was present.

Dissection of the coronary arteries as a spontaneous event has been well reported in the literature, with an undetermined but possibly

autoimmune etiology. More than two thirds of patients present at autopsy; the remaining third often recover with stenting or thrombolysis. Coronary artery dissection accounts for approximately 0.5% of sudden deaths in patients 30-40 years old. The typical victim is female, of childbearing age, frequently in her thirties, occasionally postpartum. The victims do not have a history of hypertension (or hypertension is present as an unrelated factor). Over 90% of cases that come to autopsy involve the left anterior descending coronary artery. Under the microscope, the dissection plane is in the outer media, unlike the dissection of atherosclerotic arteries. There is a striking infiltrate of eosinophils, lymphocytes, neutrophils, and macrophages in the adventitia. Some believe that the inflammatory infiltrate is secondary to the dissection, and not a vasculitis. There is no time of day, drug, or activity, which is correlated with initiation of the dissection.

Spontaneous or eosinophil-associated dissection of the coronary arteries in males is rare. Men comprise about 15% of the victims of this unusual disorder. The posterior segment of the right coronary artery is the most frequently reported site in men. Researchers were unable to find information that would answer the family's questions as to risks for other family members. The etiology and genetics of spontaneous coronary dissection are unknown. The case is discussed in conjunction with a review of the literature and the sparse information that is available on this rare disorder.

Spontaneous Coronary Artery Dissection, Males, Motor Vehicle Accident

G17 Fibrosis of the Cardiac Conduction System as a Possible Cause of Death in Chronic Cocaine Addicts

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The goal of this presentation is to present a study of the fibrosis of the cardiac conduction system in chronic cocaine addicts.

This presentation will impact the forensic community and/or humanity by demonstrating and emphasizing that the early onset of fibrosis in the cardiac conduction system may explain sudden death in chronic cocaine users and especially whose measured drug levels are relatively low

It is well known that the results of toxicological analyses can be difficult to interpret in drug addicts because of their increased drug tolerance. Thus, the forensic pathologist is occasionally faced with death cases in chronic drug addicts that demonstrate relatively low drug concentrations in their blood. In some cases, autopsy does reveal the anatomic/pathological cause of death, but in other cases no lesion can be found at the macroscopic or microscopic levels.

The goal of the present work is to study fibrosis of the cardiac conduction system in chronic cocaine addicts. Myocardial fibrosis may provide the morphological substrate in certain arrhythmias and may even explain a sudden death. At the same time, a review of the literature shows that the cardiac conduction system is rarely examined in drug addicts, including individuals whose drug consumption is chronic, as revealed by hair analysis.

Materials: The group of cocaine addicts was comprised of 33 cases all known by the police to involve chronic substance abusers. In each case, cocaine was detected in the hair. Hair analysis also revealed that for all cases, cocaine was associated with other illicit drugs, such as opiates, methadone, and amphetamines. In the majority of cases (27), the cause of death was attributed to an overdose. The control group was comprised of 31 cases where death was attributed to trauma, hanging, or a natural cause. No illicit substance was detected in the blood, urine, or hair of the control cases. The age ranged from 21 to 45 years in the drug addict group

(average of 31.6 years) and from 21 to 50 years in the control group (average of 31.7 years).

Methods: Samples were collected at the level of the atrioventricular junction. Slides were stained with haematoxylin-eosin and Masson's trichrome. The extent of fibrosis was determined using a 4-point semi-quantitative scale. Fibrosis assessment was carried out in the following regions of the atrioventricular junction: the atrioventricular node, the penetrating part of the node, the branching bundle and the left and the right bundle branches. In addition, the superior septum was also analysed.

Results: The mean values obtained from the different structures of the conduction system and the superior septum were higher for the group of drug addicts than for the control group.

Statistical analysis: The pair wise comparison population test showed significant differences ($p<0.01$) in the atrioventricular node, in the left bundle branch and in the myocardium of the superior septum.

Conclusion: Fibrosis of the different structures of the conduction system and of the superior septum is a degenerative lesion whose severity increases with age. Early occurrence of fibrosis in drug addicts appears to be linked primarily to chronic cocaine consumption. This is not surprising, as cocaine cardiotoxicity has been known for a number of years. At the same time, the hair analyses conducted in this study show that repetitive cocaine consumption is almost always associated with chronic abuse of other illicit drugs. Thus, one cannot exclude the role played by these other substances in the appearance of fibrosis in the studied cases.

Myocardial fibrosis may cause problems in the cardiac rhythm and even lead to sudden death. Thus, in the context of this study, the early onset of fibrosis in the cardiac conduction system and the superior septum may explain sudden death in chronic drug users whose measured drug levels in the bloodstream are relatively low.

Conduction System, Hair Analysis, Drug Abuse

G18 Fatal Venous Air Embolism in a Postmenopausal Female During Consensual Sexual Intercourse: A Case Report and Review of the Literature

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After attending this presentation, attendees should have an understanding of the varied setting in which venous air embolism can occur and can cause sudden death.

This presentation will impact the forensic community and/or humanity by presenting a case with an unusual cause of sudden death and to review the relevant literature for future reference.

Case Report: A sixty-year-old female had recently begun an infrequent sexual relationship with a younger man. Following sexual intercourse on the day of her death, her partner noted blood on his penis. She denied pain, but stated that she did not feel well and was having some shortness of breath. She then collapsed and expired despite resuscitative measures, which were delayed, as her partner dressed her prior to summoning help.

Autopsy revealed an atrophic vaginal mucosa with a laceration of the right lateral sidewall. Intravenous air was present in the pelvic veins and there was also interstitial emphysema. Aspiration of blood from the coronary sinus revealed frothy blood and air bubbles were present in her epicardial veins.

Methods: Autopsy protocol and investigative findings for this patient are reviewed. The medical literature was searched using the keywords *air embolism*, *venous air embolism*, *sudden death*, and *vaginal laceration* for citations relating to venous air embolism. References from citations found were further reviewed for relevant literature.

Results: Venous air embolism is a well-described phenomenon, associated with neurosurgical procedures in both the seated and prone position, as well as in pelvic procedures ranging from transurethral prostate resection to hysteroscopy. It has also been reported to occur in the pregnant women following vaginal insufflation and intercourse, in non-pregnant women following intercourse and autoerotic manipulation. Cranial blunt injuries may result in air embolism. Cases related to central venous catheter use, percutaneous lithotripsy, endoscopy and intraoperative hydrogen peroxide irrigation have also been reported.

Conclusions: Venous air embolism is an unusual cause of sudden and unexpected death and this report documents the first case of this phenomenon occurring in the setting of a vaginal laceration resulting from consensual sexual intercourse in a post-menopausal woman.

Air Embolism, Vaginal Laceration, Sudden Death

G19 Incidence of Laryngeal and Hyoid Fractures in Hangings and Strangulations Using Enhanced Examination Procedures

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After attending this presentation, attendees will understand that enhanced examination of the larynx and hyoid will reveal subtle injuries of bony and cartilaginous structures that might otherwise not be found

The rate of injury of the larynx and hyoid is significantly higher when examination of these structures is enhanced by high-resolution radiography and maceration and removal of soft tissues followed by macroscopic examination. This presentation will impact the forensic community and/or humanity by demonstrating how these simple and inexpensive procedures can reveal subtle injuries of bone and cartilage that otherwise might not be seen and complete the forensic examination of the neck in cases of known or suspected strangulation, hanging or other neck injury.

Between 1996 and 2005 the examination of the larynx and hyoid in cases of suspected or known neck injury was enhanced by the following methodologies:

1. Visual inspection and palpation of the larynx and hyoid at autopsy, in situ and after en bloc resection and limited dissection of soft tissues
2. High-resolution radiography of the fresh en bloc specimen utilizing mammography film
3. Maceration of soft tissue in water with removal of residual tissue and macroscopic visual inspection of laryngeal and hyoid bone and cartilage

The sample consists of 105 individuals who died of hanging or strangulation or suspected strangulation between 1996 and 2005. The sample population contains 52 males and 53 females with an age range of 8 to 81 years (mean of 36.32 years). For analytical purposes the ages were divided into decades: the first decade and the ninth decade each represented by one individual; the second through eighth decades ranged from four individuals (eighth decade) to 31 individuals (third decade). The ancestry of the sample was 62% European, 18% African, 18% Hispanic, and 2% Asian.

Examined were 62 hangings, 20 manual strangulations, 10 ligature strangulations and 13 strangulations not otherwise specified (mechanism unknown or evidence of arm lock or combination of manual and ligature). Sixty-one hangings were ruled suicide or consistent with suicide, one 15-year-old was ruled accidental and was consistent with autoerotic asphyxiation - this was the only hanging where padding was included with the ligature. The strangulations cases were all ruled homicide.

Of the hanging cases (N=62), 19.4% had hyoid fracture and 48.4% had thyroid fracture. Of cases of ligature strangulation (N=10), 20% had hyoid fracture and 40% had thyroid fracture. Of cases of manual strangulation (N=20), 45% had hyoid fracture and 50% had thyroid fracture. In cases of strangulation, not otherwise specified (N=13), 7.7% had hyoid fracture and 46.2% had thyroid fracture.

The most commonly fractured sites in the hyoid were the midshaft of the greater cornu either unilaterally (18.5% for left side, 25.9% right side) or bilaterally, 18.5%. This agrees with findings on a much smaller sample by Pollanen et al (1995). The most commonly fractured sites in the thyroid cartilage were bilateral fractures of the left and right superior cornua (32%), left superior cornu unilaterally (24%) or right superior cornu unilaterally (30%). The most common location for the superior cornu fracture was at its juncture with the lamina (18% left; 16% right). Ubelaker's review of the literature (1992) cites a cohesive fracture rate of 8% hyoid fractures and 15% thyroid fractures in hangings, 11% fractures hyoid and 32% fractures thyroid in ligature strangulations, and 34% hyoid and thyroid fractures in manual strangulations.

The data of the group support earlier contention that the supple nature of these structures in children and young adults does not lend them to easy fracture (O'Halloran & Lundy, 1987; Pollanen & Chiasson, 1996). The earliest age of hyoid fracture in this series occurs in the third decade with 19% fractured, all in the mid-portions of the greater cornua. The fourth through seventh decades show fracture rates varying between 14 to 26%. In the eighth and ninth decades the fracture rates are 100%; however this number is based on a total of five individuals. The earliest age of thyroid cartilage fracture is the second decade with one 18-year-old individual with a fracture of the left superior cornu at the base. Fracture rates of the thyroid cartilage range from 32% to 70% in the third through seventh decades and are at 80% in combined eighth and ninth decades.

In cases where ligature type is known for hangings and ligature strangulations, the frequency of fracture type with ligature type was detailed. Cord type ligatures, which included ropes, electrical cords, telephone cords, shoelaces, and other small diameter strings, resulted in 22% hyoid and 44% thyroid fractures. Strap type ligatures, which included cargo straps and belts, resulted in 12% hyoid fractures and 53% thyroid fractures. Fabric type ligatures, which included clothing such as t-shirts, sheets, curtains and neckties, resulted in 18% hyoid fractures and 45% thyroid fractures. In three cases where the ligature was not recovered at the scene, all had hyoid fractures and 2 out of 3 had thyroid fractures.

References:

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Larynx, Hyoid, Examinations

G20 Agonal Sequences in a Filmed Suicidal Hanging: Analysis of Respiratory and Movement Responses to Asphyxia by Hanging

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After attending this presentation, attendees will gain a better understanding of the physiological responses of asphyxia by hanging.

This presentation will impact the forensic community and/or humanity by demonstrating a unique case that will allow a better understanding of the respiratory and movement responses of asphyxia by hanging.

The goal of this presentation is to first review the literature of physiological responses to asphyxia by hanging in humans and animals, and to compare such data to a unique case of suicide by hanging that was recorded by a video-camera.

There is just one report in the literature of an analysis of agonal movement sequences in hanging, published in 1989 in German. In this case, a man recorded his autoerotic hanging with a video camera and died accidentally. Except for this foreign language case, there is very few data on human hanging. A few experimental studies have been conducted on dogs, but the application of those results to human hanging is limited. Of course, there are witnessed reports of judicial execution hangings, but those are very different in nature from typical hanging, since death is caused mostly by fracture-dislocation of the upper cervical vertebrae with transaction of the spinal cord, rather than asphyxia by neck structure compression.

A case of a 37-year-old man who filmed his hanging suicide is presented. The man tied a padded rope to his neck and fixed the other end on the rail system of an electric garage door. He used the remote control to close the door, therefore hanging himself. His feet were fixed in ski boots, tied with chains to a metal platform. A camera was previously set to film his suicide. This film allows a unique analysis of agonal movement sequences.

Before the final hanging, the man first hesitated for 23 seconds, testing the door by moving it up and down with the remote control. Then, he finally closed the door and hanged himself.

Considering the time of hanging to be time 0, the agonal sequences consisted of the following: loss of consciousness (thirteen seconds), convulsions (fifteen seconds), decortication rigidity (twenty-one seconds), decerebration rigidity (forty-six seconds), second decortication rigidity (one minute eleven seconds), loss of muscle tone with a few isolated muscle movements (one minute thirty-eight seconds) and last isolated muscle movement (four minutes ten seconds).

Twenty-one seconds after hanging, the body presented decortication rigidity, with extension of trunk and lower limbs combined with upper-limb flexion. This pattern of rigidity is caused by cerebral cortex impairment. Twenty-five seconds later, the body suddenly moved from this pattern of rigidity to decerebrate rigidity, with full extension of both upper and lower limbs. Mesencephalon impairment causes this rigidity pattern and is generally accompanied by irreversible coma and unstable vital signs.

The amplitude of movement during the initial convulsions, as well as during the rigidity pattern changes, explains the minor traumatic lesions often seen in hanging in closed areas, such as a wardrobe.

The hanging in the present case does not seem to completely occlude the airway and respiratory movements are well seen in the film. Twenty-seconds after the hanging, very deep respiratory attempts with rhythmic respiratory chest and abdominal muscle contraction started. The respiration was loud and wheezing. At one minute eleven seconds, abundant saliva freely flowed from the mouth. Respiratory movements progressively decreased and completely stopped at two minutes.

This case confirmed the well-known occurrence of rapid loss of consciousness within seconds. Moreover, it gives a unique opportunity to study the agonal movement sequences in hanging.

Asphyxia, Hanging, Forensic Pathology

G21 Visual Misidentifications of Human Remains: Lessons Learned

Joyce L. deJong, DO, Sparrow Hospital, 1215 East Michigan Avenue, Lansing, MI 48909-7980*

After attending this presentation, attendees will learn of two visual misidentifications made by parents after the death of their sons.

This presentation will impact the forensic community and/or humanity by examining the procedures followed after one of the parents alerted officials of the possible misidentification and suggests (1) methods to avoid visual misidentifications, and (2) measures to routinely follow to respond to claims of bodies being "mixed-up" in the morgue.

Misidentifications are often reported by the general media and rarely presented formally in the forensic science literature. This presentation will impact the forensic community and/or humanity by assisting the forensic community by pointing out the situations that most commonly result in misidentifications, the steps needed to prevent the misidentifications, and other measures to take to address where the misidentification occurred.

An automobile driven by a drunk driver, struck two 14-year-old white males, Child A and Child B, as they walked home from a skateboarding park. The mother of one of the boys (Mother A) "claimed" Child A as her son at the scene and rode to the hospital in the ambulance with the child. A second ambulance transported Child B. Child B died in the emergency department; "Mother B" and her husband arrived at the emergency department after Child B died and claimed him as their son. Child A died hours later in the pediatric intensive care unit with his parents and many others in attendance at his bed. An autopsy performed the following day on both of the boys showed the cause of both deaths to be multiple injuries due to pedestrian struck by a motor vehicle. Both children had severe head injuries. Photographs and fingerprints were obtained during the autopsy. Close family members viewed the body of Child A at the funeral home and then had him buried at a local cemetery. The family who claimed Child B had him cremated after an open-casket visitation and funeral. During the open-casket visitation, many students from the school the boys attended strongly voiced their opinion that the boy in the casket was Child A and not Child B. The parents denied the claims of the visiting children and the funeral directors believed the parents.

About one year later, Mother A reported that she believed she had claimed the wrong child; her opinion developed after reading the autopsy reports and recognizing the report with her son's name described the other child and vice versa. Mother A had antemortem fingerprints available for comparison with the two sets of postmortem fingerprints obtained at the autopsy; the prints matched the postmortem prints of Child B. Child A was exhumed and antemortem dental records were obtained for both children. The forensic odontologist compared the two sets of antemortem dental records to the exhumed remains of Child A; the odontologist was blinded as to the identity of the antemortem records. The antemortem records provided by Mother B matched the postmortem dental features of Child A. By both fingerprint and dental record comparison it was determined that Child A was the child of Mother B and Child B was the child of Mother A. In one photograph of Child B, the name of the child is clearly visible on the hospital identification band with the associated autopsy case number indicating the bodies were not mixed up in the morgue after being banded in the hospital. The parents visually misidentified the children.

Lessons learned from this case are multiple and include: (1) Visual identifications are not always accurate – even parents can claim the wrong individual as their child. (2) Incidents involving victims of the same sex, race, and approximately the same age, should be identified using a biological method such as fingerprints, dental record comparison, medical X-ray comparison, or DNA. (3) Photographs of all identifying tags with the autopsy case number clearly visible should be routinely obtained.

Human Identification, Forensic Science, Exhumation

G22 Identifying Corpses of Foreigners in the State of Advanced Decomposition: Sri Lanka After the Tsunami 2004

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After attending this presentation, attendees will gain an understanding of disaster victim identification under difficult conditions.

This presentation will impact the forensic community and/or humanity by assisting the forensic community in understanding the necessity of cooperation of different nations and individual specialists concerning mass disaster victim identification under difficult conditions (e.g. foreign country, different mentality, and multinational victims advanced decomposition)

After the tsunami numerous tourists were reported missing in Sri Lanka. Main objectives of the German disaster victim identification (DVI)-team were sustaining a general survey of the circumstances and to achieve actual dates concerning foreign victims, German citizens in particular, and to proceed with their identification. Exceptional conditions consisted in a relatively small percentage of multinational foreigners among a vast amount of local disaster victims and in the enormous area where the deceased were disseminated. Extensive search operations revealed that dead bodies of presumptive foreigners were located in hospitals, funeral parlours, swamps, or provisional graves. Lead-managed by local authorities, exhumations could be performed. Major challenges consisted of advanced decomposition, and some of the bodies were almost skeletonized by feeding defects. Moreover several bodies had been embalmed with formaldehyde. Pre-screening for an assumable foreign nationality was performed on the grounds of clothing, items carried along by the victims and dental work. The final identifications by multinational DVI-teams were mainly based on dental findings and results of DNA-examination performed in Austria. Targeted police investigations also revealed that numerous people were alive either in Germany or still in Sri Lanka.

At February 25th, 2005, the mission was completed successfully and no more German citizen was reported missing in Sri Lanka. It has to be emphasized that the complaisant support of the local authorities and the notable obligation of each individual specialist appointed by different nations, comparably contributed to the successful and effective completion of this complex and exceptional task.

Identification, Mass Disaster, Tsunami

G23 Mass Disaster Victim Identification: The Tsunami Disaster

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After attending this presentation, the attendee will understand how to organize, implement, and utilize the Interpol Disaster Victim Identification Protocol in mass disaster. Attendees will learn the various identification techniques used in the tsunami disaster in Thailand.

This presentation will impact the forensic community and/or humanity by demonstrating the importance of an organized approach to victim identification in mass disasters.

The Interpol Disaster Victim Identification Protocol has frequently been utilized in mass disasters like earthquakes, fires, and hurricanes however, never in a tsunami. The victim identification process in Thailand was challenging due to multiple factors including, rapid decomposition of bodies due to heat, significant number of foreigners, unprecedented number of victims, and lack of prior fingerprint and dental records. The death toll in Thailand included over 5,395 persons (1,953 foreigners) dead and 2,932 (909 foreigners) missing.

Three sites were established in Southern Thailand for the processing of victims, two in Khao Lak, Thailand, and one in Krabi, Thailand. Victims were then identified as either Thai or foreigner. All foreigners were processed by the International Disaster Victim Identification (DVI) Team while all Thais were processed by the Thai Victim Identification Team. Utilizing the Interpol Disaster Victim Identification Protocol, bodies were numbered and photographed. Forensic pathologists examined victims noting birthmarks, tattoos, scars, jewelry, clothing, height, weight, and other distinguishing characteristics. Due to the tropical environment and lack of initial refrigeration, many bodies rapidly decomposed before a forensic pathologist could examine the victim. Dentition was photographed and documented by forensic dentists for comparison to prior dental records. If possible, fingerprints were obtained from victims and recorded in the Automated Fingerprint Identification System (AFIS). In a few countries, fingerprints are part of the national ID card however, in most cases, anti-mortem fingerprints were difficult to obtain. Molar teeth and femur DNA samples were obtained for DNA profiling. According to the Interpol protocol, victims can be identified utilizing four methods: 1) Dental Records 2) Fingerprints 3) DNA 4) Property. All post-mortem information was forwarded to the Thai Tsunami Victim Identification Information Management Center (TTVI-IMC) and entered into a database.

Concurrently, embassy officials were obtaining anti-mortem records such as DNA, fingerprint, dental, clothing, and victim characteristics from victim's families around the world. The international scope of the disaster initially limited victim identification due to the logistics involved in obtaining dental and fingerprint records.

All anti-mortem information is entered into a database and cross-matched with postmortem information utilizing PLASDATA, a software database program. Of the 721 victims at the Krabi site, 560 (77.6%) were identified. 357 (63.8%) were of Thai nationality and 203 (36.3%) were foreign citizens. Utilizing property, location, and distinguishing physical characteristics identified 511 victims (91.3%). Dental records identified 49 victims (8.8%), primarily foreign citizens. DNA and fingerprints did not identify any of the victims.

At the Krabi site, identification of Thai nationals proved more successful than foreign citizens for multiple reasons. Family members physically identified Thai victims through clothing, property, and tattoos prior to body decomposition. Dental records, fingerprints, and DNA were rarely used for Thai victims. Foreign citizens were identified through property, clothing, and dental records. To date, DNA has not proven effective for Thai victim identification.

The Interpol Disaster Victim Identification System can be utilized in tsunami disasters where resources, technology, and personnel may be limited and multiple nationalities are involved.

Mass Disaster, Victim Identification, Tsunami

G24 Victim Trauma as an Identification Tool in Mass Disasters

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After attending this presentation, attendees will learn that it is important to consider the victim's injuries in relation to his location at the time of a Mass Disaster. This relationship is the basis of further identification procedures.

This presentation will impact the forensic community and/or humanity by demonstrating the need to reinforce its commitment to finance full identification procedures. There is a need to employ Forensic Science officers capable of implementing a full identification program.

Ipsa facta, "Mass Disasters" involve large numbers of victims. In the Medical Legal field, dealing with such disasters includes the identification of victims of trauma in a very wide variety of circumstances. In addition to enabling families of the victims to learn the fate of their loved ones, results of identification procedures are made available for use by law enforcement agencies.

The final identification of the victim is usually confirmed by his/her DNA profile, and /or by examination of the dentition of the victim after experiencing the trauma. This identification process is greatly simplified if the victim's pre-trauma identification characteristics can be located in existing database of DNA or dental records for comparison purposes.

Difficulties are encountered when no such pre-trauma records of a particular victim can be located and the identification procedure needs to start ab initio. The aim is to attempt to determine the probable identity of a particular individual by a compilation of data such as details of where the individual was found, the trauma suffered and anthropological features, [gender, age, height and race], for comparison with DNA profiles and/or dental records of known missing persons. The DNA profile of a particular individual can be determined from the DNA profiles of parents or children. The dental history of an individual obtained from dental records kept by dentists can also be used in identification. Other indications may be obtained from tattoo marks or moles and in some cases implants such as pacemakers (with serial numbers), artificial joints, and the like.

Victims may be found in collapsed buildings following natural disasters such as tidal waves, severe flooding, hurricanes or earthquakes as well as due to human action. Human action can include direct injury as well as building collapse due to defective building design or construction or terror explosions.

Accidents involving road transport, aircraft and maritime vessels can cause large numbers of victims. The injury to each victim is largely determined by his location in relation to the area of the damage caused by the disaster. Traumatic injuries inflicted on a group of individuals, who were in close proximity to one another at the time of the disaster, will cause similar pathological changes in each member of the group. Different types of injury may often be associated with different locations at the scene of the incident e.g. injuries to passengers in the rear of an aircraft are likely to be different than those in front seats which are closer to burning fuel. Consequently, careful examination of the nature of the traumatic injury may in some cases enable the investigator to establish where an individual victim had been located at the time the incident occurred and therefore narrow the possible identities to persons who were known to be in that particular locality, e.g. from passenger seating lists or lists of occupants of rooms in a hotel.

If the identities of individual members of the group are known from records compiled before the disaster, the DNA profile comparison search is limited to a much smaller number of individuals and the identities of indi-

vidual members of the group can be established more readily. (e.g. aircraft passenger lists or wedding invitation lists). The identification procedure is obviously much more complex when diverse crowds in public places are involved.

Injuries can be due to crushing, fire, gas or smoke inhalation, blast effects in explosions, penetration of primary or secondary missiles, laceration of soft tissue and the effects of bio-chemical agents. Examples will be shown to illustrate the various injuries and their relevance.

Victim, Location, Identification

G25 Differential Diagnosis: Antemortem vs. Postmortem Bone Trauma

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The goal of this presentation is to evaluate the difficulties in differentiation between antemortem and postmortem bone trauma in human skeletal remains

This presentation will impact the forensic community and/or humanity by demonstrating how antemortem - postmortem bone trauma is always challenging for the forensic pathologists who have to deal with predominantly skeletonised remains. This presentation will have an impact on forensic sciences by demonstrating a way of judging bone trauma on skeletonised remains.

Four years of the war in Bosnia and Herzegovina from 1992 to 1995 has left more than 30,000 missing persons, most of whom are presumed dead. Until now, between 14,000 and 16,000 sets of human remains have been exhumed from numerous single or mass graves in burials, wells, septic tanks and caverns, or as bodies simply left unburied in fields, meadows and forests. The majority of the remains were completely skeletonized, but occasionally they were saponified or mummified.

Variable burial conditions and variable decomposition of the remains caused deterioration and injuries to the bones. Also, the transfer of the remains from primary to secondary, or even tertiary, mass graves, and the different techniques used during the exhumation process, caused postmortem injuries to the bones.

Postmortem examination of the remains to determinate antemortem injuries revealed a considerable amount of additional postmortem damage.

Assessment of antemortem injuries is not only important in the legal process in order to determine cause and manner of death, but it is also helpful in the identification process, when considering antemortem information obtained from family members or witnesses about injuries sustained.

Cases from the authors' work on exhumed skeletal remains, discuss the injuries seen, and consider potential causes will be presented (in particular, consideration will be given to):

- cases with clear signs of antemortem trauma to the bones
- cases with clear signs of postmortem trauma to the bones
- cases with postmortem injury possibly due to the influence of the saponification process during the decomposition
- cases in which it is not possible to determinate whether the trauma is antemortem or postmortem

Forensic Pathology, Skeletal Remains, Bone Trauma

G26 Personal Identification by Morphometric Analyses of Retinal Vascular Pattern

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The goal of this presentation is to report the results of a biometric personal identification study conducted by comparing retinography samples obtained from different subjects

This presentation will impact the forensic community and/or humanity by demonstrating an interesting approach for personal identification for security environments

MATERIALS AND METHOD: A new method for personal identification by morphometric analysis of the retinal vascular pattern is presented.

In collaboration with the Ophthalmology Clinic of Bari University Hospital, two sets of color images of the right retinal fundus were acquired at two different times in 68 subjects, after instillation of mydriatic and using computerized fluorangiography. The system consists of a scanning laser camera connected to a computer, color monitor and operative software. This system enables acquisition of Megaplus 1.6 resolution images with 1534x1024 pixels that are immediately digitalized and stored on hard disk.

After making a quality selection of the images, they were submitted to morphometric analysis at the Electrotechnical and Electronics Department of Bari Polytechnic, using dedicated software.

Following the operative protocol, 5 reference points of the retinal vascular tree were identified: the origin of the superior temporal artery, the first bifurcation of the superior temporal artery, the origin of the superior temporal vein, the first bifurcation of the inferior temporal artery and the origin of the inferior temporal vein. These points were individuated and marked by the software on each image of the retinal tree. The program then automatically supplies the values for the absolute distances, the relative distances excluding reciprocals, the perimeter values and the areas of the triangles obtained by joining the points, as well as the independent variable consisting of the differences, albeit minimal, between similar irregular figures. Five numerical sets were thus obtained for each image. Statistical comparison was made of the sets by linear regression, determining the correlation coefficient. Cross-analysis was made of each of the five numerical sets obtained from the 136 images (68 patients x 2), yielding 23120 comparisons (5 X 68 X 68) for heterologous correlations and 340 comparisons for homologous correlations (5 x 68).

RESULTS: Analyses showed that the *independent variable* and the *areas of the triangles* did not serve for identification purposes due to overlapping, the maximum values for the correlation coefficient in the heterologous comparisons being in the same range as those for the homologous comparisons in over 60% of the samples.

Instead, cross comparison of the correlation coefficients for the sets of *absolute distances*, *relative distances* and the *perimeters of the triangles* showed that they could potentially be useful, possibly in association with other analyses, for identification purposes.

There was no overlapping between the coefficients for the *absolute distances*, which yielded separate, distant dispersion curves for homologous and heterologous comparisons. Similarly, there was no overlapping for the triangle perimeters, which provided separate, albeit close clusters, for the correlation coefficients. There was only 1% overlap for the correlation coefficients for the *relative distances* (46 false positives/4620 comparisons).

The numerical results were:

- The correlation coefficient for autocorrelations for the *absolute distances* was between 0.999 and 0.992

- The correlation coefficient for heterocorrelations for the *absolute distances* was between 0.991 and 0.566
- The correlation coefficient for autocorrelations for the *triangle perimeters* was between 0.999 and 0.99299
- The correlation coefficient for heterocorrelations for the *triangle perimeters* was between 0.99293 and 0.56651
- The correlation coefficient for autocorrelations for the *relative distances* was between 0.99995 and 0.97876
- The correlation coefficient for heterocorrelations for the *relative distances* was between 0.99248 and 0.92452

Our results indicate that:

- The section point for the output of comparison of the *absolute distances* is 0.992; higher correlation coefficients indicate certain identification and lower values certain exclusion.
- The section point for the output of comparison of the *triangle perimeters* is 0.99299; higher correlation coefficients indicate certain identification and lower values certain exclusion.
- The section point for the output of comparison of the *relative distances* is 0.97876; higher correlation coefficients indicate positive identification, with a 1% risk of false positives.

Finally, it should be noted that the cases yielding false positives for comparison of the *relative distances* presented very negative values for the correlation coefficients of the *absolute distances* and the *triangle perimeters*. Thus, interpolating the results, it can be concluded that if comparison of the two retinal maps yields a higher correlation coefficient than the minimum threshold for autocorrelation of the absolute distances, relative distances and triangle perimeters, there is certain identification.

The method is currently being patented.

Biometric, Personal Identification, Retinal Vascular Pattern

G27 Laryngeal Nerve Iatrogenic Lesions

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After attending this presentation, attendees will deepen their understanding of the surgical practices most likely responsible for damage concerning the lower laryngeal nerve. For this reason, the authors examined the surgical operating procedures that more frequently involve this nerve. Therefore, thanks to the study of the specific international bibliography, procedures have been highlighted which must be carried out, in order to avoid this complication.

This presentation will impact the forensic community and/or humanity by studying the circumstances surrounding medical malpractice concerning laryngeal nerve lesions.

The aim of this work is to highlight the surgical practices mostly responsible for damages concerning the lower laryngeal nerve. Iatrogenic lesions of the recurrent laryngeal nerve have always been one of the most serious and frequent complications in the field of the thyroid surgery. During a thyroid operation, according to the medical literature, the complication rate ranges from 0.3 to 4%, but can range up to 17% with an operation concerning a thyroid neoplasia relapse. The lower laryngeal nerve iatrogenic lesions are supported by documentary literature in the field of the thoracic surgery, especially in the surgical literature on heart surgery.

Studying the most specific reliable and recent bibliographical sources, one can learn of the different factors which cause the onset of lower laryngeal nerve lesions, so they can be identified in a timely manner, in order to prove any possible medical mistake that has occurred.

An essential role is played in this case by the fundamental features of the main pathology of recurrent laryngeal nerve damage. In particular, it depends on whether the pathology concerns primarily the nerve itself (traumatic, toxic/infectious, auto-immune, etc) or is the nerve just secondarily involved by another pathological process (thyroid and laryngeal pathologies, aortic and carotid aneurysm, pulmonary neoplasia, dilatation

of the left atrium in the mitrals, mediastinum lymph node disease, cervical adenopathy, etc). Other factors that need to be considered in a case of alleged medical responsibility are the different surgical operating procedures carried out, especially the nerve isolation techniques, which is the main step during an operation concerning frames adjoining the nerve itself.

With regard to this study, the authors found a greater number of recurrent nerve lesions occurring during a surgical operation due to thyroid pathologies and malignant neoplasia behind the breastbone that are particularly widespread. In fact, statistical data shows a higher risk of iatrogenic damage during more drastic operations, such as with a total or subtotal thyroidectomy or after a second operation in the same location. By observing and analyzing six cases of recurrent nerve paralysis, and after a review of the pertinent literature, this study attempts to underscore the medico-legal difficulty in assessing the nerve damage, or identifying the professional responsibility in causing the damage. The examination of these cases showed a sharp preponderance of mistakes made by the surgeon. Among the above-mentioned cases under examination, four cases out of six concerned people undergoing an operation for thyroidectomy (total or subtotal), one case of laryngectomy, and one of aortic replacement in a patient affected by an aortic dissecting aneurysm. The second step of the analysis of the medical practice showed a relevant number of mistakes concerning a non-isolation of the lower laryngeal nerve during the surgical operation, even though there are many intraoperative techniques able to highlight the nerve frames at issue, and preserve them properly. Medico-legal experts consider this negligent practice, able to identify these mistakes made by doctors implicated in a similar situation, as a result of not keeping to the therapeutic protocols in the specific literature.

Among six cases of phonatory deficiency under examination, four cases have been closed with the admission of the surgeon's responsibility, while in the other two cases any responsibility has been excluded. One case involved the surgical repair of an aortic aneurysm, and it was considered more important to save the patient's life than preserve his nerve. In the other case, the damage was linked to the post-operative behavior of the patient himself.

Laryngeal Nerve, Medical Malpractice, Medical Liability

G28 Electrocution by Arcing: A Non Fatal Case Study

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The goal of this presentation is to report an unusual case of electrocution by "arcing" from overhead high-voltage power lines.

This presentation will impact the forensic community and humanity in general, as it provides information about a case of accidental electrocution during working activities that occurred due to dielectric breakdown, so that the current from a high-tension overhead cable (30000V) ran down an aluminium pole grasped by a farmer who was thrashing an olive tree.

An ancient rural tradition is called "battitura", whereby farmers in South Italy thrash the branches of the olive trees with a pole or stick, causing the olives to drop into sheets placed under the trees. This is a case of a 25-year-old Caucasian male, who suddenly collapsed while he was thrashing an olive tree in front of him, using an aluminium pole 2 metres long. The olive tree was dangerously situated underneath (but at no less than 7 meters distance) a high-voltage power cable. These cables transmit very high voltages (30000-60000V) and in Italy they are built at least 10 metres above ground level, thus it should not be possible to come in contact with the power lines. The patient underwent loss of consciousness and bleeding from the mouth. He was taken to the ER where, on examination for injuries, he was found to have "electrical burns" with peculiar pits on the hands and on the soles of the feet. He developed cardiac arrhythmia with high levels of CPK and CK, requiring electrical defibrillation. Dental

radiography and CT scan demonstrated fractures of the mandibular symphysis and condyles, along with the left tubercle of the upper jaw, with no evidence of external wounds. Many teeth were injured, with avulsion of the first and second incisors of the upper right jaw (11, 12), the first incisor of the upper left jaw (21), the second pre-molar of the lower right jaw (45), coronal fractures of the first pre-molar of the upper right jaw (14), the second molar of the lower left jaw (37), and the first pre-molar of the lower right jaw (44). At the moment of electrocution, the worker was wearing shoes that were sold as safety footwear, and inspection revealed characteristic burn defects on the sole, which corresponded to the electrical burns of the feet. Therefore, the safety shoes did not prove effective.

A review of the literature reveals few data or case reports specifically addressing the issue of electrocution by arcing, with no direct contact with the wire, especially at so great a distance between the energy source and the victim. In this case the farmer was standing vertically below the power lines in front of the olive tree, grasping the aluminium pole. There was a gap of about 6-7 metres from the upper end of the pole to the high-voltage power lines. It has been reported that a sparking gap larger than 50 cm is sufficient to transmit a voltage of about 30-40000V. However, in the reported case there were behavioral and environmental factors, equally distributed, that can explain the near fatal accident. Firstly, in high voltage accidents it is known that direct contact with the wire is not necessary because when the body is near the voltage lines an electric arc may jump from the lines to the body. Moreover, the resistance opposed by the skin and the air has an important role in electrical conduction. In particular, the humid weather present at the time of the farmer's electrocution, a cloudy and drizzling morning at the end of November, boosted the electric current discharge. Another important environmental factor is the part played by the tree, known to be an excellent energy conductor, which in this case was growing just beneath the cable. This situation allowed the accumulation of energy on every branch, thus representing a potential risk of electrocution in itself. In addition, there were some behavioral aspects to be considered. The tool used by the victim for thrashing is ideal for the conduction of electric power. Aluminium or graphite, used in staff or pole manufacture, both have superconductor qualities. The current flowing from the metal staff through the hands would probably not have been able to electrocute the farmer if he had been wearing good quality safety shoes. Finally, the great human error was that of working under a tree situated so close beneath the high voltage power lines. This is commonly a great hazard for workers, especially those in industrial fields, as this is one of the most common reasons for accidents at the workplace in Italy. Each one of the above described factors likely contributed to dielectric breakdown and conduction of the current from the high voltage power lines to the end of the metal staff and then through the farmer's body. Identification of all behavioral and environmental causative factors may lead to future adjustments in design, to reduce the risk of electrocution in working environments. Photographic documentation illustrates the results of the case investigation.

Electrocution, Arcing, Accident at Work

G29 Abrasion or Gunshot Wound? The Primary Role of Forensic Pathologist

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After attending this presentation, attendees will learn about two cases of gunshot injuries that were undiagnosed by the physicians in the ER, posing a great risk of compromising both the victims' health and the Police investigations.

This presentation will impact the forensic community and/or humanity by illustrating the primary role of the forensic pathologist even in the ER, to prevent misdiagnosis of atypical lesions, especially when caused by unconventional firearms.

Although the effects of firearms on the human body are well known, in some circumstances the objective picture of the lesions may be so modest and lead to an incorrect diagnosis, unless there is a forensic expert present. The present work describes two cases in which the correct diagnosis of a shotgun entrance wound was formulated only thanks to the help of a forensic pathologist, who was called in to give an opinion of the unusual lesions observed in the patients. On 13 December 2004, at 09.00 a.m., a 35-year-old male subject, of robust build and about 180 cm tall, was brought by ambulance to the Emergency Room at Bari Hospital (S. Italy). He stated that two robbers had attacked him near his home, and one had grasped him around the neck to immobilize him. The patient was admitted to Intensive Care due to the presence of subcutaneous emphysema of the neck and superior mediastinum, causing severe breathing difficulties. He showed digitiform ecchymoses on the face, neck and upper portion of the chest. The Intensive Care specialist on duty called in the forensic pathologist for a consultation to confirm the traumatic picture and the compatibility of the lesions with the dynamics of the events referred by the patient. The forensic pathologist confirmed the presence of ecchymotic-excoriated areas in the referred sites and pointed out scratches and bruising caused by the robber's hands. An oval-shaped area appearing to be an abrasion was seen, with distinct, slightly retracted margins, 0.6 cm in diameter, with a small eschar in the lower right semicircle. The lesion was localized in the chin region, 2 cm to the left of the anterior median line. After photographing the lesion, the forensic pathologist decided to explore it in depth, introducing a needle cannula for use as a probe, which revealed the presence of an entrance into the body. X-rays of the chest and neck were performed, which demonstrated a foreign body found to be a bullet fragment, retained in the soft tissues of the anterior region of the neck just in front of the spine. After two weeks the patient underwent surgical treatment to remove the fragment, a deformed lead bullet core that was delivered into the hands of the Police. On the basis of the investigations, it was possible to conclude that the victim had been struck in the chin by a slow-moving bullet, which was partly fragmented by impact with the bone. The bullet had been fired from a small calibre firearm, likely a modified toy gun, which still had not been found at the time of this contribution.

On 5 March 2004, a 17-year-old boy accompanied his parents to a small hospital in the province of Bari. He complained of pain in the mandible, stating that he had fallen down the stairs in his home. Orthopantomography demonstrated a fracture of the mandible and avulsion of the lower incisors. Transfer to a clinic with facilities for maxillo-facial surgery was advised and the patient was taken to Bari Polyclinic for necessary care. On arrival, the forensic pathologist was called in to give an expert opinion. HA circular wound, approximately 0.7 cm in diameter, was observed in the chin region with inverted margins and a slight, ecchymotic, excoriated border. The wound was surrounded by powder tattooing and some soot, and these findings, together with the characteristics of the perforation, suggested a gunshot entrance wound. The available X-rays were reviewed and a foreign body was noted, which had not been referred to in the radiological diagnosis. The bullet, localized in the submandibular region, and surgically removed, was a 7.65 mm caliber (FMJ), deformed at the apex and with no markings (class characteristics). These elements led the investigators to conclude that, far from falling down the stairs, the victim had been hit in the face by a bullet from a modified toy gun, shot at intermediate range.

Failure to diagnose a gunshot wound is an exceptional event. Clinical medicine relies more and more on sophisticated diagnostic techniques, and procedures for quality control. However, the previous histories show that when non-conventional firearms are used, and the patient history is not suggestive of their use, clinicians may be unfamiliar with the type of wound they produce, because these events are rarely seen. In these circumstances, consultation with the forensic expert is needed to make a correct diagnosis of the wounds. This is very important to further judicial investigation procedures related to the case. In accordance with the Italian penal law code (penal procedure code, art. 331), health workers (physicians, nurses, etc) treating a wounded patient in a hospital facility are obliged to communicate

the event to the Judicial Authorities without delay, if the lesions were obviously voluntarily inflicted (criminal assault) and recovery will take longer than 20 days (penal code, art. 582-583). This obligation applies even for shorter recovery times if firearms or other potentially lethal weapons were used (penal code, art. 585). Failure to notify the Authorities lays the health workers themselves open to criminal charges (penal code, art. 361 and 362). Photographic documentation of each of the above described cases will be shown during the presentation.

Forensic Pathologist, Gunshot Wound, Modified Toy Gun

G30 Sudden Death in Toddlers Due To Influenza B Infection: A Report of Two Cases and a Review of the Literature

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After attending this presentation, attendees will better appreciate the importance of viral testing in pediatric autopsy cases. Attendees will have better understanding that influenza may present with atypical symptoms such as abdominal pain, vomiting and shock and have a very short duration between onset of symptoms and death.

This presentation will impact the forensic community and/or humanity by bringing attention to the need for specialized testing in pediatric autopsy cases, more specifically the need for viral testing, especially for influenza. Cases of sudden death among children, especially with atypical symptoms for influenza, usually do not get viral studies collected at the time of autopsy and if viral infections are not considered the cause of death may remain elusive. The authors recommend viral screening for cases of sudden death among infants and children in addition to the more standard specialized testing such as bacterial cultures.

Influenza has historically been a cause of considerable mortality world-wide during pandemics as well as small outbreaks, and continues to be a significant cause of death today. The very young and very old are especially vulnerable. Influenza typically appears during the winter months and classic symptoms include fever, sore throat, sweating, nasal obstruction, and cough and malaise. In severe attacks bronchiolitis and pneumonia may be caused directly by the virus or may result from secondary bacterial invasion of the lungs. Influenza is caused by myxovirus influenzae and there are three distinct serotypes (A, B, and C), each containing antigenic strains. Virus A causes pandemics as well as local outbreaks. It affects all age groups and is associated with a high mortality in the elderly, the very young, and those with pre-existing cardiac and pulmonary disease. Virus B causes sporadic cases and limited epidemics, especially among institutionalized young people. It tends to cause a milder disease with a lower mortality rate. Virus C is occasionally detected in local outbreaks.

Two cases of relatively sudden deaths with atypical symptoms due to influenza type B infection in a 4-year-old girl and a 2-year-old boy with no past medical history or predisposing risk factors are described. Both children presented with mild abdominal symptoms of vomiting and abdominal pain starting within two days of death, and were found dead in their beds by their parents. Scene investigation, medical history, autopsy, metabolic screening, toxicology, bacterial cultures, and toxicology were all negative. Histology of the lungs showed a viral type pattern with a chronic inflammatory infiltrate involving the bronchioles, bronchi, and trachea. The girl also had small patchy areas of intra-alveolar mixed inflammation including macrophages and neutrophils consistent with bronchopneumonia. Viral testing on the lungs of both cases was strongly positive for influenza B (by immunohistochemistry in the girl, and RT-PCR in the boy).

These cases illustrate two atypical cases of influenza B infection that would not have been suspected based on the presenting symptoms and rapidly fatal outcomes. Influenza may be found to be the cause of death if viral cultures are done in similar types of cases.

In the literature there are reported cases in adults of influenza A infection with shock like symptoms and high morbidity and mortality. There is ongoing research into the possible role that cytokines play in causing additional injury in a number of infections including influenza associated encephalopathy, streptococcal toxic shock syndrome and RSV respiratory infections. Immune mediated injury may result from the cytokine storm triggered by the initial infection and may spill over into the systemic circulation and cause devastating consequences in a relatively short period of time. There are some studies that suggest that RNA viruses like influenza may be particularly prone to inducing cytokine and chemokine up regulation including numerous interleukins (including IL-1, IL-6, IL-8, IL-11, IL-16) and tumor necrosis factor. It has been suggested that immunomodulators be used as part of the medical treatment of influenza to help prevent cytokine storm.

Influenza, Sudden Death, Toddlers

G31 Neuropathology of Pre-Teen Homicides in the State of Maryland: 1994-2004

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After attending this presentation, attendees will appreciate that pre-teen homicides differ from that of other age groups. Brain pathology is a common finding in childhood homicide, especially in cases with a blunt force component. The majority of pre-teen homicides are due to blunt force injuries of the head or head and torso. Detailed, systematic study and documentation of the central nervous system and ophthalmic injuries is essential in determining the nature and timing of the injuries and ruling out natural diseases or accidental injuries.

This presentation will impact the forensic community and/or humanity by demonstrating; (1) a better understanding of the epidemiology of pre-teen homicides; (2) the necessary role of neuropathologic studies in childhood homicides; and (3) an understanding of the pattern of injuries in blunt force head trauma in children.

Background: The State of Maryland (population below 6 million, half rural) has a unified medical examiner system that investigates suspicious deaths following standard protocols. Homicides in pre-teens differ from those in the general population in victim's characteristics (e.g. gender distribution), causes of death (e.g. firearm use), environment of death (e.g. home) and patterns of injuries.

Method: Cases were reviewed and tabulated for demographic characteristics, cause of death, post-injury survival, systemic and brain injuries. Cases with a significant central nervous system component were examined by a single neuropathology's (JCT). The majority of the cases included examination of the spinal cord and eyes. Cases were stored in a centralized database. Data was retrieved and analyzed by nonparametric statistical methods.

Results: From 1994 to 2005 one hundred and eighty five children younger than 13 years of age suffered homicidal deaths in the State of Maryland (7.5 % of all deaths reported to the office for that age group). Blunt force injuries were the most common cause of death (95 cases, 51.1%) followed by firearms (16.7%) and asphyxia (16.2%), each preferentially affecting children of specific ages. Most children with blunt force injuries had significant neuropathology, and this is the focus of the following study.

There was overrepresentation of cases in the Baltimore metro area (60% of the cases; 12% of the State wide population). Girls were slightly more prevalent than boys (52 vs. 48%) and African-Americans represented 64.5% of the total. Median age was 1.1 years. Brain weight ratio (brain weight obtained at autopsy divided by standard brain weight for individual's age) was 1.1. The neuropathologic findings depended on age, survival after injury and mechanism of force. The majority of the cases had external (73.7%) signs of blunt force head injuries, either alone (50%) or in combination with torso injuries (50%), with an average of 4.7 (median 4) head contusions/abrasions identified at autopsy. Injuries included intracranial subarachnoid hemorrhage (61.5%), intracranial subdural hemorrhage (55%), hypoxic injuries (35%), cortical contusions (38.5%), brain swelling (21%), intracranial epidural hemorrhage (17%), and gliding (intermediate) contusions (15.4%). White matter tears and diffuse axonal injuries were rare. Spinal cord was obtained and studied in 70 of 95 cases (73.7%). Intraspinal hemorrhage was seen in 31% (subarachnoid 24.3%, subdural 23% and epidural 17%). Eye pathology was found in 44 of 60 cases studied (73%), and was bilateral in 95% of them.

Summary and conclusions: Brain pathology is a common finding in childhood homicide, especially in cases with a blunt force component. The majority of pre-teen homicides are due to blunt force injuries of the head or head and torso. Age, gender, and race influence specific neuropathologic findings. Brain weight ratio correlates with survival and is influenced by neuropathology. Detailed, systematic study and documentation of the central nervous system and ophthalmic injuries is essential in determining the nature and timing of the injuries and ruling out natural diseases or accidental injuries.

Blunt Force Head Injuries, Pre-Teen Children, Homicides

G32 Transplacental Intrauterine Herpes Simplex Virus Infection Resulting in Cutaneous Calcifications in an Infant

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After attending this presentation, attendees will learn about a unique pathologic presentation of transplacental neonatal herpes infection, which may aid in future clinical diagnoses.

This presentation will impact the forensic community and/or humanity by highlighting a distinctive but rare presentation of Herpes Simplex Virus (HSV). By augmenting the relatively scant literature on transplacental HSV infection, this case may expand the differential diagnoses for infant autopsies with similar gross findings, and possibly aid in earlier detection and treatment of intrauterine HSV infection.

Neonatal HSV infection is often associated with liver necrosis, microcephaly, intracranial calcifications, and brain necrosis, and clinical signs may not be apparent until several days after birth. In many of these cases, transmission occurs during birth. More rarely, transplacental intrauterine HSV infection can occur, with life-threatening effects due to earlier onset in the pregnancy. A literature search reveals some isolated case reports of similar cases, most of which demonstrate unique gross presentations. The authors describe the autopsy case of an infant born at 25 weeks gestation with diffuse cutaneous calcifications. There was microscopic evidence of acute chorioamnionitis and acute funisitis. HSV immunostaining was positive on the tissue sections of placental membranes and umbilical cord. Polymerase chain reaction analysis (PCR) on the same paraffin-embedded tissues was positive for HSV. No viral inclusions were identified in any of the tissue sections.

A pregnant 20-year-old female (G1P0) presented to her obstetrician with spontaneous rupture of membranes at 25 weeks gestation. The patient was transferred to a tertiary care center for probable chorioamnionitis, where she was noted to be febrile with uterine tenderness and an elevated

white blood cell count. The fetus began to show signs of distress with decelerations in heart rate, and a caesarean section was planned. However, the infant was delivered vaginally in the operating room, approximately 18 hours after the membranes ruptured. The infant failed to breathe spontaneously and had no heart rate, so resuscitation efforts began, including intubation and 3 doses of epinephrine per endotracheal tube. Resuscitation was discontinued after 15 minutes since the infant could not sustain a heart rate. Apgar scores were 0 @ 1 minute, 1 @ 5 minutes, and 0 @ 10 minutes.

Maternal past medical history was significant for two urinary tract infections during pregnancy, with urine cultures positive for *Escherichia coli*. She was also briefly hospitalized for pyelonephritis one week prior to delivery, with urine cultures again positive for *E. coli*. She was treated with Macrobid and Keflex, and was still taking these medications along with prenatal vitamins at the time of delivery. Prenatal labs were negative for chlamydia, gonorrhea, HIV, and Group B Strep. She denied any history of sexually transmitted diseases. There was no documentation of prenatal HSV testing.

At autopsy, the infant's skin was light tan with extensive areas of dark red discoloration on the back, chest, and head. Additionally, there were irregular, white patchy lesions on the posterior head, back, shoulders, chest, inguinal areas, and over the coccyx. These lesions appeared to be intradermal, were not palpable, and did not scrape off. The remainder of the gross examination was unremarkable. The body was that of a normally formed male infant, consistent with a 25-week gestational age. No other dysmorphic features were noted, and the internal organs were located in their normal anatomic positions. The placenta was significant for a white area on the maternal surface, grossly consistent with an infarct, and encompassing less than ten percent of the maternal surface area.

Microscopically, the skin demonstrated multiple areas of intradermal calcifications, consistent with the white, patchy lesions seen grossly. Hyperkeratosis was present, with amorphous debris visible on the skin surface. However, only minimal inflammation was observed around the calcified areas. The lungs contained multiple areas of lymphocytic infiltration with debris-laden macrophages. The infarcted area on the maternal side of the placenta showed acute inflammation with neutrophilic extravasation and fibrin deposition. The umbilical cord demonstrated funisitis, with neutrophils visible in the walls of the cord vessels, and chorioamnionitis of the placental membranes. Of note, no herpetic viral inclusions were identified in any of the tissue sections.

Sections containing the intradermal calcifications and sections of placental membranes and umbilical cord were sent for special staining. GMS, gram stain, Steiner stain (for spirochetes) and Toxoplasmosis stain were all negative on these sections. However, HSV immunostaining was positive on the placental membranes and umbilical cord. HSV infection was confirmed by PCR at an outside laboratory (ARUP Laboratories, Salt Lake City, Utah). The tissue submitted for HSV PCR was from the formalin-fixed and paraffin-embedded sections of placental membranes and umbilical cord.

Herpes (HSV, Herpes Simplex Virus), Transplacental, Cutaneous

G33 Killer Hairdryer

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After attending this presentation, attendees will learn about the silent and invisible nature of electric current injury that requires a thorough investigation of the death scene, to aid in accurately determining the cause of death. In a suspected electrocution in water, if the autopsy fails to reveal indications for an electrocution, a check of the bathtub or pool's electrical system is still in order.

* Presenting Author

This presentation will impact the forensic community and/or humanity by assisting the forensic community in understanding the important reasons for vigorous investigations of these deaths in bathtub to prevent further injury.

This case consists of the tragic death of a perfectly healthy 9-year-old girl (Proc. N. 2172 / 2004 Court of Trani), with no history of illnesses, congenital or otherwise, who was found dead by her mother, in the bathtub filled of water. The parents reported to the Judicial Authority that it was an unexpected death, excluding the possibility of an electrocution. The findings of the following forensic investigations were unprecedented, both from a legal perspective, as well as from the point of view of the postmortem and histological data gathered.

The external examination of the child's body revealed no traces of traumatic or violent wounds, although two small unusual areas of skin were detected in the lumbar region, which, when substantially enlarged, appeared to be pale and irregular compared with the surrounding skin. The internal examination revealed only a small myocardial dyschromic area under pericardium, a small area of haemorrhage at the level of the lower part of the uterus and a reddish area in region of the vagina.

The histological examinations excluded acute or chronic pathology, revealing indications for an electrocution on the lumbar skin specimens where a palisade-type appearance of the malpighian layer was noted. Furthermore, in the myocardium specimen's bands of contractions and fragmentation and coagulative haemorrhagic intramyocardial necrosis were observed.

This suspicion of an electrocution was not related with the historical and circumstantial facts of the case. The authors suggested that the Judicial Authority obtain a specialist in electrical engineering to perform an examination of the child's home.

The survey of the bathroom revealed the presence of a glazed metal bath and a hairdryer. The examination of the hairdryer revealed that some of internal parts oxidized. The electrical plant of the house was protected only by a thermomagnetic circuit breaker and there was no differential circuit breaker.

In addition to these findings, suspicion for an electrocution was supported by the results obtained by a finite element method simulation, aiming at determining the electric current distribution inside a human body immersed in a bathtub when an electrically connected hairdryer came into contact with the bath water. The simulation showed that when the water came in contact with the electrical part of the hairdryer, the current lines permeate the bath water and go across the human body. The current flows until the thermomagnetic circuit breaker intervenes (i.e. when the total current reaches about 90 A). On the basis of this study, the authors suggest that a lethal fraction of this current went across the little girl body, and therefore across her heart, resulting in a fatal ventricular fibrillation.

Our investigation having been completed, the judicial authority summoned the parents of the child. The parents withdrew their previous statements, and replaced them with a circumstantial and specific reconstruction of the sequence of events immediately preceding the death, which revealed strong indications of fault. Indeed, the parents of the little girl confessed that her one-year-old brother, who had been left alone with his sister in the bathroom, had thrown the hairdryer into the bath in which his sister was immersed.

The JA therefore asked us to establish the cause or the contributory cause of the lack of differential circuit breaker in the electrical plant. The computer simulation allowed us to confirm that the presence of a differential circuit breaker (i.e. when the electrical plant is in compliance with the law) would not have prevented the death of the little girl, since she was immersed in a highly conductive medium.

In conclusion, the case established a grave 'negligence in supervision' by the parents. The fact that the electrical plant did not meet the Standard requirements did not account either for the cause and / or contributory cause of death. In similar cases the use of hairdryers having a full immersion protection plug against contact with water (either in the "on" or "off" position) should be mandatory. The authors also recommend that hairdryers which are not provided with a full immersion protection device be recalled.

Electrocution, Death in Bathtub, Electric Mark

G34 Pyelonephritis—Sudden and Unexpected Death in Infancy

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The goal of the presentation of these two separate cases is to demonstrate that acute pyelonephritis, which may not be detected clinically, is an unusual cause of sudden and unexpected death in infants.

This presentation will impact the forensic community and/or humanity by informing all of the role acute pyelonephritis plays in sudden, unexpected death in infancy, and providing a discussion of the differential diagnosis. This potentially lethal condition can be misdiagnosed clinically or masked by other co-morbid infections such as otitis media and viral illnesses.

This poster presents two cases of infants dying suddenly and unexpectedly from acute pyelonephritis. In the first case the infant had no known risk factors, in contrast to the second infant who had significant risk for the development of pyelonephritis. The authors review the pathogenesis, incidence, and differential diagnosis of pyelonephritis in infants dying suddenly and unexpectedly.

The first case is that of a previously healthy 7-month-old white female with medical history of asthmatic bronchitis. The infant appeared to be in her normal state of health, playing before she went to sleep the night before her death. She was fed a bottle around 3:00 AM and placed on top of her mother's chest, which was the infant's usual sleeping position at night. At around 6:00 AM the mother noted the infant to lifelessly fall limp from her chest onto the couch. The Coroner's investigation disclosed no evidence of maternal intoxication. No wedging or overlay was suspected. The mother stated the infant had a low-grade fever over the preceding 2-3 days. Despite emergency care and ACLS protocol, the infant could not be resuscitated. Gross autopsy findings revealed no evidence of accidental asphyxia or trauma. All other findings were negative except for an enlarged left kidney demonstrating wedge-shaped foci of pink, soft expanded renal cortex and medulla. No stigmata of sepsis were present. No congenital anomalies of the urogenital tract were grossly evident. Microscopic examination of the kidneys revealed acute pyelonephritis of the left kidney characterized by acute inflammatory cell infiltrates involving the renal tubules and interstitium. Tubular abscesses were present. Death in this case was attributed to acute pyelonephritis.

The second case involved a 10-month-old white male infant diagnosed with Ectrodactyly-Ectodermal Dysplasia-Clefting Syndrome complicated by extrophy of the urinary bladder with subsequent hydronephrosis. The infant had undergone multiple corrective surgical procedures for extrophy, epispadias, anteriorly placed imperforate anus, and cleft palate. His course was complicated by bilateral hydroureter and hydronephrosis. Prophylactic Cephalexin was prescribed throughout the last months of his life. On the day before death the infant developed recent onset of fussiness and low-grade fever, and was diagnosed in the local pediatric clinic with otitis media. He was prescribed Amoxicillin clavulanate and discharged to home. The next evening the infant was placed in an infant swing to calm his fussiness. He was found unresponsive in the swing 2 hours later. The body was positioned sitting in the seat with his head extended over the backrest of the seat. Coroner's investigation revealed no evidence of swing malfunction or positional compromise of respiratory excursion. At autopsy, gross examination revealed the facial and appendicular stigmata of Ectrodactyly-Ectodermal Dysplasia-Clefting Syndrome with postnatal operative corrections. The repaired urinary bladder contained numerous stones, and the mucosa was significant grossly and microscopically for chronic cystitis. Bilateral hydroureter and hydronephrosis were present. A perinephric acute inflammatory exudate was present around the right kidney and adjacent right liver lobe. Histopathologically, both kidneys demonstrated chronic interstitial nephritis, and the right

kidney contained acute and chronic inflammatory cell infiltrates within the renal interstitium associated with focal tubular abscesses. Postmortem blood cultures yielded *Proteus mirabilis*, *Citrobacter freundii*, and *Enterococcus faecalis*. Death was attributed to acute pyelonephritis with perinephric abscess and urosepsis. The significant contributing cause of death was Ectrodactyly-Ectodermal Dysplasia-Clefting Syndrome complicated by extrophy of the urinary bladder.

Acute pyelonephritis is an acute suppurative inflammation of the kidney usually caused by a bacterial infection. Routes of bacterial spread to the kidney can be either hematogenous or due to retrograde ascension from the infected lower urinary tract. Risk factors for pyelonephritis include the following: hematogenous septic spread; congenital obstruction of the urinary tract; vesicoureteral reflux; pregnancy; instrumentation; age and sex; renal lesions with scar; or immunodeficiency. Papillary necrosis, pyonephrosis, perinephric abscess, and urosepsis represent complications of acute pyelonephritis. Both cases involve ascending route of infection. Although the first infant had no gross anomalies of the urogenital tract, functional vesicoureteral reflux cannot be excluded. An incompetent vesicoureteral orifice, which is not detectable on visual inspection, could have allowed the reflux of urine and bacteria into the ureter and kidney. The hematogenous route was not deemed likely in either case. The second case involved a physical anomaly of the urinary tract with subsequent chronic traction and obstruction of the ureters.

The clinical diagnosis of pyelonephritis in infancy may be difficult for several reasons. A diagnostic index of suspicion was blunted by the mild febrile presentation in the first case. Clinical focus on otitis media masked the more serious infection in the second case. This poster presents two cases of pyelonephritis, which were neither suspected by parental caregivers nor diagnosed clinically in the presence of a less serious infection. Pyelonephritis constitutes a rare cause of sudden and unexpected death in infancy.

Pyelonephritis, Sudden and Unexpected Death in Infancy, Autopsy

G35 Necrotizing Fasciitis: Manifestations, Microbiology and Connection With Black Tar Heroin

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After attending this presentation, attendees will gain knowledge regarding the manifestations and microbiology of necrotizing fasciitis and how it is related to injection of black tar heroin. The hypothesis is that necrotizing fasciitis caused by drug injection differs substantially from the same disease due to other causes.

This presentation will impact the forensic community and/or humanity by showing the relationship of necrotizing fasciitis to injection of black tar heroin and the importance of understanding the manifestations, microbiology, and causes of this infectious disease.

Introduction: Black tar heroin use is pervasive in the Seattle area. When intravenous (IV) drug users exhaust their IV sites, they resort to subcutaneous (SC) and intramuscular (IM) routes. Unfortunately, SC and IM injection promotes infection by introducing contaminated material into the tissue. Infections are common in heroin users, who often believe that the drug rather than the injection method is responsible. From what is known about black tar heroin, it is likely that either the raw drug or diluents contain clostridial spores, which are difficult to kill by the brief heating drug users employ. It is not uncommon for clusters of infections to be associated with a single batch of heroin. Because necrotizing fasciitis is often fatal, this study was initiated to delineate factors responsible for the disease.

Methods: King County Medical Examiner's Office assumes jurisdiction in all reported cases of necrotizing fasciitis, deaths related to drug abuse, and all infections that may represent a public health hazard. For this study, a records review over 7 years yielded 87 total deaths due to necro-

tizing fasciitis. Eliminating those that lacked identification of the infecting microorganisms left 65 cases in the present study. For these 65 cases, disease manifestations were correlated with the source of infection and the microorganism(s) identified.

Results: Of 32 cases due to drug injection, 17 grew cultures isolating a single organism; the remaining 15 were polymicrobial. Of the 17 single isolates, 13 were clostridia (4 *C. sordellii* and 2 *C. perfringens*). Of the 15 polymicrobial cultures, clostridia were present in 11, with *C. sordellii* representing 4 cases. Overall, clostridia accounted for 24 of 32 cases of necrotizing fasciitis due to black tar heroin injection.

All of 13 cases of necrotizing fasciitis developing after other types of trauma grew cultures containing at least one species of streptococci; 7 grew a single isolate, 4 of which were *S. pyogenes*. The remaining 6 cases were polymicrobial with various streptococci predominating.

In 14 cases developing apparently spontaneously, with no known trauma but several with comorbid conditions, 3 had single isolates of clostridia identified, 2 of which were *C. septicum*. Another 7 grew single isolates of streptococci, 5 of which were *S. pyogenes*. Two additional infections were due to *Staphylococcus aureus*, and the remaining 2 were polymicrobial.

In 6 cases complicating integument breakdown, such as ulcers and percutaneous feeding tube sites, all were infected by streptococci; 2 had single isolates of *S. pyogenes* and 4 were polymicrobial.

Conclusions: This study shows convincingly that necrotizing fasciitis due to clostridial infections is a potential consequence of IM or SC injection of black tar heroin. This disease has a high mortality rate. Although black tar heroin is the likely source, clostridia are unlikely to cause infection unless mechanically introduced into an anaerobic environment. Thus, the injection method rather than the drug is primarily responsible for the disease. There is insufficient evidence from this study to say whether clostridial spores came from the raw black tar heroin, from diluents, or from contaminated needles. The microbiology of cases of necrotizing fasciitis originating from other sources of infection differs from those due to drug injection; in these, streptococcal infections predominate. Compared to clostridia, group A streptococci (*S. Pyogenes*) are virulent and can cause fatal disease spontaneously or following superficial trauma. Accordingly, the organism itself is often primarily responsible for disease.

This study supports the conclusion that necrotizing fasciitis caused by injection of black tar heroin is substantially different from the same disease resulting from other causes. Cases associated with heroin injection are predominantly clostridial infections while the others are predominantly streptococcal infections. While all cases of necrotizing fasciitis are potentially fatal, this conclusion indicates that different prevention and treatment strategies are necessary depending on the underlying cause.

Necrotizing Fasciitis, Clostridial Bacterial Infections, Black Tar Heroin

G36 Was the Shawnee War Chief Blue Jacket a Caucasian?

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After attending this presentation, attendees will gain an appreciation for the mutation rate of the paternally inherited Y chromosome with regards to inquiries of male lineage.

This presentation will impact the forensic community and/or humanity by demonstrating the confidence by which male line descent can be ascertained by performing a direct comparison of the Y-STR haplotypes back eight generations.

The paternally inherited Y chromosome contains the largest non-recombining block of nucleotides in the human genome (approximately 50 million base pairs) and has much lower levels of polymorphism than any other region of the human genome (International SNP Map Working Group 2001). It has become an extremely important tool in a variety of areas including forensics (Jobling et al. 1997), genealogical reconstruction (Jobling 2001), molecular archaeology (Stone et al. 1996), nonhuman primate genetics (Stone et al. 2002) and human evolutionary studies (Hammer and Zegura 1996; Underhill et al. 2000, 2001; Hammer et al. 2001). As a direct result of the relatively low mutation rate, 0.23%/STR locus/generation in human pedigrees, concordance of male-line relation can be deduced via direct comparison Y-STRs. This direct comparison of paternally inherited Y-STRs was utilized to explore a centuries old controversial legend that contends that the legendary Shawnee War Chief, Blue Jacket, was not of American Indian descent, however, was a white man of Dutch descent, known as Marmaduke Swearingen. The comparison of twelve Y-chromosome polymorphic markers in six purported male-line descendants of Chief Blue Jacket and four purported male-line descendants of Marmaduke Swearingen, eight generations removed in both families, revealed that male line descendants in each of the families shared the same 12 locus Y-STR haplotype. However, the Swearingen haplotype was distinctly different from that of the Blue Jacket male-line descendants, with consistency at only five of the 12 tested loci therefore, excluding them from an ancestry linked to Chief Blue Jacket.

Y-STRs, Genealogical Reconstruction, Mutation Rates

G37 Using Multiplexed Microsatellite Markers of Cannabis sativa to Determine Genetic Diversity

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After attending this presentation, attendees will understand previously described microsatellite markers known to discriminate between individual plants were multiplexed into a single reaction and validated in 2 separate laboratories with over 30 plant individuals.

This presentation will impact the forensic community and/or humanity by providing the forensic community with a genetic test, which they can use to track origin in order to connect samples to each other to associate distributors.

Cannabis sativa L. (marijuana) plants can be easily identified through morphological examination and chemical analysis; however there is a need for a DNA test for use as a means of association between individual plants and even as a method to track distribution networks.

Cannabis sativa L. is the most frequently used illegal drug in the United States. *Cannabis* has been used throughout history for its stems in the production of hempen fiber for rope and fabric, for its seed for oil and food and for its flowers and leaves as a psychoactive drug. Microsatellite markers have been chosen for a DNA test because these markers have distinct advantages over other genetic methods. STRs have multiple alleles at a single locus, can be standardized such that reproducibility between laboratories can be easily achieved, have a high discrimination power and can be multiplexed.

In this project, seven *Cannabis* primers selected from a set of primers previously described by the group [1] and four *Cannabis* primers from a set previously described by Gilmore's group [2] were multiplexed into a single reaction. The multiplex reactions were independently analyzed in two separate labs for 30 different cannabis plants. Both an ABI 3100 and an ABI 310 were used for the analysis. Trinucleotide repeats were chosen to reduce the incidence of artifacts that may affect interpretation. The forward primers in some of the primer sets were fluorescently tagged with 6-FAM

dye and some of forward primer sets were tagged with HEX dye. Hemp DNA extracts were provided by Tariq Mahmood of the Alberta Research Council in Alberta, Canada. The hemp samples were amplified in a single optimized reaction to determine base pair size for each allele. The primers were then combined into a single multiplexed reaction. The samples were amplified on a 9700 Thermal cycler with the following parameters: a 5-minute incubation at 94°C then twenty-five cycles of 94°C for 30 seconds, 54°C for 30 seconds and 72°C for 30 seconds, eight cycles of 94°C for 30 seconds, 52°C for 30 seconds and 72°C for 30 seconds, a 60 minute extension time at 60°C and a final 4°C chill. The samples were prepared and electrokinetically injected for capillary electrophoresis on the ABI Prism 3100. The data generated was imported into GeneScan 3.7 and the base pair size analysis performed using Genotyper 3.7.

Previous studies using these microsatellite markers were able to distinguish clones from non-clones. Efforts to construct a comprehensive genomic map of *Cannabis sativa*, where the positions of these microsatellite loci on various chromosomes/linkage groups could be defined are presented. Efforts to determine the level of polymorphism and to measure the genetic relationships between different *Cannabis* plants are also presented. There were a total of 30 individual *Cannabis sativa* plants analyzed, 15 with a low Δ^9 tetrahydrocannabinol (THC) content and 15 with a high THC content.

This study determined the practicality of multiplexing primers sets to differentiate individual plants within the *Cannabis sativa* species. Using previously described primer sets the authors were able to produce a working multiplex, which could differentiate fourteen individual Cannabis samples of unique origin. During testing, the authors determined that there was no significant difference in base pair size between alleles typed using the single locus amplification and the multiplexed amplification. Each cannabis sample gave a unique profile showing clear differences between the generated genotypes.

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Cannabis, STRs, Multiplex

G38 Co-Amplification of Cytochrome B and D-loop mtDNA Fragments for More Reliable Species Identifications

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After attending this presentation, attendees will learn a new method for the analysis of degraded DNA samples in wildlife forensics, food inspection, conservation biology and ancient faunal remains analysis.

This presentation will impact the forensic community and/or humanity by demonstrating the co-amplification method, which is a simple, cost-efficient and genomic DNA-saving approach for species identifications from minute and degraded DNA samples.

This study proposed the simultaneous co-amplification of both cytochrome b and D-loop fragments for more reliable animal species identifications. This method uses a conserved cytochrome b sequence to obtain a less ambiguous species indication and a hyper-variable D-loop DNA sequence to obtain other specific information concerning species, population, and even individual specificities. Tests on ancient whale and salmon DNA samples have demonstrated that the co-amplification is a simple, cost-efficient and genomic DNA-saving approach for species identifica-

tions from minute and degraded DNA samples. It is suitable for the analysis of degraded DNA samples in wildlife forensics, food inspection, conservation biology and ancient faunal remains analysis.

Species Identification, PCR Amplification, mtDNA

G39 Sternal Shard From Bystander Bullet: A Rare Mechanism of Homicide

Wendy M. Gunther, MD*, Office of the Chief Medical Examiner, Tidewater District, 830 Southampton Avenue, Suite 100, Norfolk, VA 23510

After attending this presentation, attendees will become aware of unusual locations a bullet may reach in the body, and understand how a gunshot wound can cause death without the bullet penetrating into the chest cavity, or injuring any vital organ.

This presentation will impact the forensic community and/or humanity by making the attendee aware of fractured sternal fragments as possible injuring substances in a death in which a bullet does not penetrate into the chest cavity, and achieve agreement on whether a death in such a circumstance can be considered accidental, or whether the manner is more appropriately to be deemed a homicide.

An 18-year-old senior high school student, who was captain of the local track team, exited an all-night pancake restaurant after two o'clock on a Saturday morning. He passed through the restaurant parking lot at the time that a gun battle was going on between adversaries on the opposite side of a busy six-lane surface street. The adversaries, who were exchanging shots after exchanging words at a nightclub, were unknown to the victim. It is likely that he was not aware of the gun battle on exiting the restaurant.

A bullet from the exchanged fire crossed the highway, and struck the young man in the chest. He collapsed in the parking lot. Emergency medical services both en route and at the local trauma center provided resuscitative efforts for more than an hour, without avail. Emergency thoracotomy revealed a large amount of blood in the chest.

At autopsy, the gunshot wound had a slightly atypical appearance, in that it consisted of a $\frac{1}{2}$ " oval, with a broader than usual central perforation. There were 250 cc of blood remaining in the chest after bilateral thoracotomy; all viscera were markedly pale, and the vascular tree was depleted of blood. In situ thoracic organ dissection revealed the presence of a partially transected right anterior pulmonary vein, with injury to the right atrial appendage. However, despite this clear evidence of an injury path, no bullet could be located for the initial hour of the autopsy.

During the prolonged search for the bullet, a physician, who was observing the autopsy, identified the projectile in the chest plate, which had been set to one side during the dissection, with its undersurface exposed to view. The bullet was clearly visible, impacted in the inner sternum, although it was partially covered by a disrupted shard of fractured bone from the inner cortex of the sternum. This shard of bone, with a triangular shape like a knife blade, projecting at close to a right angle from the inner cortex, had lacerated the pulmonary vein and right atrium. The bullet which caused death had done so without entering the thoracic cavity, and without perforating any vital structures, because it dislocated a sternal shard from the inner cortex of the sternum, at an unfortunate angle which was responsible for death.

The shooter claimed self-defense, in that he was returning fire on a person who, he stated, was firing at him from within a car across the parking lot. The mechanism of death supported his contention that he did not intend to fire at the victim. Three months later, free on bail, he was arrested with three other men after a drug-surveillance related gun battle with police.

The mechanism of this unusual chain of events leading to death will be discussed, utilizing autopsy photographs, with consideration of the appropriate manner of death.

Sternal Shard, Gunshot Wound, Bystander

G40 False Positive Diagnosis of Subarachnoid Hemorrhage and Subdural Hemorrhage by Computerized Tomography

Sangeeta Sandhu, MD*, St. Luke's-Roosevelt Hospital, 515 West 59 Street, #4K, New York, NY 10019; Stephen deRoux, MD, and Beverly Leffers, MD, Office of Chief Medical Examiner (Brooklyn), 520 First Avenue, New York, NY 10016-6402; and Thomas Gilson, MD, Office of Chief Medical Examiner (Manhattan), 520 First Avenue, New York, NY 10016-6402

The goal of this presentation seeks to raise awareness of the potential misdiagnosis of subarachnoid hemorrhage and subdural hemorrhage by computerized tomography. Attendees should understand possible reasons for misdiagnosis as well as their medicolegal and clinical implications.

This presentation will impact the forensic community and/or humanity by presenting three cases of misdiagnosed subarachnoid hemorrhage and one of subdural hemorrhage.

Death investigators should be aware of potential discrepancies between radiologic and autopsy findings.

Subarachnoid hemorrhage (SAH) involves bleeding into the space between the pia and arachnoid membranes and subdural hemorrhage (SDH) is characterized by bleeding into the space between the dura and arachnoid membranes. SDH is generally associated with trauma while SAH has well-recognized traumatic and non-traumatic (e.g. ruptured cerebral aneurysm) etiologies. Computerized tomography (CT) is frequently used in the evaluation of cases of suspected head trauma and has a high sensitivity in the diagnosis of SAH and SDH. Misdiagnosis by CT of SAH has been infrequently reported but may have significant clinical and medicolegal consequences. Potential sources of misdiagnosis include hypoxic encephalopathy, meningitis and reviewer inexperience. This report addresses three adult cases where CT misdiagnosis of SAH occurred as well as a pediatric case where CT misdiagnosed a SDH.

The **first case** involved a 25-year-old man who presented to the emergency department with vomiting and abdominal pain following an alcohol binge. He had altered mental status and went into cardiorespiratory arrest shortly after presentation. He was resuscitated but remained comatose and succumbed to multisystem organ failure three days after admission. A head CT after resuscitation was interpreted as showing diffuse SAH. No SAH was identified at autopsy. Neuropathologic examination revealed changes consistent with hypoxic encephalopathy with cerebral edema. Cause of death was acute liver failure due to acute and chronic alcoholism.

The **second case** involved a 49-year-old man who presented in cardiorespiratory arrest to the emergency department after being found unresponsive at home. Past medical history was notable for a high cervical spine injury approximately one and half years prior to death. Because of the injury the decedent was ventilator dependent. After resuscitation he remained comatose and died one day later. A CT scan of the head after resuscitation was interpreted as showing diffuse SAH but no SAH was identified at autopsy. Neuropathologic evaluation demonstrated hypoxic encephalopathy with cerebral edema. The cause of the decedent's initial cardiopulmonary arrest was related to complications of his remote neck injury and this was listed as the proximate cause of death.

The **final adult case** involved a 33-year-old man with a history of substance abuse who collapsed at a fast food restaurant and was taken unresponsive to the hospital where he was resuscitated. He regained vital signs but had sustained a hypoxic brain insult and never regained consciousness before expiring 14 hours later. A head CT after resuscitation was interpreted as showing diffuse SAH. This was not present at autopsy and neuropathologic examination again showed only signs of hypoxic encephalopathy with cerebral edema. Cause of death was related to acute drug intoxication.

The **pediatric case** involved a 5 week-old infant who was brought to the hospital in extremis by her father after she developed labored breathing. She had been previously healthy but over the preceding hours was

described as progressively lethargic. She was intubated in the emergency department but became profoundly bradycardic during a head CT. She received inotropic support but expired four hours after presentation. Head CT was interpreted as showing a small right frontal SDH with blood at the posterior aspect of the interhemispheric fissure. No SDH was identified at autopsy, which revealed bacterial leptomeningitis and this was given as the cause of death. The father was released from police custody following autopsy as he had been arrested on suspicion of child abuse (shaken baby syndrome).

Forensic Science, Subarachnoid Hemorrhage, Subdural Hemorrhage

G41 TASER-Related Fatalities: Case Report and Review of the Literature

Amy T. Sheil, MD*, and Kim A. Collins, MD, Medical University of South Carolina, Department of Medical and Forensic Autopsy, 165 Ashley Avenue, Suite 309, Charleston, SC 29425

After attending this presentation, attendees will be aware of TASER-related fatalities, understand the pathophysiological effects of TASER stunning, know common comorbid conditions identified in deaths resulting in conjunction with TASER use, and identify important clinical and pathologic information in the assessment of a TASER-related death.

This presentation will impact the forensic community and/or humanity by demonstrating a compilation of information regarding TASER-related deaths and will educate the forensic community (police, coroners, medical examiners, and investigators) regarding use and pathophysiological effects of the TASER. Identification of comorbid conditions and risk factors for poor outcomes associated with TASER stunning may lead to additional studies concerning guidelines for use. Recommendations may inspire the implementation of clinical and histopathological standards in evaluation of future TASER-associated deaths. Finally, understanding the need for cautious use may limit the number of TASER-associated fatalities, and therefore support continued utilization of this non-lethal weapon.

A recent rash of TASER-related fatalities has inspired controversy regarding the use of the touted non-lethal weapon, as well as the exact role the TASER (an acronym for "Thomas A. Swift's Electric Rifle") has played in the deaths of over 100 people since 2001. Most reports have been prominently featured by the media. TASER International, Inc. asserts that the TASER has not been directly responsible for these deaths.

The TASER is an electric stun gun designed to cause incapacitation upon delivery of approximately 50,000 volts of electricity by means of two metal darts. A cartridge containing two barbed darts is loaded in the gun. The darts are attached to the cartridge by means of thin wire (some with ranges up to 21 feet), and are deployed from the cartridge by pressing a trigger button. One press of the trigger causes a five-second delivery of electricity. A longer duration of delivery may be obtained by continuing to press the trigger. Following deployment of the darts, the gun may be used to deliver electricity by direct contact. Delivery of such an electrical stimulus causes intense, immediate, and painful muscle contraction. Many law enforcement agencies throughout the U.S. employ TASER guns; the TASER is also commercially available to civilians. While the TASER likely has been useful in preventing lethal use of force in some situations, a concern is that few standards are in place governing the use of the TASER. Fatalities have occurred during or following TASER stunning. Many perpetrators on whom the TASER has been deployed have been acutely intoxicated by various drugs, including cocaine, methamphetamine, and phencyclidine (PCP). Acute intoxication has generally been ruled as the cause of death in these cases, and TASER use indirectly implicated. In the absence of any evidence of illicit substances, other causes of death have included positional asphyxia, excited delirium, or underlying cardiac disease.

A case of a 29-year-old schizophrenic inmate who died immediately after being tased approximately six times, subsequent to his attack on cor-

rections officers is reported. He collapsed in a supine position, and his hands were cuffed in front of his body. Postmortem examination revealed an anatomically normal heart, normal postmortem vitreous chemistries, and a negative urine drug screen. No obvious cause of death was revealed by autopsy. Focal interventricular cardiac septum subendocardial myocardial contraction bands were identified by light microscopy. The authors concluded that the inmate died of a fatal cardiac arrhythmia, and in light of the temporal relationship to delivery of TASER electrical stimulus, the manner of death was deemed homicide.

The pathology findings in this case are reported, with a review of the existing literature concerning TASER-related deaths.

TASER, Forensic Medicine, Death

G42 A Demographic Analysis of Youth and Teen Suicide in Maryland (1994-2003)

Melissa A. Brassell, MD, Carol H. Allan, MD, Mary G. Ripple, MD, and David R. Fowler, MD, Office of the Chief Medical Examiner, 111 Penn Street, Baltimore, MD 21201*

After attending this presentation, attendees will be briefed on the analysis of trends regarding youth and teen suicide, which will assist in properly developing, placing and implementing suicide prevention strategies.

This presentation will impact the forensic community and/or humanity by demonstrating the trends regarding age, gender, race and methods of suicide among youth and teen age groups (age 10-19) in Maryland, which may assist in the application of suicide prevention strategies.

Learning Objectives: This is a retrospective epidemiologic survey of youth and teen suicide, ages 10-19, in the state of Maryland. Analysis of trends regarding age, gender, race and methods of suicide within this population may assist in the application of prevention strategies.

Suicide is the 11th leading cause of death in the United States, comprising 7% of all deaths. Adolescent suicide rates have continued to increase over the last several decades. There have been an increasing number of articles focusing on the epidemiology of suicide, showing the majority of suicide victims to be Caucasian males, followed by African American males, Caucasian females and African American females, in decreasing order of frequency. Fewer studies have focused on the trends of suicide in childhood. This report is a retrospective analysis of suicide in youth (age 10-14) and teen (age 15-19) age groups.

Suicide is the third leading cause of death between the ages of 10-19 years, comprising nearly 8% of all deaths, following only unintentional injury and homicide. In the state of Maryland, during the years of 1994-2003, there were 262 deaths between the ages of 10 and 19 in which the manner of death was determined to be suicide. The average age was 16.7 years. Youth suicide (age 10-14) accounted for 19.5% of these deaths.

In this population, 68% of suicide victims were Caucasian and 28% were African American, a ratio of approximately 2.5:1. This ratio is lower than that typically seen in the general population. This may be explained by the larger African American population seen in the state of Maryland when compared to the United States as a whole. Other races comprised 4% of suicide victims. As in prior studies on suicide, the majority of suicide victims were male (81%). The order, in decreasing frequency, remains Caucasian males (55.3%), African American males (24.4%), Caucasian females (14.1%) and African American females (4.6%).

Gunshot wounds and hangings, which steadily increased in frequency over the ten-year period, comprised the majority of methods of suicide (83%), consistent with that seen in the general population. A majority of fatal self-inflicted gunshot wounds occurred in the male population (41.6%), with 71.6% of these deaths resulting from contact gunshot wounds to the head or intra-oral gunshot wounds. 5.7% of female suicides resulted from gunshot wounds, approximately half of these due to contact

or intra-oral gunshot wounds. Females were significantly more likely to commit suicide by drug intoxication than were males, though hanging was the most common method used. While the availability of firearms has significantly increased over the last decade, there did not seem to be a significant upward trend in the use of firearms to commit suicide in the youth and teen population. There did appear to be an upward trend in hangings. Drug intoxication and multiple injuries, falls from a height, accounted for an additional 10%, with carbon monoxide intoxication and drowning making up the remainder.

Regional evaluation of youth and teen suicide occurrence in the state showed a preponderance of cases in Baltimore County (16%) and Baltimore City (15%). Montgomery County and Prince George's County comprised an additional 23% of cases. The remaining 20 more rural Maryland counties had suicide rates ranging from 1-4%. While there has not been a significant increase in the overall number of youth and teen suicide over the last decade, it may be useful to more closely evaluate those counties, which have had a steady rise in suicides in this age group. Knowledge of risk factors and demographics for suicide in this population, and how they differ according to socioeconomic status will assist in appropriately placing and developing prevention strategies.

Teen Suicide, Suicide Methods, Suicide Prevention

G43 Effectiveness of Death Investigation in Cases of Potential Elder Abuse

Diane C. Peterson, MD, and Richard E. Powers, MD, P220 West Pavilion, Department of Pathology, 619 19th Street South, Birmingham, AL 35233; James N. Robinson, BA, University of Alabama at Birmingham Medical School, VH P-100, 1530 3rd Avenue South, Birmingham, AL 35294; and Gregory G. Davis, MD, Jefferson County Coroner/Medical Examiner Office, 1515 Sixth Avenue South, Room 611, Birmingham, AL 35233-1601*

After attending this presentation, attendees will learn a means to examine the effectiveness of a medical examiner system at detecting cases of elder abuse.

This presentation will impact the forensic community and/or humanity by showing a means for evaluating the effectiveness of a medical examiner office at investigating cases of elder abuse.

RATIONALE: A primary means of detecting foul play is the examination by the medical examiner of the bodies of all individuals who die unexpectedly. Death in the elderly, however, is not necessarily unexpected, and it is possible that foul play is more easily hidden in the elderly by a claim that death was expected, thus bypassing the jurisdiction of the medical examiner. The rate of referral to the medical examiner's office of suspected lethal abuse or neglect in the elderly by all reporters or first responders is unknown. Reasonable conservative estimates exist, however, of claims of elder abuse substantiated upon investigation. Researchers wished to assess the effectiveness of the existing medical examiner system in Jefferson County, Alabama at capturing all cases of physical abuse in the elderly. The authors compared the number of cases of suspected elder abuse investigated by the medical examiner office to the number of cases of elder abuse expected to occur in order to determine whether present reporting network and investigative guidelines are sufficient for recognizing cases involving physical abuse in the elderly.

METHODS: The authors conducted a retrospective study of deaths investigated by the Jefferson County Coroner/Medical Examiner Office, Alabama from January 1, 2003 to December 31, 2004 and reviewed the deaths that occurred in decedents 65 years of age or older, looking for evidence of assault or physical abuse. During this time criteria for accepting cases remained unchanged. The findings were compared with an estimate based on the estimated number of cases of physical abuse that should have occurred during this time span. The estimate was made using data from the Adult Protective Services Division of the Alabama Department of Human

Resources, the United States Census estimates for the state and county populations, and the mortality statistics for Jefferson County. During fiscal year 2004 Adult Protective Services conducted 4,754 investigations into allegations of abuse, of which 16% included allegations of physical abuse. Half of these allegations were substantiated upon investigation. Given a random distribution of cases, use of population and mortality data indicate that the Jefferson County Office should expect to investigate about six cases with allegations of physical abuse and three cases of substantiated physical abuse in the elderly per year.

RESULTS: From 2003-2004 the Jefferson County Coroner/Medical Examiner Office examined 198 individuals age 65 years or older, and suspicion of abuse was reported or found in eight cases. In three cases the abuse was not substantiated at postmortem examination, and in five cases the death was a homicide. Based on the estimates given above, the expected number of cases for two years was 12 cases of suspected abuse and 6 cases of substantiated abuse, so the office investigated roughly the number of cases that might have been expected over the course of this study. Because a case more or fewer would make such a large difference when dealing with such small numbers, e looked at the number of homicides in individuals 65 years of age or older by year during the past decade (1995-2004), during which criteria for accepting jurisdiction were identical to the criteria used for the years of review. It was found that the number of homicides in individuals 65 years of age or older per year ranged from a high of 12 (in 1997) to a low of 0 (2004), with a mean of six cases per year.

CONCLUSION: Using published reports of the incidence of substantiated investigations of physical abuse in the elderly, the authors investigated about the number of cases of physical abuse that were predicted by a model. The number of deaths suspicious for elder abuse investigated by the medical examiner is in keeping with the number of allegations and substantiations for elder abuse in Alabama. The authors' approach to case selection and assumption of jurisdiction appears to be adequate for the investigation of physical abuse in the elderly.

Elder, Abuse, Homicide

G44 Use of CT as an Aid in the Recovery of Metallic Foreign Bodies at Autopsy

Edward A. Reedy, PhD, MD, John M. Getz, PhD, Lisa Pearse, MD, Craig T. Mallak, MD, JD, and James L. Caruso, MD, Armed Forces Medical Examiner System, 1413 Research Boulevard, Building 102, Rockville, MD 20850*

After attending this presentation, attendees will learn the practical application of a well-established technology to aid in the recovery of evidence.

This presentation will impact the forensic community and/or humanity by demonstrating the possible introduction of an existing radiology method into the forensic autopsy.

The recovery of metallic projectiles at autopsy can be difficult if the fragments are small, deeply embedded, very few in number or if the entrance wound or wound tract is obscured by burns or tissue loss. The recovery of projectiles is essential for evidentiary purposes. Plain radiographs frequently prove difficult to interpret, and recovery of metallic foreign objects often requires multiple views. The use of CT at autopsy to locate metallic objects is not a new concept, but is impractical when there are large numbers of foreign bodies to be recovered. Software algorithms now provide a means for the subtraction of tissue densities, allowing for: the determination of size, shape, density, and location of metallic foreign bodies in relation to anatomical structures. CT was utilized at the time of autopsy to identify and recover metallic foreign bodies as evidence.

CT, Radiology, Metallic

G45 Antemortem and Postmortem Toxicological Findings in Motor Vehicle Accidents, Maryland (2003-2004): Does Impairment Equal Death?

Sunil K. Prashar, MD, State of Maryland, Office of the Chief Medical Examiner; 111 Penn Street, Baltimore, MD 21201; Jami L. Grant, PhD, University of Baltimore, 1420 North Charles Street, Baltimore, MD 21201; Susan R. Hogan, MD, David R. Fowler, MD, and Mary G. Ripple, MD, State of Maryland, Office of the Chief Medical Examiner; 111 Penn Street, Baltimore, MD 21201; and Mary E. Kramer, RN, R. Adams Cowley Shock Trauma Center, 22 S Greene Street, Baltimore, MD 21201*

After attending this presentation, attendees will understand the potential utility of adding toxicological screening for drugs to the routine testing of alcohol levels in individuals involved in motor vehicle accidents. Furthermore, attendees will better understand the individual, situational and regional factors associated with motor vehicle related fatalities.

This presentation will impact the forensic community and/or humanity by demonstrating a method to assist state officials in setting policy for the testing of substances of impairment involved in serious motor vehicle accidents. In addition, the presentation will impact the design of public alcohol and drug prevention programs by identifying at risk populations and consumption trends, assist law enforcement in the development of improved interdiction programs, and serve as a guide for future research among the forensics community.

In the state of Maryland, law enforcement personnel perform alcohol testing of individuals involved in motor vehicle accidents. The purpose of this research is to determine whether alcohol testing alone is a reasonable marker of impairment in motor vehicle accidents or whether full toxicological screening should also be required. In addition, this research identifies factors associated with use of alcohol and/or drugs in the driving fatality population with the goal of improving public policies and decreasing driving fatalities.

This presentation will assist state officials in setting policy for the testing of substances of impairment involved in serious motor vehicle accidents. In addition, the presentation will impact the design of public alcohol and drug prevention programs by identifying at risk populations and consumption trends, will assist law enforcement in the development of improved interdiction programs, and will serve as a guide for future research among the forensics community.

The research methodology is based on a retrospective study of the motor vehicle accident fatalities that presented to the State of Maryland Office of the Chief Medical Examiner (OCME) and the motor vehicle accident injured population that presented to the University of Maryland Shock Trauma Center (UMSTC) between July 2003 and June 2004. The study sample included motor vehicle operators, passengers, pedestrians, motorcyclists and bicyclists. Outcome variables include the presence of alcohol alone, drugs alone, and both alcohol and drugs. In the fatalities, drugs included are those routinely tested for at autopsy at the OCME and include illicit drugs, prescription medications and over the counter medications. In the injured sample, drugs included the 18 drugs tested for at UMSTC.

Predictor variables include individual factors (e.g., decedent age, race, and gender), situations factors (e.g., vehicle type, single vs. multiple vehicles, driver vs. passenger, at fault vs. not at fault, safety equipment, and road conditions), and regional/geographic factors (e.g., access to trauma care). This approach is similar to that used in public health research, focusing on primary (before event), secondary (during event) and tertiary (after event) factors, as they pertain to injury-causing events.

Using various descriptive and inferential statistical techniques, the following results were derived (for fatalities n=251; for injured n=2,880). The fatality sample was predominately male (n=186), constituting 74%. Caucasians (n=147) and African-Americans (n=78) comprised approxi-

mately 90%. Decedent ages in both populations ranged from 13 to 65 years. Of the fatality sample, 50.6% tested positive for alcohol and/or drugs, 39.4% tested positive for alcohol alone, 12.4% tested positive for alcohol and drugs, and 11.2% tested positive for drugs alone. Of the injured sample, 22.3% tested positive for alcohol and/or drugs, 16.5% tested positive for alcohol alone, 2.6% were positive for both alcohol and drugs, and 5.8% were positive for drugs alone.

The results suggest that alcohol is a good indicator of driving impairment, as approximately 40% of the fatality sample and 16.5% of the injured sample tested positive for its presence. However, nearly half of the fatality sample and 69% of the injured sample that tested positive for drugs would have been missed by alcohol screening only. Therefore, the ability to determine impairment following motor vehicle accidents may be improved by expanded toxicological studies.

Toxicology, Alcohol, Motor Vehicle Accidents

G46 Descriptive Study on the Causes of Death of Residents of Boarding Homes

Andrea L. Dickens, MD, and Richard E. Powers, MD, P220 West Pavilion, Department of Pathology, 619 19th Street South, Birmingham, AL 35233; James N. Robinson, BA, University of Alabama at Birmingham Medical School, VH P-100, 1530 3rd Avenue South, Birmingham, AL 35294; and Gregory G. Davis, MD, Jefferson County Coroner/Medical Examiner Office, 1515 Sixth Avenue South, Room 611, Birmingham, AL 35233-1601*

After attending this presentation, attendees will gain a better understanding of the circumstances surrounding death and the causes of death for disabled residents of boarding homes.

This presentation will impact the forensic community and/or humanity by demonstrating how boarding homes will become an increasingly common source of cases as disabled individuals are moved from institutional care to community housing in compliance with the federal Olmstead Decree.

RATIONALE: In 1999 the Supreme Court issued the Olmstead Decree, which requires that states offer community-based living for individuals with disabilities rather than house these individuals in institutions. Several options are available to states to satisfy the requirements of the Olmstead Decree. Nursing homes, for example, often house individuals disabled by dementia. Boarding homes also play a critical role in providing housing for disabled individuals, and boarding homes have proliferated in response to the increased demand for such housing since the beginning of the movement to deinstitutionalize individuals with disabilities. The quality of care given by nursing homes has been a subject of great interest recently, both in the medical and legal communities. The nursing home industry is tightly regulated by the federal government, and the causes of death for nursing home patients are recorded as a matter of course. Boarding homes, in contrast, are under no regulation, and virtually nothing is known of the outcomes of disabled patients living in boarding homes, including the circumstances in which these individuals die.

METHODS: The authors conducted a retrospective study of deaths investigated by the Jefferson County Coroner/Medical Examiner Office, Alabama from January 1, 2000 to December 31, 2004. Review of the case files revealed 35 deaths during that time that occurred in a boarding or group home. Each case was reviewed, recording the circumstances surrounding death and the cause and manner of death.

RESULTS: Researchers found 35 deaths investigated by the office which occurred in a boarding or group home. The mean age of the decedents was 59 years, with a standard deviation of 15 years (minimum age 25 years, maximum age 91 years). Twenty-one decedents were black and fourteen were white. Twenty-two decedents were male and thirteen were female. The reasons for living in a boarding home were divided between two broad categories – a history of substance abuse (12 cases) or a history

of debilitating illness (17 cases, with 7 cases of schizophrenia or other psychiatric disorder, 2 cases of mental retardation, and 8 cases due to chronic illness such as diabetes mellitus, loss of mobility due to gunshot wounds, etc). In six cases the cause for living in a boarding home was unclear from the chart. The manners of death were distributed as shown in Table 1.

Table 1. Distribution of deaths by manner in decedents from boarding homes.

Manner of Death	No.	(%)	(Overall % of office)
Natural	20	(57)	(34)
Accident	3	(9)	(31)
Suicide	5	(14)	(12)
Homicide	0	(0)	(20)
Undetermined	7	(20)	(3)

The natural deaths were due to ischemic heart disease (7 cases), hypertension (3 cases), and one case each of pneumonia, cardiomyopathy, and alcoholism. The remaining seven natural deaths were due to undetermined natural causes, a situation that most often arises when a physician refuses to sign a death certificate after the body has already been buried or cremated. The three accidental deaths were due to intoxication related to substance abuse. Two suicides were a gunshot wound of the head, two a hanging, and one an overdose. In the seven cases where the cause of death was undetermined, four were undetermined in part because the office received the case after a physician refused to sign the death certificate, and three were undetermined following an autopsy. Decedents with a history of substance abuse tended to be intoxicated at the time of death; toxicology testing revealed an intoxicating substance in nine of the 11 decedents with a history of substance abuse who were tested. Thirty-two of the decedents were not married, whether because of death of their spouse, divorce, or never having married. The factors that led to the assumption of jurisdiction of a case were lack of a physician to sign the death certificate, history or scene evidence to suggest substance abuse, or concern on the part of the decedent's family about foul play or poor care. No evidence of physical abuse was found in any of these cases.

CONCLUSION: Federal law requires that states offer community-based living for individuals with disabilities rather than house these individuals in institutions. Boarding homes are the community-based housing available to these disabled persons. Residents of boarding homes are likely to be disabled by substance abuse or by a mental disorder. Research indicates that abuse of the elderly is more likely in individuals with short-term memory problems, any psychiatric diagnosis, substance abuse, or poor social support. Most residents of boarding homes in this study were socially isolated and either mentally disabled or prone to substance abuse, leading us to conclude that deaths that occur in boarding homes merit forensic investigation.

Group Home, Boarding Home, Disabled

G47 The Death of an Italian Soldier in Iraq: Murder or Fatality?

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The death of an Italian soldier in Iraq is presented. The goal of this study is to present a relatively quick and easy method for evaluation of gunshot residues, useful for interpreting gunshot wounds in cases where the circumstances of death are not clear. A specific histochemical stain with sodium rhodizonate and an analysis using a confocal type laser profile microscope was performed in order to clarify the exact death scenario.

This presentation will impact the forensic community and/or humanity by providing a relatively quick and easy method for evaluation of gunshot residues, using sodium rhodizonate staining on histological

samples, that may help determine range of fire in cases of death caused by firearm, and in this particular case, in order to clarify whether it is an accident, homicide or a suicide case. This histochemical data may be supported by the use of a confocal microscope.

A young Italian soldier in Iraq, at 01:00 p.m. was discovered wounded in a shooting range, where he was training with his rifle, a "MINIMI" cal. 5.56 mm. The rifle was found near the man and was seized. He was quickly taken by helicopter to the nearest military hospital in serious clinical condition, but he continued getting worse, so was transferred and hospitalized to Kuwait City, and died at 4:27 p.m. The body was transferred to Italy to the Department of Forensic Pathology of Foggia. A Military Prosecutor arranged the autopsy on the body because the circumstances of the wound suggested that the death could be an accident or, alternatively, a murder.

A complete autopsy was performed. The head injury was massive with partial evisceration of the brain. A large gaping tear of the scalp was present. The exact sites of the entrance and the exit of the bullet were not apparent. Careful re-approximation of the scalp and the examination of the tear showed an irregularly circular wound with irregular margins, surrounded by a wide zone of raw abraded skin in the forehead. A large, V-shaped scalp laceration (18 x 15 centimetres) radiated from this circular area up to the parietal and occipital bones. Gross identification of the entrance site was not possible. The brain was edematous, and the bilateral frontal and right parietal regions were lacerated with lost brain parenchyma.

The brain was sectioned with coronal cuts according to the Adams technique and showed right to left shift of the midline structure.

In the bilateral frontal region a small foci of hemorrhage was present and characteristic petechial hemorrhages continued throughout coronal cuts and affected the corpus callosum. Furthermore, in the right hemisphere, superficial subcortical hematomas extended into the parenchyma and the right lateral ventricle.

The cerebellum the subarachnoid space was affected by moderate hemorrhage, and the brainstem showed characteristic petechial hemorrhages.

The examination of the other organs was unremarkable. Routine histological investigation of skin specimens applying hematoxylin and eosin staining revealed a detachment of the upper epidermal areas mainly extending through the basal cell layers with flattened and stretched epidermis. The deeper parts of stratum papillare and underlying upper layers of the corium were homogenized. In these areas wide erythrocyte accumulation was present in the dermis and sub-epidermic adipose tissue. In superficial and deep layers of skin and dura mater were black foreign bodies. Brain sections showed intraparenchymal diffuse haemorrhages.

Frontal wound skin and dura mater samples were also stained with Rhodizonate dye technique. Rhodizonate acid exists as needle-shaped crystals of a dark orange colour and forms a sodium salt, which reacts with heavy metal ions (barium, antimony, lead, tin) contained in gunshot residues (GSR) with a red precipitate. On histological tissue sections, Rhodizonate reacts with heavy metal particles from the primer by generating a finely granular scarlet red pattern. The specimens were examined with a light microscope, in transmitted brightfield illumination and phase contrast mode.

In the samples collected from skin of the frontal region the Na-Rhodizonate reaction was positive for the presence of gunshot residues (GSR), showing dotted, non-contiguous, coarsely granulated deposits of rhodizonate, positive not only on the surface of skin, but also appearing within the gaps between connective tissue fibers. The same findings were observed in the dura mater specimens.

The GSR-positive samples were examined with confocal microscope using fluorescence emission of skin and antimony, a heavy metal contained in gunshot residues. A three-dimensional reconstruction was performed that confirmed the presence of GRS - positive granules on skin and dura mater surface.

Gunshot residue findings, their morphological aspects, and their location were indicative for a shooting distance less 40 centimetres.

In this reported case, the careful histological investigation of the wound skin through specific staining made the circumstances of the death clear, leading to the assessment of entrance site and firing distance. Furthermore the circumstantial data confirmed the hypothesized death scenario, that it was an accidental self-inflicted gunshot while the soldier was trying to unblock his rifle.

Soldier Death, Gunshot Wound, Shooting Range

G48 Prevention of Accidental Strangulation of Children in Their Sleeping Bags: Development of a New Sleeping Bag

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The goal of this presentation is to draw your attention to the dangers of accidental strangulation of children in their sleeping bags. Dr. Gerlach will also introduce a newly developed model of a sleeping bag, which prevents fatal incidents of that kind.

This presentation will impact the forensic community and/or humanity by aiming to sensitize the audience to the problem, to critically discuss the prototype as well as to show how to avoid such fatalities, which should also be accomplished by marketing the new sleeping bag.

In the last few years, researchers analysed several fatalities of children who had strangled themselves at the neckline of their sleeping bag due to their own movements while sleeping. Those sleeping bags can be purchased on the market and should be suitable to fix children.

Types of sleeping bags currently available on the market with their safety advantages and disadvantages are presented.

After this analysis, these fatal incidents appear to be avoidable, and it is possible to adopt measures to prevent these deaths. A simple means to resolve the problem would be a revision of the cut patterns in the current sleeping bags, which fixes the main hazard of these sleeping bags.

A prototype was developed with a cut to prevent these fatal incidents. This prototype sleeping bag is being tested for its functionality and handling and is registered for marketing. This prototype will be presented to an audience of experts.

Sleeping Bag, Strangulation, Prevention

G49 VIRTopsy (Virtual Autopsy) - Past, Present, and Future

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After attending this presentation the attendee will get an upgrade of the cutting edge technologies in forensic imaging/radiology.

This presentation will impact the forensic community and/or humanity by providing an actual overview of upcoming imaging technologies in forensic medicine.

The aim of the VIRTopsy project (www.virtopsy.com) is utilizing 3D body-surface documentation and minimal-invasive, image-guided virtual autopsy utilizing optical and radiological scanning to push low-tech

documentation and autopsy procedures in a world of high-tech medicine in order to improve scientific value, to increase significance and quality in the forensic field. The Institute of Forensic Medicine, University of Berne is, in collaboration with a well selected national and international research team, evaluating and validating several cutting-edge technologies such as 3D optical and photogrammetric surface scanning, computed tomography (CT), magnetic resonance imaging (MRI), magnetic resonance (MR) spectroscopy, micro-CT, micro-MR, postmortem biopsy, postmortem angiography and synthetic body models. The term VIRTOPSY was created from the terms virtual and autopsy: Virtual is derived from the Latin word ‘virtus’, which means ‘useful, efficient, and good’. Autopsy is a combination of the old Greek terms ‘autos’ (=self) and ‘opsomei’ (= I will see). Thus autopsy means ‘to see with ones own eyes’. Because the goal was to eliminate the subjectivity of “autos”, the two terms virtual and autopsy were merged - deleting “autos” - to create VIRTOPSY. Today the project VIRTOPSY combining all the research topics under one scientific umbrella, is characterized by a trans-disciplinary research approach that combines Forensic Medicine, Pathology, Radiology, Image Processing, Physics and Biomechanics to an international scientific network. The paper will give an overview of the Virtopsy change process in forensic medicine.

Virtopsy, Virtual Autopsy, Forensic Radiology

G50 Professional Quality in a Forensic Medical Setting: The Singapore Experience

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After attending this presentation, attendees will 1. Understand the need for Professional Quality in a forensic medical setting; 2. Gain an insight in how CFM, HSA has approached the subject of Professional Quality; and 3. See the need to implement quality systems suitable to their own operating environment.

This presentation will impact the forensic community and/or humanity by encouraging implementation of quality systems and promoting more emphasis on assuring quality of services of the forensic medicine community; and encouraging dialogue between practitioners as to best practices that would engender the above.

In many different industries, including the healthcare sector, the pursuit of quality has become an essential element in both assuring consumers a consistency of standards in the products and services delivered as well as delivering a competitive marketing advantage. Indeed, this also applies to many public agencies around the world.

Forensic medical practices/consultancies are typically small “enterprises” with limited budgets and they operate within a limited legal/geographical jurisdiction, in a typical single seller (the forensic practice) and single buyer/payer (State/Law Enforcement agency) environment. Some of these “enterprises” are one-man-operations (OMO).

Professional accountability is mostly limited to challenge within a courtroom environment or is non-existent outside of the courtroom in some instances. Peer review is not a norm. The weight placed on personal professional independence, expertise and experience creates an milieu amenable to development of a prima donna culture where forensic opinion is no longer largely a question of science but of the weight of persona and charisma in court and the public eye, where the risk of errant practices and practitioners may remain undetected for a long time. Failure to deliver good quality results can pervert the course of natural justice and damage public confidence in the law enforcement and judicial systems.

Considering the impact of the professional work in influencing judicial outcomes, it is important, in the authors' view that while one cannot wholesale adopt practices from the industry, efforts nonetheless need to be made to identify relevant and appropriate measures for adoption, to assure the stakeholders (the Prosecution, the Courts, Law Enforcement, the

Public, the Politicians, the funders) that high standards in professional forensic practice are delivered consistently with accountability. The paper will discuss the experience of the Centre for Forensic Medicine, Health Sciences Authority Singapore, in its journey towards assuring professional quality.

Quality, Forensic Medicine, Accreditation

G51 Insects of the Grave: A Cold Case History Involving Insects 27 Years After Death

Richard W. Merritt, PhD, Michigan State University, Department of Entomology, 243 National Science Building, East Lansing, MI 48824; Mark E. Benbow, PhD, Department of Biology, DePauw University, Greencastle, IN 46135; Ryan K. Kimbrauskas, MS, Michigan State University, Department of Entomology, East Lansing, MI 48824; Joyce L. deJong, DO, Sparrow Hospital, 1215 East Michigan Avenue, Lansing, MI 48909; and Richard Snider, PhD, Michigan State University, Department of Zoology, East Lansing, MI 48824*

After attending the presentation, attendees will understand the biology of a relatively small group of insects (Collembola) rarely mentioned as an insect frequenting decomposing remains, especially following exhumation 27 years after death. They also will be exposed to the environmental factors that may have led to this occurrence.

This presentation will impact the forensic community and/or humanity by presenting case that provides important information to entomologists and biologists on the biology of Collembolan as it relates to human decomposition. The case also will add to the biological information of this insect group as to their movement in the soil and apparent niche at this soil depth. This is information that will rarely ever be collected in normal crime scene investigations, and it is a rare occurrence in nature to find insects inhabiting a cadaver 27 years after death.

This presentation will make forensic entomologists and other biologists aware of insects and other arthropods associated with decomposing bodies far beyond the normal postmortem interval. It also will make forensic pathologists aware of what types of arthropods may be encountered during investigations when bodies have been exhumed after several years.

The cadaver of a 28-year-old female was exhumed in January 2005 from a cemetery in Battle Creek, Michigan. She had sustained a gunshot wound to the head and was found dead in her home on November 15, 1977. An autopsy was performed and the manner of death was termed as a homicide. The body of the victim was subsequently embalmed and then buried at a depth of 6 feet in an unsealed casket that was placed inside an unsealed cement vault. Information leading to the perpetrator of the crime became known in 2004 and the investigating agency was unable to locate an autopsy report. Therefore, law enforcement officials requested the body be exhumed and a second examination be performed.

The current exhumation yielded thousands of live specimens of a single species of Collembola or spring tails, *Sinella (Coecobrya) tenebricosa*. This species is considered to be a “tramp” species, cosmopolitan in the United States and Canada. It is usually collected in protected areas such as caves, wood piles, and greenhouses. Based on their occurrence in soils, small size, and given the damp conditions present in the casket, this species probably made use of soil pores and tunnels made by worms and other burrowing arthropods in searching for food. Over time, some individuals moved down further into the soil into the moist vault and eventually the casket where cadaver tissues and clothing provided a suitable substrate for fungal/yeast/mold growth as a food source. At this site the species had ideal conditions and the population exploded. Collected with the Collembola were large numbers of Acarina (mites) of the Family Glycyphagidae, and phorid fly puparia, known as coffin flies.

Insects, Burial, Collembola

G52 Seasonal Effects on Blow Fly Species Composition and Behavior

Jennifer Y. Rosati, BSc*, and Sherah L. VanLaerhoven, PhD, University of Windsor, Rm 119 Bio, 401 Sunset Avenue, Windsor, Ontario N9B 3P4, Canada

After attending this presentation, attendees will learn about blowfly species and behavior and how it relates to decomposition and PMI determination.

This presentation will impact the forensic community and/or humanity by recognizing the importance regarding the effects of habitat and season on blowfly species composition and behavior.

Blowfly species composition is an important aspect to consider in the determination of the postmortem interval (PMI). Presented here are some preliminary results from the first year of a 2-year decomposition study. The effect of habitat (sun and shade) and season (spring, summer, and fall) on the successional patterns of carrion insects were investigated using the domestic pig. Each season, 2 freshly killed pigs (approximately 23kg) were placed in each habitat type in 6 test sites located throughout Windsor/Essex County, Ontario (n=12 pigs/season). Insects were sampled using a combination of pitfall and malaise traps as well as direct sampling. Internal carcass temperatures and ambient temperatures were recorded for each pig using Smartbutton data loggers and biomass loss was determined through weekly weighing. The effect of habitat and season can play a significant role in determining the species composition and successional patterns of the blowfly community. Observations and differences concerning maggot feeding and wandering behavior for each habitat and season were recorded. The research is currently on going with the second year beginning in April 2006.

Blowfly Species Composition, Blowfly Behavior, Habitat and Seasonal Effects

G53 Improving Postmortem Interval Estimates in Forensic Entomology: Blowfly Gene Expression and Development

Aaron M. Tarone, BS*, Department of Zoology, 203 Natural Sciences Building, Michigan State University, East Lansing, MI 48824; and Kimberly C. Jennings, BS, and David R. Foran, PhD, School of Criminal Justice, 560 Baker Hall, Michigan State University, East Lansing, MI 48824

After attending this presentation, attendees will learn about the use of gene expression information to assist in making entomology based PMI estimates.

This presentation will impact the forensic community and/or humanity by improving the precision of entomology based PMI estimates.

Investigators often use the presence and age of blowfly larva on a carcass to estimate the postmortem interval (PMI). Currently, morphological traits, including larval instar and length and weight are used to approximate larval age. Likewise, pupae can be dissected and morphological features observed. However, the precision of these estimates is always in question, particularly for the longer third instar and pupal stages.

The goal of this project was to produce a more objective, genetic-based assay of juvenile fly age, and thus PMI, focusing on the widely distributed and forensically useful blowfly, *Lucilia sericata*. The foundation for this assay was the wealth of developmental data already available from the model fly system *Drosophila melanogaster*, as well as from a *sericata* sister species, *L. cuprina*, a sheep parasite that has been studied in Australia and New Zealand. In both systems, a variety of developmentally important genes have been shown to undergo changes in expression levels throughout the immature stages (egg, larva, and pupa). Using known sequence from *D. melanogaster* and *L. cuprina*, a suite of genes (white, scalloped wings,

resistance to organophosphate 1, acetylcholine esterase, ultraspiracle, ecdysone receptor, wingless, slalom, aminopeptidase 1, bicoid, chitin synthase, and heat shock proteins 60 and 90) was isolated and sequenced in *L. sericata*. The expression levels of these genes were profiled throughout the juvenile life cycle at two temperatures. They were also assayed in larvae that failed to pupate.

Gene expression profiles were obtained for replicate time series, as were the distributions of gene expression levels. Examples of informative transcripts at a specific stage include resistance to organophosphate-1, which became the most common transcript in mid pupal samples, and scalloped wings, which decreased dramatically at the same time. Through replicate analysis of many individuals from each developmental stage, a confidence interval could be assigned to the expression level of each gene throughout the life cycle. Further, by analyzing the expression levels of a number of genes, confidence levels could be assigned to the estimate of developmental stage of the flies. Finally, expression profiles of larvae that failed to pupate were examined, which indicated aberrant gene expression lay at the root of this phenotype.

Current research in forensic entomology includes investigation of error rates for PMI estimates, as well as improved use of environmental information, in an attempt to increase the accuracy of PMIs generated in this way. The developmental gene expression research presented here addresses the biological side of the same issue. The method allows for a quantitative analysis of age using many different traits, and represents a promising approach for improving entomology based PMI estimations.

This project was supported by Grant Number 2004-DN-BX-K005 awarded by the National Institute of Justice, Office of Justice Programs, U.S. Department of Justice. Points of view in this document are those of the author and do not necessarily represent the official position or policies of the U.S. Department of Justice.

Forensic Entomology, DNA Expression Levels, Postmortem Interval

G54 The Developmental Studies of The Green Bottle Fly, *Phaenicia coeruleiviridis* (Diptera: Calliphoridae)

Kc L. Deaver, MS*, 2704 72nd Avenue, SE, Mercer Island, WA 98040; and Jerry Cook, PhD, Sam Houston State University, Department of Biological Sciences, 300 Lee Drain, Box 2116, Huntsville, TX 77341

After attending this presentation, attendees will learn the developmental growth times of *Phaenicia coeruleiviridis* in this preliminary study of this species.

Insects collected at crime scenes are often used to estimate PMI (Postmortem Interval). Developmental growth curves of individual species are used in these estimations. To date, there is very little information on the species *Phaenicia coeruleiviridis*. This presentation will impact the forensic community and/or humanity by helping in creating a more accurate PMI estimate when *Phaenicia coeruleiviridis* is used.

Despite its obvious presence and abundance in the south and southeastern parts of the United States, there is little information on the growth and development of the green bottle fly, *Phaenicia coeruleiviridis* (Macquart). Growth curves were determined for the egg, larva, and pupa stage of this species under constant temperatures of 21.1, 23.8, and 26.6°C. Development from egg to adult under all temperatures ranged from 608 to 844h. Length and mass measurements for each development stage at each temperature regime were reported, giving investigators an option for analysis of age and postmortem interval estimations using *P. coeruleiviridis*. Although the genus *Phaenicia* (=*Lucilia*) is small and the species appear similar, developmental data varies greatly within this genus, indicating a need for further study.

Developmental Growth Curve, Forensic Entomology, *Phaenicia coeruleiviridis*

G55 Effects of Fluctuating Temperature and Larval Density on *Calliphora dubia* (Diptera: Calliphoridae) Implications for Postmortem Interval Estimation

Ian Dadour, PhD*, and Sasha Voss, BSc, University of Western Australia, Centre for Forensic Science, 35 Stirling Highway, Nedlands, 6009, Australia

After attending this presentation, attendees will be briefed on this part of a series of research papers, which revisits fly life histories and examines them in the environment lived in, rather than the constancy of the laboratory. Entomologists involved in case-work need to understand developmental rates of insects.

This presentation will impact the forensic community and/or humanity by reminding forensic entomologists to be careful in their assessment of fly life histories and their application in case work.

The accuracy of any entomological estimation of postmortem interval (PMI) depends on the thermal history of the larval samples investigated and the availability of comparative developmental reference data. At present, there is a paucity of data relating to larval development under geographic-specific climatic conditions and the influence of micro-environmental temperature produced by larval aggregations on development.

Most entomological PMI estimates are based on reference data compiled from larvae reared at constant temperatures. These estimations have the potential to be erroneous where ambient temperatures at the crime scene fluctuate over time, or where larval aggregations are present on the cadaver during development. High larval density can alter the temperature of the microenvironment experienced by the larvae above that of the ambient temperature used in the PMI estimation.

In this study, the rate of larval development of the forensically significant blowfly, *C. dubia*, was investigated under both constant and fluctuating temperature regimes. Temperatures investigated approximated the summer (24°C; 19/30°C) and autumn (19°C; 13/25°C) seasonal temperatures of southern Western Australia. The influence of larval aggregation on the development rate of *C. dubia* was also investigated using larval densities of between 50 and 5000 larvae. This presentation will discuss the influence of larval aggregation size and fluctuating temperatures on the development rate of *C. dubia* and the implications of this for PMI estimation.

Development, Flies, PMI

G56 The Composition and Succession of Soil Microbial Communities Following Cadaver (*Rattus rattus* L.) Burial

David O. Carter, PhD*, Department of Plant Pathology, University of Nebraska-Lincoln, 406 Plant Sciences Hall, Lincoln, NE 68583-0722; David Yellowlees, PhD, School of Pharmacy and Molecular Sciences, James Cook University, Douglas, QLD 4811, Australia; and Mark Tibbett, PhD, School of Earth and Geographical Sciences, University of Western Australia, Crawley, WA 6009, Australia

After attending this presentation, attendees will understand fundamental principles concerning the composition and population dynamics of soil microbial communities associated with cadaver decomposition in soil.

This presentation will impact the forensic community and/or humanity by demonstrating the potential for microbial succession as a basis for estimating postmortem interval.

Recent research has shown that the soil microbial biomass can respond positively to the burial of a juvenile rat (*Rattus rattus*) cadaver.

However, it is unknown what components (bacteria, fungi) of the soil microbial biomass are associated with this increase in microbial abundance. It is well understood that the amendment of soil with an organic resource (such as a cadaver) can result in a shift in the composition of the soil microbial community. Furthermore, the composition of microbial communities can also change as a resource decomposes and these successional changes may provide a basis to estimate postmortem interval.

The current experiment aims to demonstrate the concentration and succession of Gram-positive bacteria, Gram-negative bacteria, and fungi associated with cadaver breakdown. In order to investigate this, a field experiment was conducted at two disparate field sites during the dry season (March 2003). Site 1 comprised a loamy sand soil (84% sand, 11.1% silt, 4.9% clay) and was located in Yabulu, Queensland, Australia. Site 1 receives an average rainfall of 140 mm during the dry season (March–October) and average maximum/minimum temperature equals 22.9 °C/16.7 °C. Site 2 comprised a sand soil (97.7% sand, 1.3% silt, 1% clay) and was located in Pallarenda, Queensland, Australia. On average, site 2 receives 120 mm of rainfall during the dry season and the average maximum/minimum temperature is 26.9 °C/16.4 °C. The resulting vegetation at the two sites was dominated by grasses with scattered trees. These characteristics are typical of a tropical savanna ecosystem.

Juvenile rat (*Rattus rattus*: ~18 g) cadavers were buried (2.5 cm) in the center of a 2 m² plot. Cadaver mass loss and phospholipid fatty acid (PLFA) concentration of soil directly surrounding each cadaver were measured at 7, 14, and 28 days following burial. To measure PLFA concentration soil was amended with a chloroform:methanol:phosphate buffer, shaken and centrifuged. Supernatant was removed, placed in a clean glass culture tube, and dried under nitrogen (N₂). Dried lipids were resuspended in chloroform and phospholipids were eluted with methanol through a silicic acid column and dried under N₂. Dried phospholipids were amended with acidified methanol, incubated for 12 hours at 60 °C, and amended with purified water and petroleum ether. The ether layer was transferred to a clean culture tube and dried under N₂. Standard (19:0) and hexane were added to the dried ether layer and PLFAs were separated by capillary gas chromatography using an automated procedure developed by MIDI (MIDI, Inc. Newark, DE). PLFAs were used as markers of Gram-positive bacteria (15:0, i15:0, i16:0, 17:0, i17:0, a17:0), Gram-negative bacteria (cy17:0, cy19:0, 16:17c, 16:17t) and fungi (18:26c). This experiment was replicated four times and controls (soil without cadaver) were used.

After one week's burial cadaver decomposition at Site 2 (1/3 mass loss) was greater than at Site 1 (1/4 mass loss). All cadavers lost approximately ¼ of mass after two weeks at which time the larger soil microbial community was found at Site 1. At this site, the microbial community was dominated by bacteria throughout, and Gram-positive and Gram-negative bacteria comprised equal fractions of the population. Fungal PLFAs were detected after two and four weeks only. The microbial community at Site 2 was also dominated by bacteria for the first two weeks after burial, and Gram-positive and Gram-negative bacteria also comprised equal fractions of the bacterial population. In contrast to site 1 however, the microbial community was dominated by fungi on day 28.

These findings are not surprising considering the introduction of a high-quality; complex resource (such as a juvenile rat cadaver) tends to result in the proliferation of bacteria. As these resources are depleted bacteria are commonly replaced by fungi, which are more tolerant to moisture stress and can be indicators of low soil nutrient status. The difference in succession between soils may be because cadavers buried at Site 2 reached skeletonization prior to cadavers buried at Site 2. These successional sequences may be used as a basis to estimate postmortem interval of cadavers that have progressed into the skeletonization stage of decomposition. The dynamics of specific PLFAs will be presented in relation to cadaver decomposition stage.

Taphonomy, Succession, Phospholipid Fatty Acid Analysis

G57 Nematode Community Dynamics Associated With Cadaver (*Sus scrofa* L.) Decomposition and Insect Activity on the Soil Surface

David O. Carter, PhD*, Department of Plant Pathology, University of Nebraska-Lincoln, 406 Plant Sciences Hall, Lincoln, NE 68583-0722; Timothy E. Huntington, MSc, and Leon G. Higley, PhD, Department of Entomology, University of Nebraska-Lincoln, 202 Plant Industry, Lincoln, NE 68583-0816; and Thomas O. Powers, PhD, Department of Plant Pathology, University of Nebraska-Lincoln, 406 Plant Sciences Hall, Lincoln, NE 68583-0722

After attending this presentation, attendees will understand the relationships between the composition of belowground nematode communities and cadaver decomposition as well as how these relationships are influenced by insect activity.

This presentation will impact the forensic community and/or humanity by demonstrating the potential for nematode succession as a basis for estimating postmortem interval.

Soil-dwelling nematodes are microscopic invertebrates that play a key functional role in soil processes of decomposition and nutrient cycling. Nematodes are generally the most abundant and diverse metazoans living in the soil and respond rapidly to disturbance, such as the decomposition of a body. The investigation of nematode community structure can reflect decomposition status because nematodes exhibit a sensitive relationship to their environment by responding to the spatial and temporal dynamics of resources. Thus, a localised succession of nematode trophic groups (bacterial-feeder, fungal-feeder, herbivore, omnivore, and predator) occurs as a resource decomposes. Nematodes are readily sorted into trophic groups because feeding behavior can be deduced from the structure of the mouth cavity and pharynx. This makes nematodes an efficient indicator of decomposition status. In addition, nematodes may be transported to a decomposition site by insects. This may have implications for forensic science because nematodes can establish phoretic relationships with many insects associated with cadaver decomposition (Calliphoridae, Coleoptera, and Silphidae).

This study was based on the understanding that (1) insects respond rapidly to the placement of a cadaver on the soil surface and (2) a proliferation of soil microorganisms is associated with cadaver decomposition in soil. This work aimed to test the hypothesis that nematode community composition is related to the stage of cadaver decomposition and insect activity.

Six 10-week-old pig (*Sus scrofa* L.) cadavers (~45 kg) were killed by trauma (gunshot) to the head and placed inside a 2 m² plot on the soil surface within 30 minutes of death. Three cadavers were exposed to insects, three were excluded from insects using Lumite (18 x 14 mesh) exclusion cages (6 ft³), and controls (plots without cadavers) were used. Thus, four treatments were used: + cadaver + insects, + cadaver - insects, - cadaver + insects, - cadaver - insects. Cadaver decomposition was measured using a decomposition scoring system at intervals of 24 hours for the initial seven days and at intervals of seven days thereafter. Cadaver decomposition was designated as being in one of four stages: Fresh, Early Decomposition, Advanced Decomposition, and Skeletonization. Soil samples (0 cm -10 cm depth) were collected from soil adjacent to the cadavers at intervals of seven days using a soil probe (2.5 cm diameter). Following transportation to the laboratory nematodes were extracted from soils enumerated and identified morphologically. DNA sequencing was used for identification when nematodes could not be identified morphologically.

The exclusion of insects had a significant negative effect on cadaver decomposition. Cadavers exposed to insect activity reached Early Decomposition by day 2, Advanced Decomposition by day 4 and Skeletonization by day 21. In contrast, cadavers excluded from insect

activity reached early decomposition by day 3, Advanced Decomposition by day 21 and had not reached Skeletonization by day 49. Insect activity also had an effect on belowground nematode abundance that was characterized in a delay in peak nematode abundance. In the presence of insects nematode abundance reached peak levels on day 14. Nematode abundance in the absence of insects reached peak levels on day 21 to day 28 and a second peak was observed on day 49. The nematode community in association with insect activity could be dominated by phoretic nematodes while the nematode community in exclusion cages could be dominated by native soil-dwelling species. Nematode species identification is currently underway and results will be presented.

Taphonomy, Nematode, Succession

G58 Characterization of Adipocere Formation in Animal Species

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After attending this presentation, attendees will understand the chemical process by which adipocere forms, the requirements for its formation, the types of animal species it has been observed on, and an example of a case study in which its identification was required.

This presentation will impact the forensic community and/or humanity by discussing the value of adipocere as evidence and the limits associated with confirming its human origin in cases of homicide or human rights issues.

The aim of this presentation is to demonstrate the importance of identifying the species origin of adipocere samples collected as evidence. After attending this presentation, attendees will understand the chemical process by which adipocere forms, the requirements for its formation, the types of animal species it has been observed on, and an example of a case study in which its identification was required.

Adipocere is a soft white substance formed postmortem from fatty tissue in a decomposing body. Its formation is characterized by the hydrolysis and hydrogenation of the neutral fats into a mixture of predominantly saturated fatty acids. Under suitable conditions adipocere may form on both human and animal remains. The majority of research investigating adipocere formation has focused on either human remains or porcine remains, as a model for human decomposition. However, no studies of the nature of adipocere formation in other animal species have been reported. This study was conducted as a result of two enquiries from independent forensic laboratories to assist with the identification of adipocere collected as evidence in homicide cases. In both instances, the species origin of the adipocere fragments was in question.

Adipocere was formed in a controlled soil environment by burial of fatty tissue samples of several different animal species. Infrared spectroscopy was used to provide a lipid profile of the fatty tissue and adipocere samples. Gas chromatography-mass spectrometry was employed as a method for the identification of fatty acids in the original tissue and adipocere. Of the six species investigated, adipocere did not form on two of the species due to their reduced fat content. The adipocere that formed from the other species' tissue could not be visually discriminated between species.

The chemical characterization demonstrated identifiable differences in the fatty acid content of the original adipose tissue. Characterization of the adipocere samples also demonstrated differences in fatty acid content however this was determined to be a result of the different rates of formation of each species. The results suggested that the fundamental composition of adipocere is similar regardless of the species on which it formed. There was no evidence to suggest that the chemical composition

of adipocere is species-dependent. This conclusion highlights the difficulty associated with determining the species origin of adipocere, whilst also demonstrating the caution, which must be taken when attempting to link adipocere fragments to human remains.

Further studies are presently on-going to determine the feasibility of extracting DNA from adipocere. Extraction of DNA may provide the necessary information for determining species origin, as well as providing further evidentiary value in human identification. This presentation will impact the forensic community and/or humanity by discussing the value of adipocere as evidence and the limits associated with confirming its human origin in cases of homicide or human rights issues.

Adipocere, Species Origin, Characterization

G59 Maggot Development During Morgue Storage and the Effects on Estimating the Postmortem Interval

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The goal of this presentation is to present to the forensic sciences community research which demonstrates the potential for insect development during pre-autopsy morgue storage which may in turn affect estimates of postmortem intervals by forensic entomologists.

This presentation will impact the forensic community and/or humanity by demonstrating the need to consider insect development during morgue storage.

Forensic (or medicocriminal) entomology, the use of arthropods in legal investigations, is most frequently employed to estimate the post-mortem interval (PMI) of victims of violent crimes or suspicious deaths. The most commonly used method of PMI estimation employs temperature-dependent developmental rates of blow fly larvae (Diptera: Calliphoridae). Retrospective scene temperatures, those temperatures, which the insects experienced during development, are used in combination with known developmental rates of the species involved to estimate the age of the larvae, which often correspond closely with the time of death of the victim. When insect evidence is obtained during autopsy, forensic entomologists often need to make decisions regarding the effects of low temperature (-1°C to 4°C) storage of the body and associated insects when estimating the PMI. Some have argued that development ceases during refrigeration, while others suggest that maggot mass temperatures go unchanged.

During the course of a 2003 homicide investigation, temperatures experienced by the insects associated with the victim were recorded from the time the body was removed from the scene until autopsy using an Onset Hobo H8 data logger. During the intervening time the body was kept in a standard morgue cooler and the temperatures which were recorded showed that the insects were able to maintain high enough temperatures to be able to continue development despite the cold storage temperature. Consequently, subsequent experiments with decomposing pigs were conducted to confirm observations on maggot development in morgue coolers and to establish the magnitude of temperature differences.

Seven porcine cadavers were used: "small pigs" (approx. 11 kg) and "big pigs" (38 kg avg.). Pigs were placed in the field for up to 14 days to allow for insect colonization and maggot mass formation, which were defined as aggregations of feeding third stage blow fly larvae. Upon removal from the study site, each pig was wrapped in a clean sheet and placed in a medium-duty body bag, as is standard procedure for human remains. Thermocouples were attached to each replicate and temperatures inside and outside of body bags were measured during storage in a morgue cooler. Temperatures remained significantly higher ($P < .05$) inside of the body bags relative to the cooler, and remained at levels sufficient for maggot activity (feeding and development). Maggot development was slowed, but not enough to discount insect development between removal of the body from the scene and autopsy. If the assumption is made that no

insect development takes place during pre-autopsy refrigeration, potential error rates in PMI estimation of 8.6 – 12.8% occur. The potential for blow fly larvae to undergo significant development, including stadia transitions, while being stored in the morgue is a real possibility. Forensic entomologists must consider this continuing development during the course of an investigation involving samples collected at autopsy.

Forensic Entomology, Postmortem Interval, Autopsy

G60 An Unusual Postmortem Change in a Child Homicide—Leaching

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After attending this presentation, attendees will learn about an unusual form of decomposition change through leaching (loss of fluid from the body).

This presentation will impact the forensic community and/or humanity by creating awareness of such a finding and discussion of mechanism by which such a change occurred.

A child came to Singapore with her mother to study in a primary school. Her mother went back to China and left her on her own. The child went missing and sparked off a nationwide search. In the local hot and humid climate, bodies outdoors decompose quickly and early putrefaction begins within two to three days leading to early skeletonization in a week when the body is left in the open. Police investigations led to the arrest of a friend of the mother's whom the child was familiar with. After 3 weeks, the child's body was finally recovered, packed in nine plastic bags within a cardboard box in the undergrowth of a local hill-park. The case attracted much media sensation as well as outpouring of public sentiment.

At autopsy, the body was found to be much better preserved than expected. Bruises were well-defined and internal organs were well preserved. The condition of the body permitted better recovery of evidence of injury for determination of injuries resulting from allegations of sexual assault. It was also noted that after the autopsy was completed, signs of mummification became evident very quickly.

The presentation will discuss the cause of death, an unusual form of decomposition change, which has not been previously described in the literature, and the mechanism for such a postmortem change.

Decomposition, Child-Homicide, Leaching

G61 Comparison Study of Various Protocols to Release Maximal Amounts of Amplifiable DNA From Decomposed Soft Tissue Exposed to Different Environmental Conditions

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After attending this presentation, attendees will understand what protocols are most suitable for certain decomposed tissue remains based on type of soft tissue and the environmental conditions from which it came.

This presentation will impact the forensic community and/or humanity by providing guidance to the pathologist and DNA analyst in

obtaining the maximum quantity and quality of DNA from decomposed soft tissue samples.

The protocols investigated were compared using five different tissue types (brain, heart, kidney, liver, lung) exposed to three different environmental conditions (fire, submersion in water, and bog/swamp).

This presentation will benefit the forensic community by providing guidance to the pathologist and DNA analyst in obtaining the maximum quantity and quality of DNA from decomposed soft tissue samples.

At autopsy, questions are often raised regarding what type of tissue to send off for DNA analysis when the body is in a state of decomposition. While the standard answer has routinely been deep muscle tissue, anecdotal evidence from the Delaware OCME DNA Unit and Armed Forces DNA Identification Laboratory (AFDIL) have suggested that this is not always the case and that in fact, organ tissue is often preferable. Historically, the research regarding decomposed tissue samples and associated DNA yields has been somewhat limited because the typical DNA laboratory does not have access to such samples. The fact that Delaware's forensic DNA laboratory is located at the Office of the Chief Medical Examiner and, therefore, has access to such samples, allowed for this much needed study to be performed. Decomposition is a cumulative consequence that naturally occurs over time once a body is no longer living. Decomposition originates from the activity of microorganisms/bacteria and internal biodegradative enzymes, including DNases that cause autolysis of the body. The concentration levels of bacteria and enzymes vary amongst organs during decomposition based on the organ's function and location within the body. This variation results in some organs degrading DNA at a faster rate than other organs. Additionally, decomposition can be altered by external stimuli associated with different environmental conditions because different conditions have different effects on factors such as temperature, moisture, pH, and partial pressure of O₂.

Four extraction protocols were investigated in a collaborative effort between Delaware OCME, AFDIL, and National Medical Services (NMS) to develop the most successful extraction procedure from various organ tissues exposed to different environmental conditions. The four different extraction protocols were an organic extraction using a non-ionic detergent based digestion buffer, an organic extraction using an ionic detergent based digestion buffer, a non-organic extraction using standard columns, and a non-organic extraction with paramagnetic beads. In addition, variations in reagent amount as well as variations in reagent amount plus sample amount were studied. The tissue sample extracts were then quantitated, amplified, and analyzed. Data and conclusions will be presented and discussed at the meeting.

DNA, Decomposition, Tissue

G62 Eagles Syndrome: Case of an Elongated and Ossified Stylohyoid Ligament in an Elderly Female

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After attending this presentation, attendees will be able to recognize cases involving Eagles Syndrome and have a basic understanding of the mechanisms, which may result in this bony anomaly, and associated symptoms.

This presentation will impact the forensic community and/or humanity by providing death investigators with information to ascertain the presence of the skeletal anomaly Eagle Syndrome and how it may or may not be involved in the death of the deceased.

The case presented is that of a 72-year-old Negroid Female whose badly decomposed and, partially skeletonized remains were recovered from her residence in Baltimore, Maryland. Local police were called to the res-

idence of the deceased, by neighbors who reported a foul smell. Investigation of the scene found the deceased lying in her bed clothed. Police found no evidence of forced entry into the residence, or other evidence indicative of foul play. Relatives of the deceased reported that she was last seen alive approximately one month prior, during the summer months. Examination of the body at the Office of the Chief Medical Examiner in Baltimore, Maryland, found it to be in an advanced state of decomposition with partial exposure of the skull and upper thoracic cavity. Inspection of the chest and abdominal cavity revealed the absence of the internal organs as a result of decomposition. No injuries or notable defects were observed on the remains with the exception of an extraordinarily long, and irregularly shaped left styloid process of the skull.

The extremely large and lengthy styloid process was recognized as "Eagle syndrome" which is described as the elongation of the styloid process and stylohyoid ligament calcification. Eagle syndrome has been named under several other synonyms including stylohyoid syndrome, hyoid syndrome, styloid elongation syndrome, styloid process syndrome, and carotid artery syndrome. The syndrome is well documented in the dental and otolaryngology literature however it has not been widely reported in radiological and general pathological literature. Multiple symptoms are associated with Eagle syndrome, which includes cough, dizziness, recurrent throat pain, voice alteration, dysphasia and /or facial pain, and sensation of a foreign body present in the throat. It has also been reported that that approximately 4% of the general population is thought to have elongation of the styloid process, and that only a small percentage of those individuals 4% to 10%, are thought to be symptomatic.

Anthropological studies have documented the prevalence of elongated styloid process, in particular the high frequency of occurrence among various Mongoloid populations. The average length of the styloid process in adult is approximately 2.5 cm, and in most individuals there is little variation in length between left and right process. Eagle syndrome has been documented as occurring unilaterally or bilaterally. Recognition of Eagle syndrome is rare among the forensic case population unless it is noted during detailed radiographic examination of lateral views of the head and neck, or during gross examination of skeletonized remains. Most cases are picked up by dentists or oral surgeons during routine panoramic radiographs, or by physical examination involving palpation of the elongated styloid process in the tonsillar fossa, of those individuals who are symptomatic.

In the case of the elderly Negroid female, the recognition of Eagle syndrome was made during removal mummified and decomposed tissues surrounding the skull. The left styloid process measured approximately 8 cm in length, and had an average circumference of approximately of approximately 2.5 cm. Not only did the left styloid process look extremely large, but it had the appearance as if three medial phalanges had been fused together. Examination of the right side of the skull found the right styloid process to be near non-existent, measuring less than 5 mm in length. Close inspection of the left carotid foramen revealed evidence of significant narrowing resulting from the enlargement of the base of the styloid process. A review of the deceased medical records obtained by investigators later in time, provided documentation of Eagle syndrome which had been noted during a dental panoramic exam in 2003 to access periodontal disease. According to the medical records, the elderly woman was asymptomatic at the time of the exam. Documentation of Eagle syndrome provided a means of positive identification of the deceased. In regards to cause and manner of death, the absence of trauma, and documented history of heart disease, and negative toxicology, the case was signed out as hypertensive atherosclerotic disease -natural.

The cause of the elongation of the styloid process is not well understood. Multiple theories have been forwarded including congenital elongation, growth of osseous tissue at the insertion of the stylohyoid ligament, and calcification of the stylohyoid ligament by an unknown process. Pathophysiological mechanisms of symptoms is also contested which include irritation of pharyngeal mucosa by post-tonsillectomy scarring or by direct compression, traumatic fracture of the styloid process resulting in

proliferation of granulation tissue, inflammatory or degenerative changes in the tendon, and impingement of the carotid vessels thus irritating the sympathetic nerves of the arterial sheath.

Eagle syndrome can be treated by surgical and no surgical intervention. No surgical treatment includes steroid injections and other anti-inflammatory medications. Surgical treatment involves removal of the elongated portion of the styloid process.

Anthropology, Eagles Syndrome, Skeletal Pathology

G63 Where is the Head? A Case of Homicidal Decapitation

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The goal of this presentation is to present the case of a complete homicidal decapitation. Investigation of the scene where the body was discovered, autopsy findings, and DNA analysis are described. In particular, the primary importance of histological and immunohistochemical study to evaluate the vitality of wounds is underlined.

Only a few cases of homicidal decapitation are reported in the forensic literature. Sometimes the forensic pathologist faces the particular case, which may be difficult to distinguish between a vital or a postmortem beheading, especially when the circumstantial data is insufficient. This presentation will impact the forensic community and/or humanity by showing how histological and immunohistochemical investigations play a decisive role in forensic medicine.

Cases of complete decapitation have been sporadically reported in the forensic literature. In spite of high suicide rates all over the world, this particular mode of death is a relatively rare finding in violent suicidal deaths. Suicides by self decapitation have been reported, like those where individuals deliberately put their neck onto the track while a train is approaching or those where subjects use a ligature tied between the neck and a stationary object while attempting to drive a vehicle away, or even cases where individuals use a guillotine. Also unintentional decapitations are possible in suicidal cases, as after hangings. Accidental decapitation may also occur, for example, in cases of train pedestrian fatalities, industrial accidents, and unusual injuries during road accidents regarding either cars or motorcycles. Even more rare is the homicidal decapitation. This manner of death has been used for centuries for execution all over the world, and today is still used in some countries to carry out a death penalty. In recent years beheadings have also been registered in those homicides perpetrated by satanic sects, serial killers, or even in hostage killings. The forensic pathologist may meet some difficulties in evaluating cases of decapitation. A relevant problem, which the forensic pathologist has to face, may be the differentiation between a real decapitation and post-mortem mutilation of the body.

Here is presented the case of a 32-year-old Italian woman murdered by her Romanian partner and found dead under a bridge in a country of South Italy. The man himself, who in the meantime had escaped abroad, phoned the police indicating the place where he had left the lifeless body of the woman, and he also confessed to having strangled her. When the police officers arrived at the suggested place, they found the lifeless body of a woman, tidily dressed, with the upper regions of the body completely wrapped in her jacket. When they lifted it they discovered that the body was completely decapitated. Numerous locks and shards of the scalp were scattered all around the body, abundantly stained with dried blood. Some locks held her earrings and necklace. On the ground beneath the body there was only a small amount of blood. Notwithstanding the careful examination of the scene where the body was discovered and the adjacent countries, neither the severed head nor the injuring tool was found. Only a metal bar, 66 cm in length and 2 cm in diameter, was recovered near the body, showing on its surface some blood spots. The postmortem examination

showed that the neck was completely cut 3 centimeters above the jugular fossa; the wound margins were clear-cut, which led the examiner to assume that the head had been cut off with a sharp tool. The vertebral column was disconnected on the level of the seventh cervical-first dorsal vertebra. Numerous superficial linear wounds, of different length, and many excoriation zones with soft tissue bleeding underneath were present on the cutis adjacent to the neck lesion. No relevant injuries were detected in the remaining body parts. The lack of the severed head didn't allow analysis to injuries in this site. Massive blood aspiration, soft tissue hemorrhage surrounding the neck lesion and the pallor of inner organs as signs of bleeding out, were present. Histological investigation applying hematoxylin and eosin staining revealed massive hemorrhages in the cutaneous and subcutaneous tissues. Immunohistochemical studies were performed on the cutis specimens collected from the neck lesion for the determination of the vitality of the neck wound. The expression of Fibronectin, α_1 -antichimotrypsin, antitryptase, CD 31, and collagen type IV was analyzed. The positive results lead us to conclude that the neck lesion was vital, identifying homicidal decapitation as cause of death. Two months later a countryman discovered the skeletal remains of a human head on the back of his homestead, about 200 m from the place where the body was discovered. The skull showed no fractures. DNA analysis established that those skeletal remains belonged to the same woman.

Homicidal Decapitation, Vitality, Immunohistochemical Study

G64 Simple Tissue Preservation Methods That Result in Reliable DNA Analyses

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The goal of this presentation is to inform attendees of several simple tissue preservation methods that are conducive to obtaining a quality DNA sample. The procedures outlined can be applied to many situations, since the methods examined were developed for use in situations where time, materials, and facilities are limited.

This presentation will impact the forensic community and/or humanity by demonstrating providing valuable information on how to successfully preserve tissue samples for subsequent DNA analysis. The methods examined for this study required minimal materials, storage space, and temperature considerations. For these reasons, the results of this research can be useful to many factions of the forensic community, from mass disaster response teams, to conservation officers, to crime scene technicians. By having a simple tissue preservation method available in the field, samples can be preserved immediately, which increases the potential for a successful DNA analysis in the laboratory.

This presentation provides an evaluation of on-site tissue preservation methods, examining the success of each in yielding high quality DNA. The research examined factors such as availability and portability of materials, tissue storage life at room temperature, ease of use, ease of subsequent DNA extraction, and the quantity and quality of DNA obtained from preserved samples. Attendees will gain an understanding of the range of tissue preservation methods available, as well as the efficacy of each method in preserving DNA. The goal of this study was to develop a rapid, reliable method for storing tissue samples that can be easily employed in the field.

In the event of a mass disaster, where a large number of victims must be located and identified, it becomes difficult to process the site in a timely and orderly manner. Due to extensive injury or decomposition, many victims may only be identified through DNA analysis; therefore, obtaining viable tissue samples is of great importance. Amidst the rush of locating survivors, making anthropological identifications, and gathering other information about the victims of the disaster, tissue collection for subsequent DNA testing is often delayed. Likewise, tissue preservation of remains discovered in very remote areas can also be hindered. The goal of

this study was to examine protocols for on-site tissue preservation that would undergo later DNA analysis. Through development of simple, portable, and readily available methods for preserving tissues in the field, robust DNA results are more likely to be obtained.

Testing was conducted on tissues taken from recently killed pig carcasses that had been placed in a field during the summer; samples were collected regularly over a one-month period. Six preservation methods were evaluated: storage of tissue in ethanol, isopropanol, RNAlater (Ambion, Inc.), and silica desiccant, as well as hot air drying and freezer storage. Muscle, skin, and brain samples were collected in triplicate from each animal, and ca. 0.25 g placed in each storage medium. DNA extractions were performed after two weeks and after three months for each storage method. DNA quality and quantity were assessed using quantitative PCR of three species-specific single-copy nuclear genes. Results were analyzed in order to determine which preservation methods were the most successful in yielding a viable DNA sample after a period of storage.

Although DNA quantity and quality were the most significant factors in the evaluation, many other issues were addressed. Tissue type and level of decomposition, portability of materials, toxicity of the preservative, shelf life of preserved samples, and ease of subsequent DNA extraction were also factored into the analysis. By considering all of these interdependent variables, an optimized, reliable procedure for preserving tissue samples when adequate storage and DNA processing facilities are not readily available can be developed and implemented.

DNA Extraction, Mass Disaster, Tissue Preservation

G65 Quantification and Amplification of MtDNA From Chemically Treated Hair

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After attending this presentation, attendees will learn of some of the techniques used to extract, quantify, and amplify mtDNA from telogen hair shafts that have been chemically treated. The attendee will also be aware of how these chemical treatments affect the quantity and quality of DNA amplified.

This presentation will impact the forensic community and/or humanity by providing knowledge of whether chemical processes cause degradation to DNA in hair shafts and to what extent that damage may be. This knowledge can help the forensic community to establish ways in which to overcome this difficulty so as to enhance mtDNA extraction and amplification from hair so that genetic profiles can be more sufficiently attainable, as hair forensics is becoming increasing significant in forensics and law.

Evidentiary collection at crime scenes and mass disaster typically include hair strands that later undergo DNA typing that can identify victims and assailants. This presentation will impact the forensic community and/or humanity by demonstrating the effect that various beautification processes have on the quantity and quality of amplifiable mtDNA extracted from hair shafts.

Millions of people, both men and women, subject their hair to different chemical treatments, such as bleaching, coloring, and perming. As such, it is reasonable to assume that hair recovered from a crime scene may have come from a person who utilizes one or more of these popular processes.

Nuclear DNA extraction is typically done on hair strands with growing root tissue. However telogen hairs, hair strands that are naturally shed, do not contain roots. The shafts of hair are not suitable for nuclear DNA due to the degradation that occurs because of the keratinization process. However, mitochondria are present in abundance in hair shaft. Therefore, mitochondrial DNA is typically extracted from the myriad of

mitochondria that are still present in cells. There have been several studies on the efficiency of mtDNA extraction from hair. While the consensus among these studies is that adequate amounts of mtDNA can be extracted from hair and other types of degraded samples, the quality and quantity of the genetic material recovered has not been directly addressed. Within some of these same studies, researchers agreed that damage to hair caused by fire or environmental conditions can significantly affect the amount of DNA extracted. However, there has not been any published research that examines how normal chemical conditioning of hair affect DNA recovery. With the advent of real time PCR, this DNA can be quantified at the picogram level and by examining the effect of amplicon size, the level of degradation can be evaluated.

In this research project, DNA was extracted from telogen hairs from volunteers who used chemical treatments and those who did not. Ten to fifteen hairs, approximately 2-3 cm long, were extracted from each volunteer using the published phenol chloroform separation method and purification of the DNA. The recovered DNA was quantified with real time PCR. Amplification was done using published mtDNA primers and primers specifically designed for this research. The primers utilized amplified conserved areas of the coding region of mtDNA, as these areas have the least amount of variability. Sequencing was done on selected samples with non-coding, control region primers for the hypervariable 1 and 2 regions. The resulting electropherograms were compared to the known reference samples to determine if adequate amount of quality mtDNA was amplified in order to yield a genetic profile.

The amount of mtDNA recovered varied from person to person, but preliminary results revealed that the quantity and quality of mtDNA recovered from individuals without chemical hair treatments exceeds that which comes from treated hair. However, those hairs subjected to treatments can undergo successful mtDNA amplification and sequencing which can then be used to obtain a genetic profile.

Mitochondrial DNA, Real Time PCR, Telogen Hair

G66 What is Forensic Informatics?

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After attending this presentation, attendees will gain an understanding of the precise meaning of forensic informatics, knowledge of its many dimensions, its role in the progress of the forensic sciences, and the current challenges of the discipline.

This presentation will impact the forensic community and/or humanity by demystifying the boundaries and contents of the concept of forensic informatics and allow forensic scientists an understanding of the dimensions of forensic informatics.

Forensic Informatics is the systematic application of information and computer science and technology to forensic practice, research, development, and learning. It is a major discipline of the forensic sciences and encompasses many other scientific disciplines, which have reached maturity at a first generation level. As a major or covering discipline it has the responsibility for establishing performance standards and ideological goals for the component parts. The forensic responsibility entitles the application of sound computer engineering and scientific principles in an open, introspective, and universal manner applicable to the judicial system. The goal of utility in the solution of crimes, the search for the criminal act, the discovery of the criminal, and the analysis and retention of evidence is obvious; the boundaries of informatics extends into the civil affairs of government additionally and extends into property, taxation, public health, and inheritance; the detailed review of the fine details and codes of computers and computer software entitling long hours of study are not easily obtained, but required. Forensic informatics has practical utility in the solution of complex problems and the retention for review of the detailed data arising

from the solutions of the problems. Importantly, forensic informatics not only records the past in its archival function, and solves problems with its present capabilities, but necessarily provides a key to the future as vacancies in disciplinary content and theory are discovered and programs developed to encompass the missing details.

Current challenges in forensic informatics are immense and include the development of operational and proficiency standards for all forensic software and information systems including the error rate of the system, operator deficiency recording, output errors, logic error detection in software, security requirements for forensic systems, acceptable decay rates, the mathematics of the database, specialized forensic informational databases, data mining of criminal patterns, three dimensional forensic images, the schooling of new scientists in forensic informatics with the development of educational standards and professional employment opportunities, and dimensions in informatics. Guidance to the judiciary in forensic informatics seems of major operational import.

Involvement of the forensic sciences in these initial stages of the “computer revolution” is a major activity of the current membership of the American Academy of Forensic Sciences.

Formal models of forensic informatics and its dimensions are presented in relation to the other recognized disciplines of information and computer science, including medical informatics, pathology informatics, chemical informatics, public health informatics, digital evidence, and bioinformatics.

Forensic Informatics, Forensic Computer Science, Forensic Science Models

G67 Death in Custody: A Historical Analysis

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After attending this presentation, attendees will understand the historical evolution of death in custody, be familiar with the various types of and the agencies that experience death in custody, and recognize the need for conceptual specification of death in custody.

This presentation will impact the forensic community and/or humanity by delineating the historical evolution (both qualitative and quantitative) of death in custody. Few analyses have examined death in custody from a historical perspective. An understanding of the history of death in custody may provide insight that would enhance the development of intervention protocols.

A substantial amount of controversy generally surrounds deaths that occur in custody, especially in this era of instant media coverage and communication. Often, allegations of brutality are launched and community relations are notably compromised. Exacerbating the situation, medical examiners are often presented with minimal physical findings at autopsy. To understand the phenomenon and minimize its occurrence, the medical-legal community has conducted a considerable amount of research. However, few analyses have examined death in custody from a historical perspective. The purpose of this research is to delineate the historical evolution (both qualitative and quantitative) of death in custody. An understanding of the history of death in custody may provide insight that would enhance the development of intervention protocols.

To identify the frequency and type of deaths in custody occurring over time, a retrospective, exploratory analysis was conducted. Using data from Maryland's Office of the Chief Medical Examiner, a sample of approximately 15,000 cases, dating from 1939 to 2004, was examined. Employing a general definition of the phenomenon, all deaths that occurred

in custody were included for analysis. Custodial agencies were operationalized to include law enforcement, correctional, psychiatric and emergency medical. Study variables include, incident location, decedent demographics, behavioral, medical and toxicological indicators, and the cause and manner of death.

Results indicate that death in custody is a multi-faceted phenomenon, subsuming a variety of qualitative types. All manners of death were identified; however natural deaths and suicides comprised the vast majority of cases. Similarly, while all custodial agencies experienced death in custody, most cases occurred in correctional and psychiatric facilities, respectively. Results also suggest that there have been substantive, qualitative changes in death in custody. For example, during the 1940s and 1950s a significant portion of deaths occurred during police transport. This finding reflects the unique role of law enforcement during those decades: prior to the establishment of a formalized emergency medical system, police transported the sick and injured to local hospitals. “Sudden unexpected death in custody,” especially those occurring after a violent struggle with police, emerged during the 1980s and 1990s, concomitant with widespread, recreational stimulant drug abuse.

Generally defined, death in custody is an “umbrella” concept that subsumes a variety of unrelated manners of death and that occurs in disparate custodial agencies. To understand deaths that occur in custody, further conceptual specification is required. Such specification would allow for better methodological precision and improve theoretical/conceptual uniformity.

Death in Custody, Sudden Death, Law Enforcement

G68 Simultaneous Diabetic Ketoacidosis and Neuroleptic Malignant Syndrome in a Patient on Olanzapine

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After attending this presentation, attendees will understand how neuroleptic malignant syndrome and diabetic ketoacidosis are well-described phenomena in conjunction with the use of antipsychotic medications. They can independently cause sudden death and this case report documents their first simultaneous occurrence in a patient taking olanzapine.

This presentation will impact the forensic community and/or humanity by documenting and reporting the first simultaneous occurrence of DKA and NMS in the same patient taking olanzapine.

Learning Objectives: To present to the forensic and psychiatric communities the historical, clinical and laboratory findings in a patient who was diagnosed postmortem as having concomitant diabetic ketoacidosis (DKA) and neuroleptic malignant syndrome (NMS) as the cause of his sudden death.

Case Report: A 32-year-old black male taking olanzapine for a long history of psychiatric illness (variably diagnosed as schizophrenia and schizotypal personality disorder) was found unresponsive. On arrival at the hospital he was afebrile with symptoms and lab findings consistent with DKA. During his stay in the emergency room he developed a progressive decline in mental and clinical status and subsequently developed clinical and laboratory findings of NMS, which were diagnosed postmortem. His condition continued to deteriorate and he expired despite aggressive resuscitative measures approximately 6 hours after being found unresponsive. Body temperature at the time of death was 108 degrees Fahrenheit.

Methods: Medical records and autopsy protocol with laboratory studies were reviewed for this patient and are presented. The medical literature was searched using the keywords *olanzapine, diabetic ketoacidosis, and neuroleptic malignant syndrome* for citations relating to NMS and DKA in the setting of neuroleptic use and relevant citations are reviewed and discussed.

Results: Poor glycemic control is a well-described phenomenon in the setting of neuroleptic use and new-onset DKA has been reported in patients taking many different neuroleptics, including olanzapine. Neuroleptic malignant syndrome, which was reported with much greater frequency on older neuroleptics, has also been reported to occur with newer antipsychotic agents, including olanzapine. A single case of the simultaneous occurrence of NMS and DKA was previously reported in a hospitalized patient on Thorazine. This case report is the first reported case of the simultaneous occurrence of both conditions in a patient taking olanzapine.

Conclusions: While both NMS and DKA are well-known occurrences in patients on neuroleptics and equally well-known causes of death in forensic practice, their simultaneous occurrence has not been previously reported in the era of newer antipsychotics.

Diabetic Ketoacidosis, Neuroleptic Malignant Syndrome, Olanzapine

G69 An Unusual Case of Child Head Injury by Coat Hanger

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After attending this presentation, attendees will understand the value of a multidisciplinary team, composed of clinical forensic medicine specialists, and law enforcement, in the management of injured children.

This presentation will impact the forensic community and/or humanity by demonstrating the value of crime scene reconstruction coupled with the evaluation of physical evidence in determining the factors in equivocal child abuse and neglect investigations.

The question of natural disease process versus accidental injury versus inflicted injury is the central issue involved in a clinical forensic investigation. The physical findings in the infant or child must be correlated with the history provided by the caretaker, as well as milestones achieved by the infant or child. Injuries affecting specific frontal locations, such as the forehead, nose, chin, palms, and knees, are often the result of accidental events secondary to children playing or falling. For these kinds of injuries, the examiner must have an open mind that the injury could be the result of an unintentional event, instead of a horrible episode of domestic violence.

The Clinical Forensic Medicine team in Louisville Kentucky is routinely consulted in a variety of cases of presumed child abuse and neglect. The authors present a case of a 2-year-old female who was brought to the Emergency Department with a large stainless steel hanger embedded in her left frontal region, between the orbit and the bridge of the nose. She was conscious, alert and moved all extremities. A lateral radiograph of the head demonstrated a foreign body embedded in the frontal region of the skull for approximately 2cm. A CT scan of the head demonstrated a U shaped body entering the frontal bone with probable fractures of the cribriform plate and crista galli, a small interhemispheric subdural hemorrhage and a left frontal subdural pneumocephalus. There was no injury to the left globe or nasolacrimal duct.

She was taken to the operating room where the curved part of the hanger was removed and the injured brain was derided. The ethmoid bone and shredded galea were repaired. After a five-day admission, she was discharged to home with a CPS approved caretaker. After examination by the Clinical Forensic Medicine team, coupled with home inspection and interviews by the local police, it was possible to reconstruct the child's injury.

The parent's, who are not married, were reported to be arguing. The child's mother stated that when she had her back turned to the father, he is reported to have thrown a hanger, with the intention of hitting the mother. Instead, the hanger hit his daughter, who was playing on the floor.

The investigators were uncertain whether the hanger was thrown from several feet across the room or if it was directly applied to the child's skull. The tool was a large caliber, stainless steel hanger measuring approximately 4 by 4 millimeters in thickness, while the U-Shaped angle measured approximately 3 centimeters. Experiments conducted by the police using a similar hanger and double-up pieces of cardboard demonstrated the U-shaped portion of the hanger penetrated the cardboard six inches deep or more, when thrown from the same distance the father stated he was from the child. The crime scene investigation pointed out that there were other hangers on the floor, manufactured of plastic material, and the one used was the only stainless steel, large caliber hanger present in the room.

The findings of the physical examination, the scene investigation with interviews of the parents, and the reconstruction of the incident support the conclusion that the injury to the child was inflicted.

In conclusion, diagnosing child abuse is a complicated issue. When the injuries are uncommon and involve specific parts of the body, such as the frontal plane, the examiner has to eliminate the potential of an accident. The combined efforts of a multidisciplinary team serve a primary role in the management of domestic violence and child abuse cases.

The present case represents a very unusual case of domestic violence, with child head injury using a stainless steel hanger. Unfortunately, this is only another incredible report about how abusers carry out their harmful acts.

Coat Hanger, Child Abuse, Pediatric Head Injury

G70 Adolescent Suicide Trends in the Third Largest County in the United States

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After attending this presentation, attendees will gain knowledge and awareness of the epidemiology of suicide and suicidal trends in Harris County, Texas, the third largest county in the United States.

This presentation will impact the forensic community and/or humanity by providing the audience with an understanding of the scope of the adolescent suicide problem and relevant risk characteristics of adolescents in a large urban setting.

Introduction: Harris County accounts for 17% of the adolescent population in Texas and has a growing adolescent suicide rate, ranking first in the number of youth suicides reported to the Texas Department of State Health Services. Harris County, the home of the fourth largest city in the nation (Houston), is also the third largest county with 3.6 million residents and an area of 1,778 square miles. The Houston/Harris County Child Fatality Review Team (HHCCFRT) recorded a rise in the suicide rate for children aged 10-17 from 2.1 per 100,000-population size in 1999 to 3.3 in 2003. The Harris County Medical Examiners Office (HCMEO) has identified adolescent suicide as a public health problem, and has conducted a collaborative retrospective study to identify those most at risk for suicidal injury. The results of this study can be used to drive prevention and intervention programs in Harris County.

Purpose: This collaborative study between the HCMEO, Harris County Public Health and Environmental Services, the Houston-area Suicide Prevention Coalition, and the HHCCFRT was implemented to identify and describe the number and relevant characteristics of adolescents who died by suicide from 2000 through 2005.

Results: The Harris County Medical Examiners Office classified the manner of death as suicide for 154 adolescents aged 10-19 years who were autopsied in the HCMEO from January 2000-July 2005. The majority of

these adolescents (79%) were male. White teens comprised the majority of these cases at 52% but a notable 34% were of Hispanic ethnicity, followed by 13% Black and only 1% Asian teens. Gunshot wounds were the cause of death in 55% of the cases. Hanging (34%) was the second leading cause of death. The remaining 10% of the cases were comprised of overdose deaths, blunt force injuries, and carbon monoxide poisonings. The most recent HHCCFRT data from 2002-2003 (N=34) cases demonstrates that older teens (15-17 years) most often used a gun as the mechanism of injury but the majority of younger (10-14 years) adolescents used hanging as a mechanism. A suicide note was recovered in only 21% of the reviewed cases. The most common precipitating factors to the injury were prior attempts/suicidal ideation (37%), argument with a parent or girlfriend/boyfriend (19%), documented depression or mental illness (17%), substance abuse (10%).

Implications: The results of this study are an important foundation for establishing prevention and intervention efforts in Houston and Harris County. The rising suicide rate among adolescents makes it imperative that the HCMEO and HCPHES mobilize to reduce risk in the adolescent population. The scope of the adolescent suicide problem and the characteristics of at risk adolescents will be disseminated to area agencies and community organizations for use in obtaining funding for effective, best practice suicide programming.

Adolescent Suicide, Epidemiology, Trends

G71 Intraspecific Competition in the Blowfly *Chrysomya megacephala* (Diptera: Calliphoridae) Reared at Different Densities

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After attending this presentation, attendees will learn the effects of population densities on the rates of development and subsequent effects on the calculations of postmortem interval estimates using entomological techniques.

This presentation will impact the forensic community and/or humanity by demonstrating the calculation of an estimated minimum postmortem interval estimate using entomological techniques depends on correct developmental data for the species involved. Understanding the effects of density and intraspecies competition will serve to gradually increase the accuracy of these estimates.

Larvae of *Chrysomya megacephala* are major factors in the early decomposition of remains in tropical habitats. This study was undertaken to determine the effects of larval density on rate of development, larval and puparial mortality and adult size for this species under laboratory conditions. Larvae were collected from a pig (*Sus scrofa* L.) carcass in a mesophytic habitat on the Island of Oahu, Hawaii. Colonies were established with limited food resource (15 gms of beef liver) at densities of 1:1, 5:1, 10:1, 15:1, and 20:1. All colonies were reared at a constant temperature of 24°C, with light/dark cycles of 13/11 hours. In one section of the study, total lengths of 10 larvae per day were recorded to determine rate of development based on increase in size. In the other section of the study, colonies were left undisturbed for the duration of larval development. Larval mortality and puparial mortality and total mortality were recorded. Of the densities studied, the 10:1 ratio appeared most favorable for development. Larvae reared in these colonies were significantly larger than those in other colonies, reached the puparial stage 24 h ahead of other colonies and had the lowest larval mortality.

Entomology, Competition, Postmortem Interval Estimation

G72 Comparison of Early Decomposition Between Domestic Pig Carcasses Hanging and in Contact With the Ground on Oahu Island, Hawaii

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The goal of this presentation is to document the differences in early decompositional changes in carcasses that are in contact with the ground and hanging.

The patterns of decomposition observed in hangings are quite different from those observed for bodies in contact with the ground. This presentation will impact the forensic community and/or humanity by demonstrating how the accurate estimation of the postmortem interval is dependent on an understanding of these differences in insect invasions, temperature generation, and biomass removal.

This study was conducted on the campus of Chaminade University on the island of Oahu, Hawaii. Carcasses of two domestic pigs, *Sus scrofa* L., were used. One carcass was placed in contact with the ground on a wire mesh platform and the other suspended from a tree, not in contact with the ground. Carcasses were observed twice daily for a period of two weeks. Weights were recorded daily using a hand-held scale to determine rate of biomass removal. Internal temperatures were recorded using telemeter probes of the mouth, abdomen, and anus. Ambient temperatures were recorded at each visit. During the study period, both carcasses passed through four of the five stages of decomposition established by Goff (1993): Fresh, Bloated, Decay, and Post decay. The skeletal stage was not reached during this study. Differences in decomposition patterns were noted between the two carcasses. The hanging carcass demonstrated an initial rate of biomass loss greater than the carcass on the ground. After the first week, the rate became more equal. Internal mouth temperatures for the pig on the ground were uniformly higher than for the hanging carcasses, probably due to the mediating effect of the air. Abdominal temperatures, as well as anal temperatures were more similar, although still higher for the carcass on the ground.

Decomposition, Temperature, Biomass Removal

G73 A Preliminary and Pilot Study About Mitochondrial DNA Deletion in Sudden Infant Death Syndrome: An Endemic Study in Taiwan

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After attending this presentation, attendees will gain an understanding whether there is a relationship between mitochondrial DNA deletion and sudden infant death syndrome. This presentation will impact the forensic community and/or humanity by demonstrating how although some change of genetic markers in mitochondrial DNA may not be the real etiological cause of death in SIDS cases; it could be a contributing factor to an infant's death within a critical medical condition or situation.

Sudden infant death syndrome (SIDS) is a leading cause of post-neonatal infant mortality and a serious and challenging issue confronting the medical and legal professions. Many hypotheses have been proposed

and studied, however, a consensus on the causes of SIDS is still lacking. Although a number of coding region mitochondrial DNA (mtDNA) mutations involving SIDS have been reported, the role of mtDNA deletion or depletion in SIDS victims is still unknown. This study was designed to investigate whether mtDNA deletions exert any effect on the etiology of SIDS. Statistical data have shown that infants dying from SIDS score lower in activity tests and appear to be sleepier and less reactive than control subjects. These behavioral characteristics may have been the result of ATP depletion attributable to mutations or deletion in mtDNA.

Seven SIDS and 19 non-SIDS fatalities were included in this study to determine the relative amount of mtDNA copy number and the occurrence of mtDNA deletion in blood, skeletal muscle, and cardiac muscle specimens. Analytical approaches included real-time quantitative PCR, primer-shift PCR analysis and DNA sequencing. Breakpoints of the three types of mtDNA deletions (4977, 5335, and 7599 bp deletions) observed in the population were identified by sequencing methods.

Only one specimen (cardiac muscle) from a congenital heart malformation subject was found to have 4977 bp mtDNA deletion. Fisher's exact probability test and Spearman's correlation coefficient were applied to the analysis of the observed data on 5335 bp and 7599 bp mtDNA deletions and found no statistically significant difference on the occurrence frequencies of 5335 bp and 7599 bp mtDNA deletions between SIDS and non-SIDS victims. However, the observed data indicate: (a) for blood specimens, the occurrence frequencies of 5335 and 7599 bp mtDNA deletion observed in the SIDS were 4- and 2-fold, respectively, higher than the non-SIDS victims; (b) for skeletal muscle specimens, the occurrence frequencies of 5335 bp mtDNA deletion in SIDS victims was 1.8-fold of the non-SIDS victims. No significant correlation was observed on the relative amount of mtDNA copy number and the occurrence frequencies of mtDNA deletions between the SIDS and non-SIDS groups; however, the occurrence frequencies of 5335 bp and 7599 bp deletions and the relative amount of mtDNA copy number in the skeletal and cardiac muscle specimens from the SIDS group were much higher than that from the non-SIDS group.

The increase in mtDNA content in mtDNA deletion cases correlates with mitochondrial proliferation that might have been a compensatory mechanism of defective mitochondria. These defects in mtDNA may result in impaired production of ATP and bioenergetic crisis. mtDNA deletions in themselves do not cause SIDS but may cause energy deficiency or hypoxia in stressful situation during a vulnerable developmental stage. These preliminary results show that mitochondrial DNA deletion might predispose an infant to death in a critical medical situation.

Sudden Infant Death Syndrome, SIDS, Mitochondrial DNA Deletion

G74 Expression of Heat Shock Protein (hsp) 70 in Tissue of Different Human Organs After Burn Fatalities

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After attending this presentation, attendees will gain some understanding of the regulation of the early inflammatory response in humans, specifically regarding the initial response of heat shock proteins (hsp).

This presentation will impact the forensic community and/or humanity by providing some understanding of the regulation of the early inflammatory response in the human organism after burning fatalities, and contributing to the clinical understanding of the development of the serious septic or sepsis-like processes in these cases.

Heat shock proteins play an important role in the early response to various physical or chemical alterations and contribute to the up-regulation of numerous other stress-related mediators such as cytokines. To enhance

the knowledge regarding the complex regulation of these inflammatory mediators, 18 cases of burn fatalities were evaluated immunohistologically after autopsy. Paraffin embedded tissues were investigated for expression of hsp 70 on the protein level related to survival time and further complications, such as pneumonia or sepsis). A tendency toward the early expression of hsp 70 in respiratory epithelium, inflammatory cells, and in the epithelium of renal tubuli was revealed. In the cases with longer survival time, hsp was increasingly expressed in other organs.

Heat Shock Proteins, Burn Fatalities, Inflammatory Response

G75 “Coca-Cola Man”: Sudden Death in a Jailed Mentally Retarded Man After an Altercation Involving Police

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After attending this presentation, attendees will have an increased index of suspicion for diabetes insipidus in unsuspected cases, familiarity with the four types of diabetes insipidus, and gain an understanding of the mechanism of diabetes insipidus in psychogenic polydipsia.

This presentation will impact the forensic community and/or humanity by providing recognition, postmortem diagnosis and classification of diabetes insipidus, and exploring the medical, legal, and media ramifications of death from dipsogenic diabetes insipidus in a mentally retarded inmate.

A 58-year-old inmate of an institution for the mentally retarded, who bore a number of additional psychiatric diagnoses including undifferentiated schizophrenia, violently assaulted a fellow resident, as well as two nursing home workers who attempted to restrain him. He was subdued with the assistance of police. He was arrested for the assault, and taken from the group home to jail, where he received a medical evaluation, and was noted to be in good health. He was jailed for ten days, during which he received ongoing medication with oxcarbazepine. At 0310 hours on the eleventh day, he was found dead on the floor of his cell.

At autopsy, the oral cavity was noted to be full of vomitus. When the vomitus was rinsed away, white foam appeared. An 11" x 8" fading green-brown bruise occupied most of the right side of the chest, extending across the midline. Two smaller, more recent-appearing bruises were noted on the chest and abdomen. Healing abrasions and almost completely faded bruises were noted on both sides of the upper back, and on the left side of the chest. Multiple bilateral rib fractures appeared, by their freshness, location, and lack of hemorrhage, to have been incurred during cardiopulmonary resuscitative efforts. Natural disease at gross autopsy was restricted to pulmonary emphysema, slight heart hypertrophy, and minor renal changes consistent with hypertension. There was no coronary artery disease, and no coronary thrombosis or pulmonary embolism. It was noted that the urine was root beer colored.

Vitreous electrolytes, analyzed the following day, exhibited a severe deviation from expected values. The BUN was 127 mg/dl, and the creatinine, 1.2 mg/dl. The sodium level was 180 mmol/L, and the chloride level, 150 mmol/L. Potassium, CO₂, and glucose showed a postmortem pattern.

Significant social history included moderate mental retardation, a variety of psychiatric diagnoses, and a noted addiction to soft drink products. At the hospital where he underwent occasional treatment for exacerbation of psychiatric symptoms, the inmate was referred to as “Coca-Cola man,” due to his nonstop consumption of as much of this soft drink as he could obtain. Psychiatric treatment notes had documented a recommendation that he be switched from caffeinated and sugar-containing soda to decaffeinated and diet soda, to control some of his behavior problems.

Death was due to marked hemoconcentration. Consultation with a local endocrinologist suggested the disorder diabetes insipidus.

Diabetes insipidus is a disorder of excessive urination, which may be traced to four types of inciting cause. One type, gestagenic, occurs only in association with pregnancy. Another, neurogenic, is due to a pituitary lesion, which may be acquired or congenital. A third, nephrogenic, may be congenital, but may also be drug-associated. Certain commonly administered drugs are well known to be associated with diabetes insipidus, including lithium, foscarnet, and clozapine, as well as many cytostatic drugs and antimicrobials. No record of administration of any of these drugs could be found. Trileptal is not associated with diabetes insipidus.

The fourth category of diabetes insipidus is dipsogenic, or caused by psychogenic polydipsia. In this disorder, excessive drinking of any fluid, over a prolonged period of time, causes excessive urination, which may become independent of normal feedback mechanisms. What was originally a psychological compulsion then becomes an organic condition. This disorder could be produced by a protracted indulgence in very large quantities of soft drinks.

As diabetes insipidus was not suspected at autopsy, the opportunity to examine the pituitary was lost. So it cannot be definitively stated whether this was in origin a neurogenic diabetes insipidus, or dipsogenic. A mentally retarded and schizophrenic person with a strong drive to imbibe as much soft drinks as possible may not have recognized water available in his cell as a source of rehydration. Nor could he likely explain his symptoms in terms, which would convey his condition to corrections personnel.

The postmortem diagnosis and classification of diabetes insipidus, and the ramifications of dipsogenic diabetes insipidus in a mentally retarded inmate, will be discussed, along with a consideration of how to deal with newspaper interest in the cause and manner of death.

Diabetes Insipidus, Psychogenic Polydipsia, In-Custody Deaths

G76 Estimating Time-of-Death by Body Temperature Analyses - A New Mathematical Strategy

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After attending this presentation, attendees will learn of a revised curve-fitting method of postmortem estimation of time-of-death by body temperature.

This presentation will impact the forensic community and/or humanity by presenting a new way of analyzing temperature data without making a priori assumptions regarding postmortem cooling rates or involving measurement of complex heat transfer parameters.

Accurate determination of a patient's time-of-death is routine in a hospital, nursing home, hospice, or other well-monitored setting. It is more difficult when death occurs alone at home, at an isolated hunting site, in a vehicle in a remote area, at a crime scene or at some other unsupervised site. Time-of-death (TOD) nonetheless provides crucial information required in many clinical and forensic investigations.

Numerous techniques have been used for the past fifty years to estimate TOD, including quantitative analysis of body tissue and fluids or qualitative staging of rigor mortis, postmortem lividity, putrefaction, or mummification of the decedent's remains (6). Sequential and precise measurements of the change in deep body temperature during the postmortem period have been also been employed by numerous investigators (3). The amount of postmortem temperature data collected is practically limited by the amount of time the medical examiner is allowed access to the body by police and the stability of the environment in which the body was found.

Previous investigators have developed equations (2, 4) or intricate finite-element computer simulations (5) to predict postmortem body

cooling from analyses of empirical data collected from the recently deceased and from tests on manikins. In most cases these analyses use three or fewer postmortem data points and impose, a priori, a multi-exponential curve fit. Data presented here are a first-order attempt using a thermodynamic model and non-linear regression with at least ten postmortem data points.

We are developing mathematical and curve-fitting techniques to construct an analytical model for which body cooling rate is deduced and from which time-of-death is estimated. Data for this model require measurements of internal body temperature during postmortem cooling at matched clock times, although not necessarily at regular intervals. Inexpensive, portable temperature monitoring and logging devices facilitate making these measures are currently available. An estimate of the person's body temperature at death and ambient temperature are also required, as are data about body weight and the quality of clothing or other body covering. Data about the person's physical activity immediately prior to death, medication history, environmental conditions, and exposure circumstances provide useful ancillary, but not essential information. The analyses are equally valid for people whose bodies are found in water or in air. Data analyses are made either with programmable calculators or with standard spread sheet programs. Time-of-death is reported as a range depending on the strength of the correlation coefficient revealed by curve-fitting data for the fall in multiple postmortem body temperatures. Interpretations of preliminary analyses for people whose postmortem cooling rate is recorded in a monitored environment as well as bodies found at crime scenes are providing important information to amend the mathematical model, increase its validity and improve the precision for estimating time-of-death by temperature.

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Postmortem, Time-of-Death, Temperature

G77 Photography of Abuse: Is There a Best Method?

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The goal of this presentation is to discuss methods of recording photographically injuries both visible and invisible to the unaided eye.

This presentation will impact the forensic community and/or humanity by demonstrating how there is a need for further research in the development of a standardized protocol for photographing injuries that are not immediately visualized. A standardized protocol for documentation of old injury patterns would be useful in elder and child abuse cases.

Historically, documentation of bruising of abuse victims was accomplished using standard film cameras, recording injuries visible to the naked eye. Presently documentation of abuse has advanced to include both infrared and ultraviolet imagery using both fast black and white film and high-speed infrared film. This research will attempt to establish standardized parameters and techniques for optimum light source and filtration together with an ideal photographic protocol for documentation of fresh and older patterned injuries. When developing a photographic protocol for this research, specific attention is given to techniques appearing in past literature concerning UV and IR imaging of bite marks and bruising. Several methods appearing in the literature on the documentation of pattern injuries are explored and tested. In the research the authors are attempting to determine if any one of those selected protocols explored proves more beneficial than the others, ultimately determining a "best method" if one exists. Since this is a time of technological shift from film to digital media, both types of cameras are examined for compatibility, advantages, and limitations. Photographs were taken for six weeks at two-day intervals using numerous filters with both digital and film capabilities in an attempt to discern if the digital camera is comparable for this type of forensic work. Different alternate light sources are tested during ultraviolet and infrared digital photography. The digital camera has advantages and limitations when working with infrared and ultraviolet photography.

Abuse, Ultraviolet, Infrared

G78 The Cave Man in the 21st Century: Chronicle of an Announced Tragedy: Preventive Measures and Repeating Risk

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The goal of this presentation is to describe a building collapse with fatalities in a typical southern Italian location. According to the common definition of a disaster, the authors want to warn against complacency and the underestimation of the appropriateness of certain environmental structures, and underscore the social impact of such a dramatic event, that upon review was truly a predictable tragedy.

This presentation will impact the forensic community and/or humanity by demonstrating how in spite of the tragic event, people continue to live in "the caves", in a condition of absolute poverty and in contrast of every safety rule. In all likelihood, just a few precaution safety measures could have avoided the dramatic event and could prevent a repeat collapse of these types of buildings.

A human made, level I disaster, occurred with the collapse of a building in the historical center of Foggia, a city in the South of Italy. In this location, some families still live in small, tall, and rundown buildings of usually two floors tall. These buildings were built in the very early 20th century, usually above a basement, three meters underground, named by the town citizens as "the caves." These basements are composed of one or two rooms and a small bathroom, with poor lighting and even worse ventilation, with just a small window for an entrance, accessed by stairs. The "caves" were generally intended for storage, but have often hosted people, usually elderly.

During the night of the 20th of November 2004, at 3:15 a.m., a one-floor building over one a "cave" suddenly collapsed. Of the 14 people living in the building at the time, six were found alive within a few hours after the collapse and were immediately transported to the local hospital. Eight bodies were recovered lifeless from the building, and none were missing.

Soon after the disaster, the local legal authority engaged a team composed of forensic pathologists and engineers to investigate the causes of death and the cause of the building collapse. Engineers' investigations discovered that the cause of the collapse was due to the accidental explosion of a domestic gas cylinder originating from a cave. Scene investigations also revealed irregular gas network connections in spite of standard safety rules.

Three working areas were designated early as medicolegal facilities. A provisional holding area was used to receive dead bodies coming from site of collapse prior to examination allowing family members to be able to identify the victim. A second private viewing area was designated to let family members and friends see photographs of the bodies, objects pertaining to the deceased (jewelry, clothing or identifiable objects found), and finally, the bodies themselves, carried from the holding area. An examination space was designated to conduct a more detailed exterior assessment of the body to provide a careful external examination, and to perform a complete autopsy in order to determine the cause of death, documenting injuries sustained, and determining activities at the time of the collapse.

According to the most advanced disaster preparation guidelines, injuries were coded using the Abbreviated Injury Severity Scale and its derivative Injury Severity Score (ISS). The AIS is a comprehensive taxonomy of individual injuries, which denoted body region, type of anatomic structure and severity of injury. The severity index ranged from 0 (no injury) to 6 (unsurvivable injury), the ISS estimated overall body trauma and was calculated by squaring and summing the single highest AIS score in each of the three most severely injured body regions. An ISS score of 76 was indicative of unsurvivable injury. A complete radiographic study of each body was performed.

Cranio-facial injuries, cranial fractures, sternum and multiple ribs fractures, upper and lower limbs fractures, spine fractures and vertebral subluxations, multiple diaphragm lacerations, multiple lacerations and contusion of internal organs (heart, lungs, kidneys, liver and spleen) were detected in a first group of persons represented from the "cave man" group, and the family living immediately above the cave. The second group was composed of three persons in the family living very close to the source of explosion, and presented with only mild to no traumatic injury. People belonging to the first group died quickly, due to the severity of their injuries. The people in the second group died from mechanical asphyxia.

Cave, Building Collapse, Injury Severity Score

G79 Hypothermia-Related Deaths in Cook County, Illinois From November 2000 to February 2005

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The goal of this presentation is to identify common risk factors in cases of hypothermia death.

This presentation will impact the forensic community and/or humanity by presenting epidemiological data on deaths due to hypothermia in Cook County, Illinois, including scene investigation, medical history, and toxicological studies.

Deaths due to hypothermia are a significant public health problem in cold climates in the United States. Cook County, IL, has a population of over 5 million people, and includes Chicago and 120 surrounding suburbs. Winter month temperatures in Illinois can reach below zero degrees Fahrenheit.

Risk factors for death during cold exposure are infancy, advanced age (? 65 years), inadequate shelter, mental impairment, substance abuse, and serious medical conditions. Cold-related deaths have received increased media attention in recent years in Cook County, Illinois, aimed in part at increasing public awareness of the deaths in order to decrease future deaths from hypothermia.

This retrospective study examined 129 cases of death related to hypothermia from the Office of the Medical Examiner in Cook County from November 2000 through February 2005, encompassing five winter seasons. Data examined included age, race and sex of decedents, location found, concomitant medical conditions, outdoor low temperature when found, the presence of paradoxical undressing, the presence of alcohol or other drugs, body temperature (when available), whether or not the decedent was homeless, and any other significant conditions that contributed to the death.

Three of the 129 cases were excluded from the study. In these three cases, the decedent suffered low body temperature due to sepsis during prolonged hospitalization; none were exposed to low ambient temperatures.

Of the 126 remaining cases, 34 occurred in the winter season of 2000-01, 27 from 2001-02, 26 from 2002-03, 20 from 2003-04, and 19 from 2004-05. Eighty-three cases (66%) listed hypothermia or cold exposure as the primary cause of death, and the remaining cases listed hypothermia or cold exposure as a contributing factor to death. Manners of death were listed as accident in 123 cases, suicide in two cases, and undetermined in one case, which involved an unwitnessed drowning with a high post-mortem alcohol level. The group consisted of 65 white males (52%), 26 white females (21%), 25 black males (20%), 9 black females (7%), and 1 Asian male (<1%). In 52 cases (41%), the decedent was of advanced age. In 31 cases (25%), the decedent was homeless. The youngest decedent was 28 years old. Forty-seven cases (37%) involved alcohol, and 12 cases (10%) involved other drugs. In 67 cases (53%), the decedent had one or more significant medical problems, including heart disease, diabetes mellitus, dementia, or a seizure disorder. In six cases (5%), a significant injury contributed to the death. Body temperature was taken in 26 cases (21%), and ranged from less than 70°F to 94.5°F. Outdoor temperatures ranged from -9°F to 49°F on the evening before or day found. Mean temperatures per winter season were: 11°F in 2000-01, 21°F in 2001-02, 18°F in 2002-03, 20°F in 2003-04, and 25°F in 2004-05. Seventy three decedents (58%) were found outdoors, 39 (31%) were found indoors with no heat, 13 (10%) were found in various unheated areas, including motor vehicles, porches, and garages, and one was dropped off at the hospital with a high alcohol level and low body temperature by an unknown person. Paradoxical undressing, often cited as a hallmark of hypothermia, was observed in only seven cases (6%).

Autopsy findings in cases of death due to hypothermia may be absent or nonspecific. Correlation with the circumstances surrounding the death and the medical and social history of the subject is important in order to determine the correct cause of death.

Deaths due to hypothermia have decreased in Cook County over the last five years, possibly due to milder winters, but still remain a significant public health problem. The forensic community needs to be aware of the possibility of a cold-related contribution to cause of death.

Forensic Sciences, Hypothermia, Cold Exposure

G80 Analysis of Gene Expression Patterns to Identify Tissue and Body Fluid Specific mRNA Species Using Real Time PCR Assays

Rixun Fang, PhD, Christine Shulse, BS, Pius Brzoska, PhD, and Manohar R. Furtado, PhD*, Applied Biosystems, 850 Lincoln Center Dr., Foster City, CA 94404; and Chitra F. Manohar, PhD, Lawrence Livermore National Laboratory, 7000 East Ave, Livermore, CA 94550

After attending this presentation, attendees will learn that it is possible to test for specific mRNAs that serve as markers for tissue and body fluid identification. Attendees will be informed about pre-amplification protocols that can be employed to simultaneously amplify and detect multiple targets when the amount of material available is limiting.

This presentation will impact the forensic community and/or humanity by teaching the forensic community that gene expression profiles and specific mRNA can be used to identify a large number of body parts and fluids. Attendees will understand that this can be done with very small amounts of material and therefore useful in forensic investigations when sample available is limiting.

This presentation proposes that by screening microarray and SAGE based tissue expression data in multiple databases, both public and internal, it is possible to identify candidate mRNA species that would show tissue specific expression. Additionally, this would select highly expressed messages for use in forensic applications.

In this presentation, and from the screening of human tissue and body fluids, it is possible to define specific markers that can be used for identification. Identification of tissue parts and body fluids is frequently required in crime scene investigations. Conventional methods are often labor-intensive, not confirmatory and employ a diverse range of methodologies. Several forensic laboratories have pioneered the selection of specific protein or mRNA markers for identification of tissues and body fluids. Some laboratories have designed and tested real-time PCR based assays that target the detection of mRNAs encoded by > 20,000 genes in identified in the human genome. The presented methods employ proprietary methods to design assays specific to a target transcript avoiding amplification of related gene transcripts. It also allowed for the development of methods for pre-amplification of hundreds of targets present in a single sample preserving relative quantification information. These methods will be useful when dealing with heterogeneous mixtures.

In this study, the performance of assays targeting saliva specific markers was analyzed such as Statherin, Histatin Ge3, PRB1, PRB2, PRB3, menstrual blood markers like metalloproteinases, and semen specific markers like protamines. These were targets selected based on literature reports. A total of 480 genes from the analysis of microarray data from specific tissues were selected. TData was used to further limit this to a set of 130 genes. Next, RNA from 48 tissues was selected and converted to cDNA by reverse transcription reaction using random primers and commercially available kits. Initially, cDNA was tested using six endogenous controls (GAPDH, GUSB, 18S RNA and ACTB, HPRT and B2M) for normalization purposes. Next, assays targeting transcripts from these genes were used to analyze gene expression relative to endogenous controls across 48 tissues. HeatMap views of gene expression patterns were constructed to identify tissue specific patterns. Based on these expression profiles researchers identified ~20 genes, not reported in the literature as specific markers that are highly expressed in single tissues. Additionally, the authors identified some genes that were expressed in a few (2 to 3) tissues and could still serve as specific markers when used in specific combinations. This research also shows that pre-amplification protocols can be used to detect mRNA when the sample is limiting. Detection of saliva specific markers was demonstrated following pre-amplification.

This study demonstrates that, in many instances, single markers can be defined as specific for a given tissue. These include SEMG1, SEMG2, KLK3, and PRB4/HGNC that have not been reported in the literature as tissue specific markers. In some instances, using a combination of targets will provide identification. This research has shown that if the sample is limiting, pre-amplification of a large set of mRNAs in a single reaction is useful for identification.

Tissue Identification, Gene Expression, Real Time PCR

G81 Caveat Emptor: A Series of Deaths Related to Subcutaneous Silicone Injections in Transgender Males

Morna L. Gonsoulin, MD, Ashraf Mozayani, PhD, Terry Danielson, PhD, and Luis A Sanchez, MD, Harris County Medical Examiner's Office, 1885 Old Spanish Trail, Houston, TX 77054-2098*

After attending this presentation, attendees will learn about the history and consequences of the practice of illicit subcutaneous silicone injections as well as the circumstances, findings and available methods of testing in cases involving subcutaneous silicone injections in the forensic setting.

This presentation will impact the forensic community and/or humanity by alerting forensic professionals about the circumstances, findings and available methods of testing in cases involving subcutaneous silicone injections, as well as informing or increasing awareness of a largely underground, poorly documented and dangerous trend which may be gaining popularity despite the potentially significant morbid and lethal risks.

This presentation highlights a series of three deaths resulting from subcutaneous silicone injections obtained illegally outside the medical setting for cosmetic purposes. The goal of this presentation is to review the circumstances and findings of the cases in light of the general characteristics of the typically utilized silicone-containing compounds, their legal and illegal uses, the methods and procedures used during the injections and the complications of subcutaneous silicone injection as a result of inadvertent systemic siloxane exposure. The presentation will impact the forensic community and/or humanity by alerting forensic professionals about the circumstances, findings and available methods of testing in cases involving subcutaneous silicone injections, as well as informing or increasing awareness of a largely underground, poorly documented and dangerous trend which may be gaining popularity despite the potentially significant morbid and lethal risks.

In Houston, Texas, a series of three deaths within a three-month period in 2003 due to pulmonary silicosis were caused by the illegal practice of subcutaneous silicone injection for cosmetic enhancement of the hips and breasts among local transgender males. Gas chromatographic / mass spectrometric analysis indicated the presence of the cyclic siloxanes, hexamethylcyclotrisiloxane, octamethylcyclotetrasiloxane and decamethylcyclpentasiloxane, in fluids collected from hip and breast injection sites, and from syringes and containers of silicones seized during the investigations. These low molecular weight siloxanes may serve as chemical marker substances in the confirmation of siloxane injection.

This unusual cause of death occurred with alarming frequency over a relatively brief period of time due to a sporadic surge in popularity of the practice of subcutaneous siloxane injection among the local transgender community. The injections had been administered by two independently operating agents with no medical training who were soliciting in bars frequented by transgender males. Although ethnically diverse, the three individuals involved were young transgender males who had received several injections on at least one previous occasion, and their clinical presentations, hospital courses and autopsy findings were similar.

Siloxanes are used in preparations such as hair conditioners, skin care products, and industrial lubricants. While their topical use is common, siloxanes are not intended for internal use. Subcutaneous injection of siloxanes (silicone) presents the risk of direct introduction of silicone compounds into the systemic circulation, where they can accumulate in the pulmonary macrophages (pulmonary silicosis), resulting in hemorrhage, respiratory failure and death. Because of the potentially lethal consequence, injection of siloxanes into subcutaneous tissue is illegal in the United States.

Isolated case reports documenting the sequelae of subcutaneous silicone injections have been presented since the 1970's due to occasional trends, particularly in the transgender subculture, where silicone injections

are sought as an easily accessible, non-surgical cosmetic procedure to create a more feminine appearance. The materials required for the injections are easily obtained through cosmetic supply companies (non-medical grade silicone), medical supply companies (medical grade syringe lubricants) or any supplier of viscous liquid silicone (including brake fluid), and the injections are commonly administered in large veterinary syringes. The substance is injected into the dermis and superficial subcutaneous fat, usually in a circular cluster of small punctures. There it accumulates as filler, distending the tissue with the objective of creating a more tense and rounded outline.

Multiple injections are usually required for contour enhancement of the hips and breasts, in particular. Most individuals require additional applications to maintain the enhanced appearance over time. No estimates are available for the number of individuals who have received such injections or for the effects of cumulative silicone exposure of a given individual who has been repeatedly injected. The clandestine nature of the practice and the pervasive social stigma associated with transgender community does not lend itself to obtaining accurate statistics. The persistence of the practice worldwide and anecdotal evidence would suggest, however, that the reported incidence of lethal sequelae of subcutaneous silicone injection is infrequent relative to the number of individuals who have received these injections.

Increased public awareness appears to have had a significant effect in the Houston area. After the local authorities began publicizing the dangers of subcutaneous silicone injections and prosecuting the individuals administering them, no more deaths related to the practice have been reported as of July 2005.

Pulmonary Silicosis, Silicone, Transgender

G82 Anogenital Anatomy: Colposcopy to Study the Appearance and Changes During the Postmortem Interval

Sharon R. Crowley, MN, RN, Forensic Clinical Nurse Specialist, 122 Emeline Avenue, Santa Cruz, CA 95060*

After attending this presentation, attendees will be able to describe the nature and appearance of the anogenital tissues at various postmortem intervals, and evaluate the efficacy of a previously described system of mobile technology for postmortem genital examinations.

This presentation will impact the forensic community and/or humanity by increasing the diagnostic acumen of forensic examiners, increasing the reliability and consistency of both examination techniques and documentation via improved methodology and an efficacious taxonomy, and to eventually allowing reliable comparisons between the anogenital findings in cases of sexual homicide to normative postmortem controls.

Text/background: A paucity of data exists on the "normal" appearance of the anogenital anatomy during the postmortem interval. Data from scrutiny and photodocumentation of these tissues are lacking. Detailed observations of the usual anatomic sites, which have been carefully studied in living sexual assault victims, are lacking in postmortem examples. Thus, the interpretation of genital findings in the deceased remains a vital and timely issue. In addition, techniques that are often employed by some examiners for the medical-legal examination of living sexual assault victims, such as the application of the nuclear stain, toluidine blue dye, have been insufficiently studied in the postmortem arena.

In order to accomplish this, postmortem cases presenting from various causes of death from natural, accidental, suicide, and homicide of non-sexual etiology, are the focus of the present discussion. These cases will comprise a normative, core group of baseline cases, and the first study of "normal" postmortem genital anatomy.

Materials and methods: Baseline examples of genital anatomy during the postmortem interval are selected based upon availability and accessibility. Female cases from the representative causes of death will be clinically evaluated, using the mobile system of technology described by Crowley (JFS, 2004).¹ Colposcopic technique includes inspection at 7.5X, 15X, or both, and photodocumentation via a 35 mm SLR camera. Colposcopy was chosen because it is a well-established technique for the evaluation of sexual assault in both child and adult victims. The range of postmortem interval categories are \leq 24 hours (fresh), 48-72 hours, 73-96 hours, \geq 5 days, and unknown. Reproductive status is categorized as pre-pubertal, reproductive age, perimenopausal, and post-menopausal. Some of the variables to be collected and entered into a sexual homicide database include age, ethnicity, race, date/time body found, date/time of examination, cause of death, past medical history, reproductive status, exam techniques, and any known past medical history, especially gynecological history. Routine inspection, visualization, and photodocumentation of the salient anatomic sites includes the labia majora, peri-clitoral area, peri-urethral area, labia minora, hymen, vagina, cervix, perineum, fossa navicularis, posterior fourchette, anus, and rectum. Any concomitant gynecological condition or benign lesions are noted. Examination techniques such as labial separation, labial traction, use of vaginal speculum, anoscopy, and the degree of fixed magnification (e.g., 7.5X, 15X), used for colposcopic documentation, are also documented.

Discussion: The use of colposcopy is well documented in living sexual assault victims. The obvious benefits of improved visualization via magnification, photodocumentation, and the capacity for peer review are equally germane to the postmortem arena. For living victims, the sexual assault examiner is asked to determine if the physical examination is consistent or inconsistent with the history as provided by the victim. In the deceased, the lack of a history provided by the victim makes the need for reliability and accuracy paramount. The examiner must consider the usual benign factors, gynecological conditions, and concomitant anatomical variations often present in antemortem cases. The examiner of postmortem cases must have the ability to reliably and accurately assess the nature and appearance of anogenital tissues at all major anatomic sites and at various postmortem intervals, while the normal changes of decomposition are simultaneously superimposed on the anatomy. For both the normative, baseline controls and suspected cases of sexual homicide, it is vital that meticulous attention be paid to technique, taxonomy, and interpretation.

The most compelling argument for the use of the colposcope in this setting is the dearth of information available on what is “normal.” In the field of postmortem sexual anatomy, the pivotal issue is that “normal” has never been defined. Postmortem changes that are routinely recognized by the adroit examiner of deceased victims such as mucosal autolysis, skin slippage, dilatation, and lividity, may be mistaken for traumatic changes by even experienced sexual assault examiners, whose prior experience is limited to antemortem cases. The entire perineum including the vagina and rectum can be removed en bloc for dissection and microscopic evaluation by the Forensic Pathologist. However, there may be valuable information gleaned by initial *in situ* examination via colposcopy of the anogenital site.

A high degree of photographic detail and careful analysis of related sample variables will also facilitate categorization of anogenital findings, using an expanded version of the taxonomy described by Crowley and Peterson (AAFS, Dallas, 2004). Continued study may require that the initial taxonomy be modified or expanded.

Reference:

1. Crowley, Sharon R. “A mobile system for postmortem genital examinations with colposcopy: SART-TO-GO,” *J. Forensic Sci.* 2004 (Nov); Vol. 49(6):1299-1307.

Colposcopy, Forensic Nurse, Postmortem Anogenital Anatomy

G83 Unusual Suicide With Chain Saw: A Case Report

Gilles Tournel, MD*, Fabrice Dedouit, MD, Anne Becart-Robert, DDS, PhD, Nicolas Pety, MD, Valéry Hedouin, MD, PhD, and Didier Gosset, MD, PhD, Institut de Médecine Légale, Faculté de Médecine, 1, place de Verdun, Lille, 59000, France

After attending this presentation, attendees will learn the importance of a careful observation of the crime scene. This presentation will impact the forensic community and/or humanity by reminding the forensic pathologist that a careful analysis of both the death scene and the findings of the autopsy are essential in reaching the proper conclusion, especially in a very unusual death.

Only a few cases of suicide with a chain saw exist. The reports of these cases are never a complex system, such as presented in this case report. It is interesting to know of this type of a complex system.

A case of suicide using a chain saw is presented. A female suffering from schizophrenia committed suicide through an ingenious system leading to the sectioning of her upper cervical spine involving the cervical spinal cord. The findings of the resulting investigation are described and the mechanism of suicides with the use of a chainsaw is reviewed. The damages to organs and soft tissues are compared to the kinds of chainsaw used.

Case report: Death scene findings: A 32-year-old woman was found dead in her living room. The decedent was a female Asian engineer. She had a significant medical psychiatric past history. She was found dead by her family members ten days after her death. The head was disposed under a material of pulleys and bags filled with water bottles. The material and the appliance are detailed. The chain saw had a 1600 W, 220-240 V, 50-60 Hz engine, and weighted 3 kg. The length was 50 cm including the projecting rim of the chain. The chain’s number of revolutions was 9.5 per second. The stains of blood were located on the floor without splatter on the walls.

Postmortem findings: The wound extended 7 cm deep into the neck and involved the posterior muscles and the posterior side of the third and fourth cervical vertebrae. A complete section of the spinal cord was noted. A study of the cervical bones was performed to compare with the characteristics of the chain saw and to explain all wounds on the cervical vertebrae. Bone injuries were compatible with the use of a large width cutting edge instrument consistent with known chain saw toolmarks. The edges were regular and no hesitation lesion was seen. Because the cadaver was decomposed, the dentist performed identification. The dental comparison of antemortem records and postmortem examination confirmed her identity.

Discussion: Suicides or suicidal attempts with saws are rare but sensational, due to the unusual patterns of injury and sometimes, because of the unusual death scene. Cases reports exist in the forensic literature of this type of suicide. The injuries are almost always inflicted to the head or the neck but in some cases are visceral, and tissue damage occurs because of strong vibrations of the chain saw applied directly to the body. In this case, the young female had significant psychiatric disorders, conceived, and completed a complicate scene of suicide. The wounds inflicted to the neck confirmed the observation of other authors.

The findings of the scene of death were very important to understand the mechanism of the additional material used in the complex manner. No typical hesitation injuries were observed in the neck, and these findings were compatible with the situation of the cadaver and the device. The dry bone study confirmed the regular and sharp limits of the bones injuries.

The authors discuss and compare this case to the literature in consideration of her occupation with possible cultural influences to explain the invention of this efficient and complex deadly system.

Initial autopsy study of the decomposed body were not sufficient enough to characterize the chain saw wounds on her neck, and therefore a dry bone analysis was important and subsequently performed in order to objectively study and understand the mechanism and the physiopathology of her death.

The presentation will illustrate the complex deadly system at her scene of death, in addition to the autopsy findings and the dry bone study.

Chain Saw, Suicide, Complex System

G84 Suicidal Hangings: A Growing Trend in Northern Virginia

Erin E. Falconer, MFS, Danielle L. McLeod, MFS, and Todd M. Luckasevic, DO, Northern Virginia Office of the Chief Medical Examiner, 9797 Braddock Road, Suite 100, Fairfax, VA 22032*

The goal of this presentation is to identify trends present in suicidal hangings.

This presentation will impact the forensic community and/or humanity by providing information on the findings associated with suicidal hangings with emphasis on injuries to the neck, ligature device, presence of a suicide note, and history of mental illness/life event.

Introduction: Suicide is one of the most important public health issues in the United States. Suicide represents the eleventh leading cause of death in the United States. Nearly 20% of the caseload of the Northern Virginia Office of the Chief Medical Examiner in Fairfax, Virginia is suicide. Suicide rates for this country have been relatively stable over the past decade with approximately 10 suicide deaths per 100,000 people. The most common method of suicide in the United States for both males and females is the use of a firearm. The second most common method of suicide in males is hanging.

Materials and Methods: This is a retrospective review of case files from the Northern Virginia Office of the Chief Medical Examiner in Fairfax, Virginia. Inclusionary data for this pilot study included the cause of death from hanging and the manner of death ruled as suicide for autopsy cases from the years 2003 thru 2004. A total of 320 suicides were autopsied during this 2-year study period. Of these 320 suicides, 52 (16%) were due to hanging. These 52 cases were reviewed for the following information: injuries to the neck, type of ligature device, history of mental illness/life event, the presence of alcohol, the presence of a suicide note, past ideations/attempts, and the demographics of the decedent. The case information was organized into a spreadsheet and the data was analyzed for any trends or interesting correlations.

Results: Between the years 2003 and 2004, the Northern Virginia Office of the Chief Medical Examiner in Fairfax, Virginia investigated 320 suicides. Of these 320 suicides, 52 (16%) were reported as hanging. Males comprised 81% (42), while females accounted for the remaining 19% (10) of all suicidal hangings. Caucasians accounted for 71% (37) of the cases, followed by Asians with 13% (7). Case files will be reviewed for a history of depression, mental illness, or life event, and past suicide attempt(s). The presence of alcohol and/or suicide note will be reported.

Conclusions: This pilot study emphasized the increasing rate of suicidal hangings in Northern Virginia. Sixteen percent of the suicides in Northern Virginia are due to hanging. In 2003, 20 individuals died as the result of suicidal hanging. The rate of suicidal hangings increased to a total of 32 cases in the year 2004 and the rate continued to rise in the first half of 2005. This study will report the correlation between type of ligature used and pathologic trauma to the neck. A history of depression, mental illness, or life event, and/or past suicide attempt(s) by the decedent will be analyzed, and the presence of alcohol and/or suicide note will be reported.

Suicide, Hanging, Ligature

G85 DNA Done Right: Manner of Death Determination, Based on Evidence Obtained From a Belt at a Complex Scene Involving a Decomposed Body

Leah L. Bush, MD, and Wendy M. Gunther, MD, Office of the Chief Medical Examiner, Tidewater District, 830 Southampton Avenue, Suite 100, Norfolk, VA 23510*

After attending this presentation, attendees will learn the appropriate methods for handling of evidence at complex scenes; learn about the use of DNA analysis in cases where manner of death is not evident from forensic autopsy; and learn about the value of DNA analysis in cases involving decomposed bodies.

This presentation will impact the forensic community and/or humanity by demonstrating an expanding awareness of the usefulness of DNA touch preparation analysis on items such as ligatures in scenes involving decomposed bodies, and to influence the collection and handling of relevant items at scenes where the manner of death appears undetermined.

A 32-year-old man was found dead in his home at Christmastime, in a state of moderately advanced decomposition. His car was missing from his home, as it had been towed away after an interstate crash days before. The house was secure. There was no suicide note.

The body at the scene was face down on the bedroom floor, lying prone between the bed and a chest of drawers. He was clad only in bikini underwear and socks, with some clothes draped over his lower legs. He was partially suspended by a belt ligature tied to a drawer handle. The belt was looped twice around his neck, with one end of the belt pulled through the buckle behind his left ear. The opposite end of the belt was tied in an overhand knot to the brass drawer handle.

Significant social history included homosexuality, with a history of depression over his sexual orientation, as reported by his mother. There was no known history of autoerotic asphyxia. He had no significant medical history.

Scene investigation included leaving the ligature intact for the autopsy pathologist, bagging the hands in clean paper bags, leaving the clothing undisturbed to allow for a physical evidence recovery kit at autopsy, and wrapping the body in a clean white sheet prior to placing it in a body bag.

Autopsy procedures included photography and close examination of the hands, clipping of the fingernails for DNA analysis, physical evidence recovery kit for sexual activity, removal of the ligature by division away from the buckle, and complete visceral dissection. Autopsy findings included a $\frac{1}{2}$ " horizontal ligature furrow with no upslope, and the following pertinent negative findings of no internal neck injuries, significant blunt force or penetrating injuries, obvious sexual assault, or significant natural disease processes, as far as could be determined in his state of moderate decomposition. Postmortem toxicology on bloody purge fluid yielded only an ethanol level of 0.07 mg%, which most likely was due to postmortem bacterial production.

The cause of death was evident at autopsy as ligature strangulation. The manner of death was not evident. Manners considered included either suicide, supported by the Christmas season and history of depression, accident due to autoerotic asphyxia, or homicide by another person. Autopsy findings could not distinguish between these manners of death. After discussion of this fact with the responsible detective, he elected to submit the entire ligature for touch DNA determination of the tied belt ligature end.

This case report will discuss how the DNA evidence from the end of the belt determined the manner and solved the case, with examination of relevant procedures by forensic personnel at scene and forensic pathologists at autopsy, with recommendations for future similar scene investigations.

Touch Preparation DNA, Scene Investigation, Manner of Death Determination

G86 Guns That Fire Themselves: Report of Three Cases

Elizabeth L. Kinnison, MD, and Wendy M. Gunther, MD, Department of Legal Medicine, Virginia Commonwealth University, Medical College of Virginia, 1101 E Marshall Street, Richmond, VA 23298-0568*

After attending this presentation, attendees will be able to recognize characteristics of unusual gunshot wound fatalities that suggest accidental misfires from dropped guns.

This presentation will impact the forensic community and/or humanity by increasing awareness of gunshot wound fatalities due to accidental misfires from dropped guns, recognition of typical characteristics of such cases, and familiarity with pistol types which are associated with accidental misfires on dropping.

Most unwitnessed deaths due to distant gunshot wounds are homicides. Most unwitnessed deaths due to close range or hard contact gunshot wounds are suicides. This report discusses three cases in which dropped guns accidentally took the lives of their owners, in unwitnessed events which had to be pieced together by the examining forensic pathologist.

A 21-year-old man was found shot beside his bed, with a .44 caliber revolver beside him. He had no history of depression, strife, worries, or alcohol abuse. A trail of blood led to the body from the bathroom, where there was a narrow gouge in the vinyl flooring. There was no soot or stippling on the skin or the clothing. The bullet entered the right chest, and was retrieved from the soft tissues of the back, with an angled trajectory through all three lobes of the right lung. The gouge in the vinyl flooring was measured, and was found to correspond in size to the hammer of the gun.

A 30-year-old man was found shot inside a locked residence. Earlier in the evening, a 911 call had been placed from the residence, but operators only heard an open line, with no talking. Attempts to re-establish communication were unsuccessful. Police arrived to find him dead inside of his locked residence. A .22 caliber pistol, knife, and telephone were nearby. Autopsy revealed a single gunshot wound to the back of the right inner thigh. While it had minimal marginal darkening, there was no soot or stippling. Microscopic examination of the entrance showed evidence of a close range of fire. Firearms examination of the clothing revealed a range of fire estimated between 6 and 30 inches. The bullet had a steep upward trajectory through the body, ending its course anterior to the lumbar vertebrae, after lethal iliac artery injury. The gun had marks on the hammer spur, and could be fired without pulling the trigger if the hammer was resting against the firing pin.

A 22-year-old man, seated on his front porch with his friend, and in possession of an illegal gun, observed a police cruiser passing by. Deciding to return the gun to his house, he left the porch, and entered the small anteroom that led to his apartment, with an additional exit in the form of stairs to the upstairs apartment. His friend heard a single gunshot report. He was found dead in front of his door, with his keys beside him in a location that suggested he had been about to unlock the door. Autopsy showed a single distant (more than 3 feet) gunshot wound of the abdomen, with visceral injuries on a sharply rising course, exiting the back of his neck. Significant history included his involvement in an altercation five days previously, resulting in a fracture in his hand, which had been cast at a local emergency room. It proved to be important that the gun was a Takharov pistol.

Characteristics of these cases include unusual, sharply angled trajectories, no evidence of hard contact gunshot wounds in victims with any documented suicidal ideation, frequent absence of powder soot or stippling, and guns which may be known to misfire on impact. Case discussions highlight these and other useful findings in similar cases.

Gunshot Wounds, Dropped Guns, Accidental Misfires

G87 Handgun to the Head: Suicide Trends in Northern Virginia

Erin E. Falconer, MFS, Danielle L. McLeod, MFS, and Todd M. Luckasevic, DO, Northern Virginia Office of the Chief Medical Examiner, 9797 Braddock Road, Suite 100, Fairfax, VA 22032*

The goal of this presentation is to identify trends present in suicidal handgun wounds to the head.

This presentation will impact the forensic community and/or humanity by providing information on the findings associated with suicidal handgun wounds to the head. Emphasis will be focused on the location and characteristics of the wound, caliber of the handgun, result of gunshot residue (GSR) testing, presence of a suicide note, and history of mental illness/life event.

Introduction: Suicide is one of the most important public health issues in the United States. Suicide represents the eleventh leading cause of death in the United States. Nearly 20% of the cases autopsied at the Northern Virginia Office of the Chief Medical Examiner in Fairfax, Virginia are ruled suicide. Suicide rates for this country have been relatively stable over the past decade with approximately 10 suicide deaths per 100,000 people. The most common method of suicide in the United States is with the use of a firearm.

Materials and Methods: This is a retrospective review of case files from the Northern Virginia Office of the Chief Medical Examiner in Fairfax, Virginia. Inclusionary data for this pilot study included the cause of death as gunshot wound to the head with a handgun as the lethal device and the manner of death ruled as suicide for autopsy cases from the years 2003 thru 2004. A total of 320 suicides were autopsied during this 2-year study period. Of these 320 suicides, 113 (35%) were due to handgun wounds to the head. These 113 cases were reviewed for the following information: the location and characteristics of gunshot wounds, the caliber of weapon, underlying psychiatric illness/depression or life event, GSR results, the presence of alcohol, the presence of a suicide note or past ideations/attempts, and the demographics of the decedent. The case information was organized into a spread sheet and the data was analyzed for any trends or interesting correlations.

Results: Between the years 2003 and 2004, the Northern Virginia Office of the Chief Medical Examiner investigated 320 suicides. Of these 320 suicides, 113 (35%) were caused by shooting oneself in the head with a handgun. Males comprised 87% (98), while females accounted for the remaining 13% (15). Caucasians accounted for 87% of the cases. Ethanol (>.02% by weight by volume) was present in postmortem toxicology samples in a total of 39 (35%) of the decedents. Gunshot residue (GSR) was present in 61 (87%) out of 70 samples analyzed. Suicide notes were present in 44 (40%) cases. The location of the gunshot wound in decreasing frequency: right temple 61 (55%), intraoral 34 (31%), left temple 8 (7%), forehead 6 (5%), submandibular 4 (4%), and back of head 1 (<1%). Two cases involved multiple gunshot wounds to the head. A .38 caliber revolver was the most common handgun used. There was no known or documented history of depression, psychiatric illness or life event in only 7 (6%) of the decedents. Finally, 6 (5%) of the decedents had a previously documented suicide attempt.

Conclusions: This pilot study emphasized the role handguns play in suicide. In the years 2003 thru 2004, thirty-five percent of the suicides in Northern Virginia were due to handgun wounds to the head with the right temple region being the most common location. Interestingly, when handedness of the decedent was known and reported, only 3 gunshot wounds of entry were located on the opposite side of the decedent's dominant hand. Also, 2 cases involved multiple (2) gunshot wounds to the head. There was only 1 case where the gunshot wound of entry was located to the back of the head. GSR was positive in 87% and a suicide note was present in 40% of the cases. Finally, only 7% of the cases had no known/reported history of depression, psychiatric illness, or life event.

Handgun, Head, Suicide

G88 Evaluation of Less-Lethal Impact Munitions

Richard T. Wyant, MS, Washington State Patrol, 2203 Airport Way South, Suite 250, Seattle, WA 98134; and Chris Myers, and Tom Burns, Seattle Police Department, 810 Virginia Street, Seattle, WA 98101*

After attending this presentation, attendees will learn about the types of less-lethal munition systems available, their relative safety, and forensic considerations.

This presentation will impact the forensic community and/or humanity by providing a further understanding of the relative safety of less-lethal impact munitions that will assist forensics examiners in the study, analysis, and reconstruction of events associated with serious injury or death.

Law Enforcement is embracing the concept of less-lethal weaponry. Less lethal options are demonstrating their worth in reducing injury to officers, and often suspects while providing alternatives to higher force options. The function of these less lethal devices is often misunderstood. When a negative outcome or even death results from the use of a less lethal option, the forensic examiner is often called upon to analyze and reconstruct the incident.

There is currently a lack of independent data useful for the comparison of the various products available on the market. Police agencies and trainers often have to rely on manufacturer and marketing data to select munitions and tools for their agencies.

A study was devised in an attempt to develop a more objective standard.

Six basic types of specialty impact munitions were examined for this initial study; 12 Gauge bean bags, 40mm bean bags, 40mm sponge type rounds, 37mm ARWEN/Sage variants, FN303, and Pepperball products. The ordinance was fired at 10 feet and 35 feet into bare and covered ballistic gelatin. The ballistic gelatin was used to observe energy distribution and relative injury potential across the spectrum of munitions tested.

Less-Lethal, Impact, Bean Bag

G89 A First Time for Everything: Homicide Involving the Brenneke® Super Sabot Shotgun Slug

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After attending this presentation, attendees will understand the physical characteristics of the Brenneke SuperSabot shotgun slug as it pertains to the practice of forensic pathology, including injury patterns and scene interpretation.

This presentation will impact the forensic community and/or humanity by introducing a novel projectile, including its physical characteristics that have never before been reported in a homicide.

Sabot shotgun slugs are not a new projectile, but the Brenneke® Super Sabot shotgun slug has never been reported in a homicide. The authors present the case of a 28-year-old man killed with multiple gunshot wounds during an alleged “drive-by” shooting. At autopsy, a 496.2 grain slightly deformed projectile with a base diameter of 5/8” (1.7 cm) was found within the decedent’s clothing. Six distinct bullet tracks were identified. An entrance of the anterior right thigh was 3/4 x 5/8” and ovoid, having only passed through the decedent’s jeans. This bullet track passed through the soft tissue of the right thigh, exiting out the medial aspect and partially transecting the right greater saphenous vein, re-entering the medial left thigh and re-exiting out the posterior left upper thigh. With the exception of an irregular entrance on the sole of the left foot, which passed through the decedent’s shoe, all other entrances were less than 1/2” in greatest dimension. Investigating officers recovered an additional pro-

jectile of the same type, which had undergone more extensive deformation after striking and penetrating the tailgate of a truck. Further investigation identified the projectiles as the Brenneke® Super Sabot shotgun slugs.

Homicide, Shotgun, Sabot

G90 Death by a Radio-Controlled Helicopter

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The goal of this presentation is to report an unusual death by a radio-controlled helicopter and to discuss the safety issues concerning model helicopters with the forensic community.

This presentation will impact the forensic community and/or humanity by providing awareness of the dangers in the recreational use of radio-controlled aviation models by detailing the types of fatal injuries that can occur with these aircrafts.

This case involves a 41- year- old, white male who was instructing another man on how to operate a radio-controlled helicopter. The scene was a five-acre, grassy field, designated as an area for model aeronautic recreation. The instructor had five years of experience with flying radio-controlled helicopters, whereas his student had just three months of experience. The instructor demonstrated to his student how to hover the helicopter, an older model PHI Tornado radio-controlled, and then passed the controls to his student. The student hovered the helicopter for a few minutes and was attempting to land it, when it tilted and came straight toward them. The student immediately threw himself to the ground and was uninjured; however, the instructor was struck by the helicopter blades and died at the scene.

At autopsy, the decedent had a 7 by 2 inch, gaping chop wound of the right side of the neck and chin. The wound injured the sternocleidomastoid muscle, the strap muscles, the salivary gland, and the right jugular vein. The mandible was exposed, and the transverse processes of the 4th and 5th cervical vertebrae were palpable through the wound. He also had linear-patterned abrasions on the right shoulder, right upper arm, and right upper back. Toxicology for alcohol was negative. An examination of the helicopter showed fragmentation of the main rotor blades with blood spatter on the frame and on the rotor blades. The rotor blades were made of fiberglass composite and had an interior metal wire along the leading edge. The helicopter measured approximately four feet in length, two feet in height, and had a main rotor span of five feet.

Based on the circumstances of death and type of injury in this case, there seems to be an inherent danger in the design and rotational movement of the blades used in radio-controlled helicopters. The use of radio-controlled aircraft is restricted to designated flying fields, and a license is not required to operate them. Flying fields also have designated areas for the aircraft operator with separate areas for spectators.

The recreational use of model helicopters and airplanes is guided by the Academy of Model Aeronautics, which publishes an official national model aircraft safety code. In addition, there are many local model airplane clubs that establish their own rules and regulations about the use of radio-controlled aircraft, based on the official national code. Local clubs usually have their own posted safety guidelines at their flying fields. The Academy of Model Aeronautics recommends that qualified instructors should teach beginners how to use these aircrafts, as was the case in this situation. Instructors, however, are not required for beginners, who can instruct themselves on their use. It is also recommended that people learn to fly airplanes before flying helicopters.

This case illustrates an unfortunate accident where the recreational use of a radio-controlled helicopter by an inexperienced person led to the death of another individual.

Accidental Death, Radio-Controlled Helicopter, Safety Issues

G91 A Fatality Due to Atomoxetine - The First Known Case

Kathryn Haden-Pinneri, MD, 21827 Hollow Field Lane, Katy, TX 77450*

The goal of this presentation is to alert the forensic community to the first known fatality associated with Atomoxetine, a non-stimulant medication utilized for the treatment of Attention Deficit Hyperactivity Disorder (ADHD).

This presentation will impact the forensic community and/or humanity by alerting forensic scientists and the medical community of the potentially deadly combination of atomoxetine and paroxetine and to inform them of the first known fatality due to atomoxetine.

Attention Deficit Hyperactivity Disorder (ADHD) is a diagnosed condition in which a child exhibits symptoms of inattention, hyperactivity, and impulsivity. As these behaviors are part of most developing children at one time or another, the diagnosis requires that such behavior be demonstrated to a degree that is inappropriate for the person's age. Diagnostic guidelines exist to aid clinicians in determining if the symptoms displayed represent ADHD or are just part of normal development. This diagnosis can be quite controversial amongst physicians, with some feeling that the diagnosis is fictitious and over-used and others who feel that it is a medically justified disorder and have documented improvement in children with treatment. This paper serves to provide basic information on ADHD, without bias towards one view or the other.

Treatment for ADHD includes behavioral therapy and medication management. Stimulants are typically the class of medication used for ADHD treatment, and include amphetamine, methylphenidate, and dextroamphetamine. These medications work on the dopamine receptor. Atomoxetine is the first and only non-stimulant medication approved by the FDA for the treatment of ADHD in children, adolescents, and adults. Atomoxetine works differently than the stimulants in that it is a norepinephrine reuptake inhibitor. Evidence to date indicates that over 70 percent of children with ADHD who take Atomoxetine manifest significant improvement in their symptoms. Over 2 million prescriptions have been filled since the FDA approved it in 2002. It is not a controlled substance like the amphetamines; therefore refills may be phoned in, rather than having to pick up a refill prescription in person.

Because it is a relatively new medication, postmortem blood and tissue levels are not well established. Prior to this case, there have been no known fatalities associated with the use of the medication. There have been deaths due to other factors (motor vehicle accidents, hanging, etc) where atomoxetine has been identified, but in low levels. One factor in the lack of information regarding postmortem levels is that not all the toxicology laboratories have the atomoxetine standard to run the samples against.

This case is a 17-year-old male with a history of ADHD, depression and one prior suicide attempt with medications. His social history is negative for alcohol and tobacco use, but positive for prior recreational marijuana use. At the time of his death, he had not used marijuana in approximately one year. He presented to a psychiatrist in January 2004 with complaints of difficulty sleeping, indifference towards school, anxiety and depressed mood. At the time of that presentation, he was taking escitalopram, quetiapine, and lamotrigene. He was diagnosed with Bipolar disorder and ADHD and the plan was to begin a trial of atomoxetine and taper and stop the lamotrigene. He was also placed on zolpidem, 10 mg each evening. Several days later, he attempted suicide with the zolpidem after relationship problems. He had not shown any suicidal ideations prior to that. His atomoxetine dose was increased from 40 mg to 80 mg three weeks from the initial visit and he was instructed to stop the lamotrigene. Three weeks later, the depression was reportedly improved, his aggression reduced and overall affect seemed "more flexible." At the time of his death, his medications consisted of atomoxetine, paroxetine, quetiapine, lamotrigene, and zolpidem. He was found face down in a wooded area near his home, approximately 22 hours after last being seen alive.

Autopsy findings reveal a well-developed male with pulmonary edema and no evidence of natural disease. There were a few abrasions on the face that were consistent with the terminal fall and body position. Toxicologic examination of postmortem blood from the inferior vena cava, just above the iliac bifurcation, revealed an atomoxetine level of 16 mg/L and a small amount of paroxetine (less than 0.10 mg/L). The liver level of atomoxetine was 240 mg/kg and paroxetine of <5 mg/kg. These levels of atomoxetine are markedly higher than any levels published to date.

The presence of both the atomoxetine and paroxetine complicates the toxicologic picture, as they are both metabolized by the cytochrome P450 2D6 enzyme. It has been documented that co-administration of other 2D6 inhibitors with atomoxetine can increase serum atomoxetine levels three- to fourfold. In one documented non-fatal overdose of atomoxetine alone, the patient developed seizures and a prolonged QTc, but was medically managed and survived. Because of the co-administration of these two medications and the lack of suicidal ideations or suicide notes, the manner of death is undetermined. The cause of death is atomoxetine and paroxetine poisoning.

Atomoxetine, Attention Deficit Hyperactivity Disorder, Paroxetine

G92 Methadone Deaths are on the Increase in Maryland (1998-2004)

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After attending this presentation, attendees will learn the details about the increase in methadone related deaths in Maryland and they will realize the importance of cooperation between state drug research groups and the medical examiner's office.

This presentation will impact the forensic community and/or humanity by assisting the forensic community in recognizing local and national trends in methadone related deaths and the need to be diligent in checking the information that is given to research groups that share data with medical examiner's offices. They will also realize that the cooperative effort between these groups can result in the elucidation of causes for drug trends that can be of public benefit.

This presentation will review the increase in Methadone deaths in the State of Maryland from 1998-2004 and discuss the cooperative efforts of the Office of the Chief Medical Examiner (OCME) and the Maryland Drug Early Warning System (DEWS) at University of Maryland's Center for Substance Abuse Research (CESAR).

Methadone is a narcotic used in the treatment of addictive disorders and chronic pain. Nationally, methadone associated deaths increased rapidly in 2001 and 2002. A national report in 2004 showed that the recent increases in methadone use and associated mortality were related to its use as an analgesic and not to its use in opioid treatment programs. Maryland also showed a significant increase in methadone related deaths from 1998 to 2004.

The computerized files of the OCME were searched for all cases positive for methadone by toxicology. These cases were then individually reviewed to determine the number of cases in which methadone intoxication was the only cause of death and those in which methadone contributed to the cause of death in multiple drug intoxications. The concentration of methadone, cause and manner of death, and demographics were reviewed for those cases.

There was over an eight-fold increase in the number of methadone intoxication deaths from 1998 to 2004 with a peak 11-fold increase in 2003. There was over a five-fold increase in the total number of drug deaths

involving methadone, including methadone only and multiple drug deaths involving methadone. During this time the commercial distribution of methadone increased at a much faster rate than the admissions to methadone treatment programs. Most decedents were white males in their late 30s and early 40s. Over the years, the residents of Baltimore City made up a decreasing proportion of the deaths. Medical conditions contributing to death made up a small percentage of cases. In all cases, the most commonly found drugs were antidepressants. The most common other lethal drug was morphine in the multiple drug intoxication deaths. The most common manner of death was undetermined. There was no significant difference in the concentration of methadone in the methadone only vs. multiple drug intoxication deaths. The source of the methadone was unknown in over 50% of the cases and this spurned a pilot study in which OCME pathologists collected additional information from September 2004 to May 2005 about each decedent's source of methadone using a specially prepared CESAR form. Even using the form, information about the source of methadone was still unknown for over 50% of the cases.

Our review has findings similar to the national review, in that decedents most likely obtained methadone through means other than treatment programs. The increase in methadone deaths appears to be due to the procurement of legally prescribed drug for chronic pain or illegal diversion and street sales and does not appear to be from its use in treatment programs. Investigators were not asking specific enough questions about the source of methadone. If additional information was requested on the CESAR form and that information was not needed for the determination of cause and manner of death, then additional calls were not made and the information was listed as unknown. In the future, OCME investigators will be paid by funds from CESAR to collect the desired information for these forms. Thus, in the near future, an answer to this question should be available. Also, as a result of this review, the OCME adopted a new protocol in which each separate drug is now listed in the cause of death and this will facilitate statistical research.

Methadone, Research, Maryland

G93 Methadone-Related Deaths: A Review of Medical Examiner Cases in a Large Metropolitan Area

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The goals of this presentation are to (1) to present a review of methadone-related fatalities encompassing comprehensive medicolegal death investigations conducted at the Office of the Chief Medical Examiner in Kentucky between 2000 and 2004; (2) to offer guidance in the interpretation of toxicological data involving methadone, specifically in the context (a) of the victim's use of methadone prior to death and (b) of combinations with other drugs, particularly benzodiazepines, antidepressants, and other opiates.

The documented rapid rise in methadone-related deaths in Kentucky and nationally requires a better understanding of its pathophysiology and the ways it contributes to significantly increased morbidity and mortality. A thorough investigation into the practices of procurement and use/abuse

of this drug is essential to arrive at the proper designation of the cause of death. The interpretation of blood methadone concentrations alone or in combination with other psychoactive drugs must include inquiry concerning the victim's potential chronic use and tolerance of the drug. Research shows that pharmacogenetics play an equally important role in an individual's metabolism of methadone and other opiates. This presentation will impact the forensic community and/or humanity by demonstrating why further forensic study should focus on the interplay of drug metabolism with potential genetic links in individuals who die from opiate drug intoxication.

Methadone, a synthetic opioid, received approval by the U.S. Food & Drug Administration (FDA) in 1947 for use as an analgesic. By 1950, physicians prescribed it for the treatment of withdrawal symptoms associated with heroin and other opioids. The majority of methadone-associated deaths in this study include at least one other drug, in most cases another opioid or central nervous system depressants such as benzodiazepines. The synergistic effects of methadone in combination with ethanol, benzodiazepines, or other opioids may be lethal. Methadone-associated deaths skyrocketed in the early 2000's: a greater number of these deaths were reported to MedWatch (FDA's Safety Information and Adverse Event Reporting Program) in 2001 alone than in the previous decade; the number doubled once again in 2002. The dramatic increase is likely due to a rise in consumption attributable to either (a) the rise in prescription of oral methadone to outpatients for chronic pain management, or (b) the greater availability of "street" methadone, which may account for overall increases in illicit drug diversion tactics and usage.

This study reviews 176 methadone-related deaths involving postmortem examination with toxicological analyses at the Office of the Chief Medical Examiner in Louisville, Kentucky between 2000 and 2004. Analysis by the Kentucky Office of Forensic Toxicology revealed that more than a ten-fold increase in methadone-related fatalities occurred, varying from 6 cases in 2000 to 68 cases in 2003. Sixty percent were males; all were Caucasian. Individuals ranged between 17 and 60 years (mean age: 38). The average body mass index (BMI) was 26.2. The Coroner's investigation reported methadone use in 95 (54.0%) cases. Of these, 46 (48.4%) involved prescription by private physician, 19 (20.0%) obtained the drug illegally, 9 (9.5%) received it through a methadone treatment clinic, and 21 (22.1%) acquired methadone by unknown means. Of the 46 individuals receiving physician-prescribed methadone, 23 (50.0%) either initiated or refilled their prescriptions < 10 days prior to death. One-third of these had been undergoing pain management, as supported by the Coroner's documented clinical history and, in some cases, in conjunction with a lumbar or other significant surgical scar.

In view of the broad overlap in blood methadone concentrations in cases of toxicity compared to tolerant individuals on maintenance, interpretation of the postmortem blood methadone concentration was uniquely individualized for each subject. Evaluation included consideration of the history of past exposure, including amount, frequency, and duration of consumption, in an effort to determine whether the subject developed tolerance to methadone. With application of this evaluative methodology, a total of 130 (73.9%) individuals had toxic or lethal blood concentrations of methadone. The blood alcohol concentration (BAC) was negative in 152 (86.4%) of cases, while 9.1% had a BAC $\geq 0.1\%$; 4.0% had a level between 0.1% - 0.2%; and one victim had a level between 0.2% - 0.3%. The following psychoactive medications were detected in the blood: benzodiazepines (33.0%), antidepressants (39.2%), and other opiates (27.8%). The P450 metabolizers, promethazine and diphenhydramine, were frequently observed in combination with methadone, at 14.2% and in 10.2%, respectively. Urine was collected in 88.1% of cases. In addition to blood concentrations of drugs noted above, the urine screen confirmed cannabinoids in 28.4% and cocaine or its metabolites in 21.9% of all cases.

Methadone, Opiates, Pain

G94 The Value of Expanded Postmortem Toxicology Testing Menu

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After attending this presentation, attendees will understand the value of retaining alternative tissues for postmortem toxicological analyses.

This presentation will impact the forensic community and/or humanity by demonstrating the utility of alternative postmortem tissue analysis in determining defensible cause of death.

The objective of this presentation is to relate experiences from the Harris County Medical Examiner's Office regarding use of brain tissue, as a supplement to blood, for the postmortem identification of cocaine and its metabolites.

First reported by Spiehler and Reed in 1985 (1), and then further clarified by Karch in 1998 (2), the concentrations of cocaine (COC) and benzoylecognine (BE) in brain parenchymal tissue are vital components to a defensible cause of death due to cocaine intoxication.

Over a 16-month period, in Harris County, there were 58 cases initially designated as undetermined but were suspected of being cocaine-associated deaths. Brain tissue from each of these cases had been obtained as part of the routine autopsy protocol at the time of necropsy. Due either to insufficient quantity, the complete lack or poor quality, of blood specimens taken from these cases, the traditional blood analyses did not identify COC or its metabolites and did not contribute to the determination of cause or manner of death. Subsequently, the brain tissue was analyzed for the presence of COC, BE, and/or cocaethylene (CE). Of the 58 cases analyzed, 35 (60%) COC, BE, and/or CE was found in the brain tissue. As a result, 35 cases that would potentially have been classified as undetermined could be closed and signed out as cocaine-associated deaths.

While the analysis of brain tissue should not be considered as a routine procedure, the collection of parenchymal tissue (e.g., brain) should be incorporated as part of the autopsy procedure. Even if not actually analyzed, this tissue may prove to be invaluable when more routine analyses prove to be non-contributory to the cause of death determination. Other solid tissues or alternative specimens such as hair, nail clippings, maggots, and other solid organs are proving to be useful in postmortem toxicological analyses.

In conclusion, the Harris County Medical Examiner's Office has observed the utility of alternative specimens, such as brain, in the determination of cause in cocaine-related, or suspected, deaths.

References:

1. Spiehler VR, Reed D, Brain Concentrations of Cocaine and Benzoylecognine in Fatal Cases, *Jour Foren Sci*, 1985, 30(4):1003-1001.
2. Karch SB, Hearn L, Mash D, and Ruttenber J, Postmortem Diagnosis of Cocaine Toxicity: The Utility of Brain Concentration Measurements, SOFT-TIAFT Meeting, October 1998, Albuquerque, NM.

Cocaine, Alternative Tissue Testing, Cause of Death

G95 Arteriovenous Malformation and its Implications in Forensic Pathology: A Case Report

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After attending this presentation, attendees will gain better knowledge and understanding of the four types of vascular malformations (morphology, usual location, outcome) and their implication in forensic pathology.

Sudden deaths from the rupture of an arteriovenous malformation (AVM) are rare in forensic pathology practice. This presentation will impact the forensic community and/or humanity by illustrating the importance of understanding this entity to avoid confusing an AVM with child abuse.

The goal of this presentation is first to differentiate the four major groups of vascular malformations of the brain, which are arteriovenous malformation (AVM), cavernous angioma, venous angioma and capillary telangiectasia, and secondly, to describe their implications in forensic pathology.

AVMs consist of tangled masses of tortuous arteries and veins devoid of intervening capillaries that frequently extend from brain parenchyma into the subarachnoid space. Cavernous angioma is a tightly packed collection of hyalinized vascular channels most commonly found in the cerebellum, pons and subcortical regions. Venous angioma is composed of varicose veins generally located in the cerebral white matter. Capillary telangiectasia appears as a collection of small-caliber, very-thin-walled channels most likely found in the pons. Cavernous hemangioma is the only malformation lacking intervening brain parenchyma. AVM and cavernous angioma often cause hemorrhages. On the other hand, venous angioma and capillary telangiectasia are typically asymptomatic.

AVM is a rare cause of sudden death. In forensic context, six cases of such deaths have been reported, in three different papers. In five of these reported cases, children aged 5 to 10 years old complained of headache and went to lay down, and later found dead from a ruptured AVM within the cerebellum. The other one is an 8-year-old boy found dead in a swimming pool after rupture of an unsuspected brain AVM.

Presented here is the case of a 14-year-old girl who died from a ruptured arteriovenous malformation of the brain. The girl was in good health except for asthma. The eldest of nine, she lived in a family that was part of a marginal community. Her parents were members of a group that allowed child beating and refused all vaccination and modern medicine.

The girl was found dead in the morning, lying on her bed, her legs hanging off the side. Child brutality was suspected at first sight because of a bluish coloration on the side of her face, which was later proven to be livor mortis. On the previous morning, she was feeling fine and went to school. At noon, she started to feel sick. She vomited twice and complained of headache and nausea. Her body temperature was normal. She went home and went to bed by 6 pm, and later found dead the next morning.

External examination of the 60-pound and 4-foot-5 girl revealed nothing worthy of note. At internal examination, the 1580-gram brain showed massive edema with intracerebral hemorrhage and secondary necrosis around the left lateral ventricle, extending to the ventricle with widening of the latter. Microscopically, the lesion was composed of different caliber thick-walled vascular channels surrounded by intervening reactive cerebral parenchyma, with gliosis and hemosiderin deposits. The abnormal vessels extended into the subarachnoid space in some areas. The rest of the autopsy was unremarkable except for mild lung congestion. Toxicological analysis reveals only a therapeutic dose of acetaminophen. The death was attributed to a rupture of a cerebral AVM and the manner of death was ruled natural.

The present case is a reminder that the forensic pathologist should be able to recognize an AVM and know how to differentiate it from the others types of cerebral vascular malformations. Although rare, it can be a cause of sudden death, and should be considered in the differential diagnosis of intracerebral hemorrhage, and not confused with trauma, especially in children.

Sudden Death, Arteriovenous Malformation, Forensic Pathology

G96 Sudden Death in the Young in Australia

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After attending this presentation, attendees will have a good understanding of the range of causes of sudden death in young persons, and be able to implement recommendations made from this analysis.

This presentation will impact the forensic community and/or humanity by providing a greater understanding of the range of diseases causing sudden death in the age range 5 to 35 years.

Objective: To determine the causes of sudden natural death in persons aged 5-35 years.

Method: A review of all autopsies conducted at a forensic medicine facility for the years 1995-2004 (inclusive). This facility serves over 2.5 million people in the eastern part of Sydney, Australia. Data collected included the subjects' age, height, weight, gender, circumstances of death and pathologic findings at autopsy. Deaths caused by trauma, accidental causes, drowning and drug toxicity were excluded from the analysis.

Results: There were 427 non-traumatic, sudden deaths in the 10-year period (70.7% male). Cardiac causes accounted for 56.4%, non-cardiac causes for 39.3% and the cause was not determined in 4.3%. The most common cardiac cause for sudden death was presumed arrhythmia in those with no or minimal structural heart disease (29.0%). Other causes were acute myocardial infarction (24.5%), myocarditis (11.6%), hypertrophic cardiomyopathy (5.8%), aortic dissection and dilated cardiomyopathy (5.4% each). Over two-thirds of deaths caused by acute myocardial infarction occurred in the 30-35 year age group. Sudden cardiac death occurred during physical activity in 10.8% of cases. Sudden cardiac death had been reported in a first-degree relative in 4.5% of decedents. The most common non-cardiac causes for sudden death were epilepsy (23.8%), intracerebral hemorrhage (23.8%), asthma (16.1%), and pulmonary embolism (12.5%).

Conclusion: Presumed cardiac arrhythmia is the most common cause of sudden natural death in the young. There was no reported history of sudden death among the relatives of most decedents.

Sudden Death, Arrhythmia, Autopsy

G97 Suicide Among 10 to 20 Year Olds in Cook County, Illinois: A Retrospective Review

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After attending this presentation, attendees will learn the risk factors and most common methods of suicide in this age group.

This presentation will impact the forensic community and/or humanity by identifying the following: the methods used to commit suicide among 10- to 20-year-olds in a large urban population, the frequency of drugs and alcohol in the study group, and the relationship of suicide to other factors studied. This information will further assist in the formation and implementation of prevention strategies.

The goal of this presentation is to present a review of the findings of a retrospective study of suicide deaths among 10- to 20-year-olds in Cook County, Illinois between 1994 and 2004. After attending this presentation the attendee will be able to recognize the risk factors and most common methods of suicide in this age group.

This presentation will impact the forensic community and/or humanity by identifying the following: the methods used to commit suicide

among 10- to 20-year-olds in a large urban population, the frequency of drugs and alcohol in the study group, and the relationship of suicide to other factors studied. This information will further assist in the formation and implementation of prevention strategies.

After steadily increasing during the late 1970s through the early 1990s, the Centers for Disease Control and Prevention reported that between 1992 and 2001 the overall suicide rate for 10 to 19-year-olds in the United States decreased from 6.2 to 4.6 per 100,000 population. In 2001, suicide was the third leading manner of death behind accidents and homicides among 10 to 19-year-olds. In the United States, approximately 2000 adolescents commit suicide annually. Nationwide, 8.5% of students in grades nine through twelve report that they have attempted suicide. Of those attempts, 2.9% required medical attention for their injury or overdose. Several major risk factors for adolescent suicide have been identified. Although a history of a previous suicide attempt is a known risk factor, according to the American Psychiatric Association, many teen suicide completers have never made a prior attempt. Other identified risk factors include a history of a psychiatric disorder (most commonly a mood disorder either alone or in combination with a conduct disorder or substance abuse), a history of sexual abuse, and a history of parental psychiatric disorder. A family history of psychiatric disorder probably increases the risk of suicide in two ways: by bestowing genetic vulnerability and creating home and living conditions with decreased social support, which increases stress at home. Girls are three times more likely to attempt suicide when a psychiatric condition is present in association with alcohol use or a conduct disorder. Peer related violence also appears to increase the level of suicide risk for boys and girls. A recent study found that several of the known risk factors for completed suicide are constant across cultures and countries. The precipitating event, according to one study, occurred from within 24 hours of death up to one year prior to death. The most frequent precipitants within the week prior to death were difficulties in, or the end of, a relationship, and arguments with relatives and friends.

The most common method, identified in numerous studies, is firearms. This is followed by asphyxial deaths - most commonly caused by hanging. Beginning in 1997, however, among 10 to 14-year-olds, asphyxia became the most common method, exceeding deaths caused by firearms. The explanation for this change is unclear. It may in part be due to youth focused firearm laws which are intended to keep firearms away from teenagers - such as gun safe storage laws known as child access prevention laws. Many states have adopted laws, which establish a minimum age for legal possession and purchase of a firearm in response to studies that have consistently found that the presence of firearms in the home increases the risk of adolescent suicide. In 1994, a federal law established 18 years as the minimum legal age for purchasing and possessing handguns. Illinois has a minimum age of 21 years for the purchase and possession of a firearm. Interestingly, a study examining the association of these laws and suicides found that among 14 to 17-year-olds there was no statistically significant association between suicide rates and laws setting minimum ages for firearm purchase or possession. This study did find a modest reduction in suicide rates among the same age group associated with child access prevention laws. Their model estimates that in the absence of the law the expected suicide rate in this age group would be 6.51 per 100,000 rather than the observed 5.97 per 100,000.

This study examines suicides in children and adolescents who live in Cook County, Illinois, a large culturally and racially diverse, primarily urban setting. Cook County, which includes the city of Chicago, has a population of 5,376,741 according to the 2000 census. Caucasians comprise 56.3% of the population, including 19.9% that are of Hispanic ethnicity, African-Americans comprise 26.1 %, Asians 4.8%, and other racial backgrounds 12.8 %. The same census indicates that the city of Chicago has a population of 2,896,016, and a slightly higher African American population — 36.7% — than the county. In the city, Caucasians comprise 42% of the population, Asians 4.3% and other racial backgrounds 17%.

This study explores the demographics, seasons, methods, situational factors, presence of drugs, presence of notes, history of previous suicide

attempts and the identification of known risk factors/stressors when possible. With cases involving gunshot wounds, the location of the injury, the caliber, and ownership of the weapon, (when available), was noted.

In the time period examined there were 254 cases of suicides: 205 male (81%) and 49 females (19%). The majority involved Caucasians, 120 (47%), followed by African-Americans, 87 (34%). Hispanics accounted for 42 (17%) of the cases. Among Asians, there were 5 (2%) suicide deaths.

The majority of the cases occurred in the 16- to 19-year-old age range, accounting for 74%. Overall, the leading cause of death was from a firearm injury, 48%, followed by hanging, 38%. Among 10- to 14-year-olds, however, the leading cause of death was asphyxia (hanging), which accounted for 65.8%. This is similar to a national trend in this age group, reported by the Centers for Disease Control and Prevention in June 2004, in which asphyxial deaths surpassed firearm deaths. Three methods tied for third, each accounting for 3%. The three were pedestrians who stepped in front of vehicles, carbon monoxide deaths, and falls from heights. Drug overdoses accounted for 2%. Self-immolation, drowning, and incised/stab wounds, each accounted for 1%.

The number of suicides was fairly uniform throughout the year. There were slightly more deaths during the spring (29%), compared to autumn (27%), summer (24%), or winter (20%). A history of previous suicide attempts was identified in 11%. Depression and/or another psychiatric disorder were found in 23%. Suicide notes were left by 28%.

Toxicology studies revealed the presence of alcohol, and/or drugs (cocaine, benzoylconine, opiates, methadone and phencyclidine) in 19.3%. Blood alcohol levels ranged from 12 mg/dl to 350 mg/dl (mean: 109.6 mg/dl).

Although the data from retrospective studies cannot predict who will commit suicide, by identifying risk factors, strategies and intervention, and assistance programs can be implemented for those who may be at risk. Families, friends, school personnel and healthcare providers need to continue their vigilance because the complexity of childhood and adolescent suicide requires multiple strategies to identify and assist those at risk. Childhood and adolescent depression is more common than many adults believe. In this study, 23% had a psychiatric history, and/or a history of depression. It is estimated that for every completed suicide there are between 100 to 200 suicide attempts.

Depression in children and adolescents can be misinterpreted as anger or sullen behavior. The years between ages 10 to 20 can be a difficult time. Warning signs or behaviors can be subtle and may be mistaken as typical growing pains. Some signs of depression include: unhappiness, isolated behavior, drop in school performance, loss of interest in activities that were formerly sources of enjoyment, increase in physical complaints, fatigue, lack of energy or motivation, changes in sleeping and eating habits, increase in drug and alcohol use, outbursts of temper, irritability, restlessness and reckless or dangerous behavior. It is important to remember that the traumatic events, which are the triggers or catalysts for suicide in this age group, may seem minor from an adult's perspective (such as failing a test/class, getting into an accident, breaking up or being rejected). There is no single theory, which explains why children and teenagers take their lives in great numbers. Strategies in the home may include restricting access to medications and firearms. Child firearm access prevention laws can only go so far because, ultimately, laws cannot protect those intent on harming themselves.

Suicide, Methods, Children & Adolescents

G98 Immunohistochemical Examination of α -Lactalbumin in SIDS (Sudden Infant Death Syndrome)

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After attending this presentation, attendees will understand the usefulness of semiquantitative comparison of α -lactalbumin immunohistochemical staining in evaluating cases of suspected SIDS (Sudden Infant Death Syndrome).

This presentation will impact the forensic community and/or humanity by demonstrating the use of alpha-lactalbumin in the diagnosis of SIDS. The aim of this study is to evaluate the presence or absence of milk's particles within pulmonary histologic sections of 10 infants whose cause of death was suspected to be asphyxia due to human breast milk aspiration.

α -Lactalbumin is a whey protein. Previous immunohistochemical research with this antibody in SIDS deaths has been useful in some cases where aspiration was suspected as a cause of death (Iwadate K. et al., 2001).

The authors selected 10 cases of SIDS from the archives of the Section of Legal Medicine and Pathological Anatomy of the University of Bari. All tissues were embedded in paraffin. In order to demonstrate aspirated milk within the lungs, histological sections stained with Hematoxylin-Eosin (H&E) were initially evaluated. In each case, and when the staining was positive or suspected by H&E, immunohistochemical staining using commercially available anti-human α -lactalbumin antibodies was performed.

The authors compared the results of the 10 infants with pulmonary sections from a control group of five infants in which the cause of death was due to a cardiac malformation. In the control group of five deaths, none were positive for the antibody, while in the studied group there were two kinds of results. In the experimental group, one pattern showed small quantity of protein suggestive for a gastroesophageal reflux or cardiopulmonary resuscitation, with both of these factors a cause of terminal inhalation. In the second pattern, there was clear positivity of immunohistochemical staining. This result was clearly interpreted to mean that aspiration was the cause of death.

This method allows the pathologist to evaluate in a semiquantitative manner for the possibility of milk aspiration (Iwadate K. et. al., 2001). Using this technique, the authors are able to evaluate in detail cases in which the circumstances, the autopsy, and the classical histological techniques alone do not allow for a definitive diagnosis. It is possible that a re-examination of cases of SIDS using this technique could be useful in evaluating for the possibility of breast milk aspiration.

Lactalbumin, Breast Milk Aspiration, Immunohistochemistry

G99 Forensic Approach in a Case of Simultaneous Sudden Infant Death Syndrome

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Simultaneous Sudden Infant Death Syndrome (SSIDS) has received limited attention in the medical forensic literature with only a few articles directly addressing this topic. The goal of this presentation is to present a rare case of simultaneous sudden infant deaths (SSIDS) in twin infants. The complete multidisciplinary approach from scene investigation, autopsy examinations, and performance of toxicological testing, satisfies the SIDS criteria and explains this simultaneous lethal event.

This presentation will impact the forensic community and/or humanity by reporting the simultaneous death of a pair of twins. The rarity of the event makes it peculiar and the described complete pathologic investigation (death scene investigation, autopsy examination, and toxicological screening) is strongly recommended in SIDS and is warranted in SSIDS cases.

The case of a simultaneous death in premature, identical male monozygotic, 138 days old twins who were found lifeless in their crib three or four hours after feeding is presented. In the history given by the mother, she stated that early in the morning she fed her sons and then put them at one end of their crib. A few hours later she found the babies in prone position, cyanotic and breathless. She immediately took each of them out of the crib, wet their faces, and alerted medical rescue, meanwhile trying to unsuccessfully resuscitate them. It was also noted that the babies suffered from a cough and respiratory difficulties with mucus production for the last few days, and were seen by a general practitioner who prescribed a cough syrup. The mother also stated that both babies refused feeding before their deaths. The extended family had no history of prior SIDS deaths. After death notification, the authority immediately alerted a forensic pathologist and a detailed scene investigation was performed. Upon the death scene investigation, the babies were found lying on the sofa in the restroom of a small and poorly furnished apartment situated on the ground floor. A domestic gas stove was connected to its fuel cylinder and was found cold to the touch in the same room. A technical assessment performed by fire fighters revealed that the gas supply system was functioning perfectly. The mother, except for cigarette abuse, denied risk factors for SIDS, such as maternal alcohol consumption and legal or illegal drug use during the pregnancy. Internal temperature of the infants measured by means of a bulbous thermometer was 29°C each, and external temperature was 10°C. Rigor mortis was present and livor mortis was represented by fixed reddish-purple coloration localized on anterior part of the body. External examination was unremarkable, showing no sign of traumatic injuries and/or signs of compression of the nose or mouth or upper airway obstruction. Only an intense cyanosis on lips and nails was observed. Complete autopsies two days later were performed. In both cases, cardiac sections showed a septum secundum atrial septal defect, the lungs were hypoexpanded and heavy with diffuse, firm, red boggy parenchyma, with the presence of white fluid in the upper respiratory tracts. Examination of other organs showed cerebral edema, epicardial petechiae, and intense vascular congestion. Histological examination of the hearts revealed the presence of multiple foci of myocardial contraction band necrosis, and myofiber break-up. Examination of the sinoatrial (SA) node and the bundle of His revealed no abnormalities. The lungs showed subpleural haemorrhages, alveolar septa mildly thickened by edema, capillary congestion, alveolar edema, and interstitial infiltrates with leukocytes. No other findings were found except for brain edema and generalized intraparenchymal acute hemostasis. A complete toxicological screening was performed to test for concentrations of bromexine in blood and urine, and for determination of HbCO in the blood. Results of the analysis excluded toxic values for drugs, including carbon monoxide. Data provided from the death scene investigation,

medical history of the children before death, macroscopic and microscopic autopsy findings and the results of toxicological examination, exclude any traumatic injury, carbon monoxide or drug intoxication, and led us to conclude that acute respiratory failure from interstitial pneumonia was the cause of the deaths. The presence of environmental risk factors such as the ambient air temperature in the infants' room, number and position of covers, type of bed, prone sleeping position, cosleeping, mother's cigarettes abuse, and recent signs and symptoms of illness, acting at the same prolonged time on each baby, had to be considered relevant in justifying the simultaneity of the lethal event.

Simultaneous Sudden Infant Death Syndrome, Acute Respiratory Failure, Interstitial Pneumonia

G100 Infant Position and the Assessment of Risk Factors for Asphyxia: A Review of 209 Sudden Unexpected Infant Deaths

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After attending this presentation, attendees will understand the importance of a scene investigation, preferably with reenactment using a doll, in identifying the risk factors for asphyxia in a sudden, unexpected infant death.

This presentation will impact the forensic community and/or humanity by demonstrating how historically, the investigation of an infant death has focused predominately on autopsy and microscopic findings with little understanding or consideration of the risk factors for asphyxia at the scene. Since most infant autopsies are negative for significant disease or injury, many of these have traditionally been called sudden infant death syndrome (SIDS). Even in some cases where asphyxia was strongly suspected at the scene, such findings have been ignored in favor of a SIDS diagnosis or cause of death based on some evidence of natural disease at autopsy such as a respiratory tract infection. By ignoring risk factors for asphyxia in many cases, pathologists have missed emphasizing a major cause of sudden infant death through the years.

At the Wayne County Medical Examiner Office in Detroit, Michigan, from 2001 to 2004, scene investigations were performed on 209 sudden and unexpected infant deaths, ages 1 day to 12 months. This included a follow-up visit, usually performed by a public health nurse. A reenactment of the position of the infant's body when found using a doll took place in all except 7 scenes where parents refused or a doll was unavailable. The 209 cases were reviewed to assess the position of the infant at the time of discovery and identify the common risk factors for asphyxia including bed sharing, overlay, wedging, strangulation, and prone position, demonstrated obstruction of the nose and mouth and coverage of the head by bedding. Sixty (28.7%) of these infants died in their cribs, 110 (52.6%) died after being placed to sleep in adult beds, 25 (12.0%) died after being placed to sleep on couches, 5 (2.4%) died in car seats and 9 (4.3%) died in miscellaneous other locations. Conclusive evidence of asphyxiation including witnessed overlay, wedging, or strangulation was established in 27 cases (12.9%). Bed sharing occurred in 114 deaths (54.5%). An infant position with demonstrated complete obstruction of the nose and mouth upon discovery was shown in 64 cases (30.6%). Prone positions on soft bedding +/- partial obstruction of the airway, general prone position, and/or coverage of the head by bedding were documented in 30 cases (14.4%). Overall, one or more risk factors for asphyxia were identified in 178 out of 209 cases (85.2%). Nonspecific criteria which may complicate breathing in an infant with airway compromise were identified in 59 out of 178 infants with asphyxia risk factors (33.1%) and included symptoms of the flu or upper

respiratory infection, medication with sedating decongestants, known respiratory complications of prematurity and/or a previously diagnosed medical condition for which they were not exhibiting acute symptoms. Thirty-one of 209 infants (14.8%) had no discernible risk factors for asphyxia. The information gathered at the scene investigation regarding the infant's position at death was completely different from the initial death report in 26 of 209 cases (12.4%) and revealed additional information regarding asphyxia risk factors in 92 cases (44%). Of the 209 infants, the cause of death of 49 (23.4%) was determined to be position-related asphyxia, 35 (16.7%) were natural causes (with pneumonia/airway inflammation and congenital heart disease predominating), 67 (32.1%) were designated sudden infant death syndrome (SIDS), 57 (27.3%) died of indeterminate causes and 1 case was ruled accidental aspiration of food. The increasing awareness in risk factors for asphyxia at the scene has led to a reduction in the diagnosis of SIDS at the Wayne County Medical Examiner Office from 38 in 2000 to 2 in 2004 (94.7% decrease). In this same time period, the diagnosis of position-related accidental asphyxias in the 1-day to 12-month age group increased by 283% from 6 to 17 and indeterminate causes of death increased by 900% from 3 to 27. This study suggests that asphyxia plays a greater role in many sudden infant deaths than has been historically recognized, and a thorough scene investigation with doll re-enactment is an effective way to identify the risk factors. A better understanding of the significance of these risk factors is needed so that the causes of many sudden infant deaths can be determined and appropriate preventive measures reinforced.

Sudden Infant Death, Infant Position, Asphyxia

G101 Hyperglycemic Hyperosmolar Nonketotic Syndrome in a Sixteen-Month Old Child With Rotaviral Diarrhea

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The goal of this case study is to present a child death due to severe dehydration from hyperglycemic, hyperosmolar, nonketotic syndrome (HHNS), with concomitant rotavirus diarrhea.

This presentation will impact the forensic community and/or humanity by reviewing the rare entity of HHNS in children; and discussing the differentiation between stress-induced hyperglycemia, diabetic ketoacidosis (DKA) and HHNS.

A sixteen-month-old male child, born at twenty- five weeks and five days gestation, had several congenital anomalies including serious mental and neurological deficiencies.

The initial five months of his life were spent in the hospital during which time he never demonstrated hyperglycemia or showed signs of being diabetic.

Three days prior to his death he developed episodic, profuse watery diarrhea. He was fed a banana, rice, applesauce, toast, (BRAT) diet, without toast. He was also treated with acetaminophen and bismuth subsalicylate. There were no visits to a physician.

On the third day of his illness, he was fussing at 0430. His mother tried to give him cough medicine but he refused. She changed his diaper, laid him prone, and rubbed his back. He was notably limp. When she checked on him approximately two hours later, he was unresponsive. Paramedics were called, but death was obvious and no resuscitation was attempted.

Postmortem examination revealed a slightly dysmorphic male, weighing 18 pounds and having a crown-heel length of 29.5 inches. The occipital frontal circumference was 16.8 inches. The eyes appeared sunken. The organs had dull surfaces and were tacky to touch. There was no physical or historical evidence of previous or recent abuse.

The stomach contained 300cc of light pink fluid without any food fragments. The intestinal contents were of a similar consistency to that of the stomach and light tan in color. The brain had markedly small cerebellar hemispheres and atrophic optic nerves. The hippocampi were atrophic and the lateral and fourth ventricles were mildly dilated. Microscopic sections from the pancreas, heart, lungs, liver, kidney, adrenals, thymus, and trachea were normal. Vitreous electrolytes included a glucose of 598mg/dL, vitreous osmolality 430mOsm (285-305mOsm), sodium-158mEq/L, chloride-140 mEq/L, urea nitrogen-37mg/dL, and creatinine-1.0 mg/dL. Acetone was negative. Stool culture was positive for rotavirus. Toxicology was positive for liver acetaminophen with 25mcg/gm, and liver salicylate of 3.5mg/100gm.

Diarrhea illness, world wide, represents a leading or second cause of death for children less than five years old. In the United States only about 300 child deaths per year are due to diarrhea.

HHNS is almost always a disorder of Type II diabetes mellitus in elderly, neglected, or debilitated adults. In HHNS, glucose levels are elevated, often as high as 1000 mg/dL or more. Ketones are negative because lipolysis is inhibited. Serum osmolarity is high, with the measured level being higher than the calculated level. Acidosis may occur, and is usually due to lactate from hypoperfusion.

Fewer than 30 cases of HHNS have been reported in children since 1960. In most of these, the children are less than two years old and/or neurologically impaired. Mortality is as high as seventy five percent, and occurs from dehydration or from cerebral edema if rehydration occurs too rapidly.

HHNS in children represents either the initial presentation of diabetes mellitus, or it is associated with gastroenteritis, usually rotavirus, as was the case with this child. When HHNS is associated with gastroenteritis it is a transient condition and, if the child survives, they have no greater risk of developing diabetes mellitus than the rest of the population. The mean glucose level (634 mg/dL) is lower, and the sodium is higher (mean 135 mEq/L), when gastroenteritis is the cause of HHNS.

Suggested laboratory studies needed to make the diagnosis of HHNS, and to exclude diabetes mellitus, include glucose, osmolarity, HgA1C, plasma insulin levels, and islet cell antibodies.

Although samples to exclude diabetes mellitus did not remain in this case, this child, who had a severe neurologic disorder and no prior history of a hyperglycemic event, and who was hyperosmolar with rotavirus diarrhea, represents a rare case of HHNS.

Hyperglycemic, Hyperosmolar, Nonketotic

G102 Starvation – Interpretation of Morphological Findings and Pitfalls

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After attending this presentation, attendees will learn how to interpret the morphological findings in cases of starvation.

This presentation will impact the forensic community and/or humanity by helping to avoid the misinterpretation of the morphological findings in cases of starvation by demonstrating the classifications of malnutrition and potential pitfalls in its diagnosis.

Starvation is still a worldwide and every day problem. A high infant mortality exists in many Asian, African and some Central and South American states, which is directly explainable by hunger and its after-effects. In European and North American countries cases of death from starvation are rare, but nonetheless, are not unknown in the forensic pathology literature. Actually, illness resulting from wealth and overfeeding are much more prevalent.

Nowadays, cases of death due to starvation originate, in general, from physical or psychical diseases, from food refusal or food deprivation. The latter cause of intentional food depravation of a child being in most cases a sign of child neglect punishable by the law.

Starvation due to consumptive illness resulting from serious natural disease, such as cancer, is always related to the original natural disease. Deaths caused by malnutrition are cases of unnatural death.

Under-nutrition can be classified in certain stages. According to the Gomez-Classification the body weight of a malnourished individual is compared to the expected weight of an individual of the same age. The categories mild, moderate and severe malnutrition is based on a body weight of 75 to 89%, 60 to 74% and <60%, respectively, of the expected body weight. With this classification it is difficult to interpret the correct body-weight of children. Because of the different growth rates of children, in these cases of suspected starvation, the Waterlow classification (Table 1) should be used. The chronic growth retardation of a child can be assessed by comparing the measured height of the body with the expected height. Then the weight of the individual is compared with the expected weight of the body corresponding to the actual height to assess the actual state of under or malnutrition.

Growth Retardation (Chronic)	0 normal Height (% of the expected height at a defined age)	1 mild > 95	2 moderate 95 - 87	3 severe 87 - 80	
Protein-Energy-Malnutrition (Acute)	Weight (% of the expected weight at a defined age dependent on the actual height)	0 normal > 90	1 mild 90 - 80	2 moderate 80 - 70	3 severe < 70

In this study, cases of starvation were evaluated to point out the difficulties in interpretation of body weight and weight of internal organs and to demonstrate potential pitfalls in this analysis.

The following conclusions can be drawn from this analysis:

- The suspicion of death through starvation becomes evident at first sight.
- The real cause of starvation has to be confirmed by numerous examinations (autopsy and histology and toxicology).
- The autopsy of the body includes the determination of all measurable parameters (height, body weight, organ weight), as well as photo documentation.
- Verification of the development of the child at an early age and from birth on is necessary.
- Investigation by the police of the responsible caretakers for the child, and their responsibility in the starvation, must be carried out.
- Under certain circumstances, such as suspicion of a rare chronic disease, a pediatrician can be consulted for their expert opinion.

Starvation, Waterlow Classification, Malnutrition

G103 Perimacular Circular Folds in the Eyes of Injured Children

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After attending this presentation, attendees will gain an understanding of how to recognize perimacular folds, will know when to look for them, and know in what kinds of cases perimacular circular folds have been reported to be present.

This presentation will impact the forensic community and/or humanity by demonstrating an increasing ability of forensic pathologists to recognize perimacular circular folds and stimulate interest in looking for such folds in a wider variety of death investigations, although most perimacular circular folds have been seen in abusive head injury deaths.

Hypothesis: Examination of the retinas of a group of children would allow the identification of perimacular circular folds if present. Review of the clinical history, investigative information, and autopsy findings would help establish the significance of such circular folds.

Circular folds have been identified in the eyes of injured children. The initial reports described these findings in children described as battered babies and in children with head injuries attributed to shaking. Cases were selected to report the presence of circular folds. Another report described them in three of ten consecutive cases of child abuse. In all of these reports vitreous traction was the proposed mechanism in the development of circular folds. In the consecutive series report it was proposed that direct head trauma was sufficient to produce the acceleration deceleration traction. More recently, a report described circular folds in a child with crush head injuries occurring when a television fell from a stand, which was an accidental event.

Ocular examinations were a part of a prospective study of child deaths investigated at the Southwestern Institute of Forensic Sciences. Adequate material was available for a retrospective evaluation of 33 of the children's retinas for the presence of circular folds. This group consisted of 25 children with abusive injuries, 5 children with accidental head injuries, and one each of lethal trunk injuries, brain tumor and drowning. Perimacular circular folds were identified in 11 cases. Review of the clinical histories, investigations, and autopsy findings revealed that the circular folds were only found in children with abusive head injuries.

The mechanism of the head injury has previously been reported for a subgroup of head injured children from the entire series from the Southwestern Institute of Forensic Sciences. The mechanism of injury for the 30 head injured children in this group was established independent of information about the presence or absence of perimacular circular folds. Circular folds were seen in 3 of 15 deaths attributed to blunt force mechanisms, 7 of 12 deaths with combined shake and blunt force mechanisms, and 1 of 3 with the mechanism of injury attributed to shaking.

Conclusion: These observations confirm the association of perimacular circular folds with abusive head injuries in a larger group of child deaths than previously reported. The cases were not selected on the basis of circular folds or abusive head injury. The number of accidental head injuries and other causes is too small to clarify whether the perimacular circular folds could be found in other conditions. The mechanism of injury in 8 of the 11 children with circular folds included shaking which supports the proposed vitreous traction mechanism for the formation of perimacular circular folds. However, the presence of circular folds in 3 abusive head injury deaths attributed to blunt force injuries suggests more observations are needed to clarify this issue.

Perimacular Circular Folds, Abusive Head Injury, Vitreous Traction

G104 Postmortem Detection and Evaluation of Retinal Hemorrhages

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After attending this presentation, attendees will gain a better understanding of the variety of disease processes associated with retinal hemorrhages in neonates, infants, children, and adults.

This presentation will impact the forensic community and/or humanity by demonstrating how postmortem monocular indirect ophthalmoscopy permits visualization of the fundus after death and can identify retinal hemorrhages associated with a variety of conditions in children and adults.

Although occurring in about 25% of adults with subarachnoid hemorrhage, Terson syndrome has been considered rare in children and any retinal hemorrhages (RHs) not associated with inflicted childhood neurotrauma have been described as few in number and restricted to the posterior pole. A number of ophthalmologists, pediatricians, and forensic pathologists have asserted that RHs in conjunction with intracranial hemorrhages in children can be considered virtually pathognomonic for inflicted childhood neurotrauma or shaken baby syndrome based on the number, character, location, and distribution of RHs. Unfortunately but characteristically, most studies to date concerning hemorrhagic retinopathy in non-accidental head injury have lacked specific criteria for case definition, exhibited observational and selection bias or cases were selected by the presence or absence of RHs - the clinical or autopsy finding that was being sought as diagnostically valid.

Since June of 2004 the authors have used postmortem monocular indirect ophthalmoscopy to prospectively examine the eyes of 425 deceased individuals at the institution (medical examiner and non-medical examiner cases) ranging in age from birth to 96 years. The postmortem interval ranged from 1 hour to 3 days with 65.9% of examinations occurring less than 24 hours after death. Slightly over 17% exhibited retinal hemorrhages associated with a variety of diseases and conditions. The number of decedents with retinal hemorrhages by age group is listed in the accompanying Table.

Age Range of Decedents and Presence/Absence of Retinal Hemorrhages

	< 1 yr	1-4 yrs	5-9 yrs	10-14 yrs	> 15 yrs	Total
Cases in which fundi not visualized	6	0	2	1	5	14
Cases with no RHs	43	14	7	4	270	338
Cases with RHs	11	3	3	2	54	73
Total	60	17	12	7	329	425

Conditions or causes of death associated with the presence of RHs by age group and number of cases (noted in parenthesis) were:

< 1 yr: Birth-related (2), asphyxia/suffocation (2), Sudden Infant Death Syndrome (SIDS)/resuscitation (2), apnea/gastroesophageal reflux (1), intrauterine intracranial hemorrhage (1), blunt trauma of head (1), prematurity/congenital heart disease (1), meningitis (1)

1-4 yrs: Blunt trauma of head (3)

5-9 yrs: Blunt trauma of head (3)

10-14 yrs: Intra-cranial hemorrhage/metastatic cancer (1), blunt trauma of head (1)

> 15 yrs: Blunt trauma of head (17), coagulopathy (10), gunshot wound of head (7), ruptured saccular aneurysm (7), intra-cerebral hemorrhage/hypertension (6), subarachnoid hemorrhage/vascular malformation (1), hypoxic-ischemic brain injury/drug toxicity (1), meningo-encephalitis/leukemia (1),

intra-cerebral hemorrhage/amyloid angiopathy (1), hypertension (1), diabetes mellitus (1), pulmonary fibrosis/extracorporeal membrane oxygenation (1).

The manner of death in children under the age of 14 years with RHs (by age group and number of cases) was:

< 1 yr: Natural (7), Accident (2), Homicide (1), Undetermined (1)

1-4 yrs: Homicide (2), Accident (1)

5-9 yrs: Accident (3)

10-14 yrs: Natural (1), Homicide (1)

Histological ocular examination of 28 neonates, infants, children and adults with retinal hemorrhages from this study demonstrated a variable pattern as to the number, character, location and distribution of retinal and optic nerve sheath hemorrhages. Of the 73 individuals with retinal hemorrhages, 75.3% died in the hospital; however, only four children and one adult had documented clinical fundal examinations. The four children had child abuse consults while the adult experienced a vitreous hemorrhage from thrombocytopenia during treatment for leukemia. Postmortem monocular indirect ophthalmoscopy is a valuable technique for identifying retinal hemorrhages associated with a variety of conditions and diseases in children and adults.

Retinal Hemorrhages, Postmortem Monocular Indirect Ophthalmoscopy, Shaken Baby Syndrome

G105 Examination of Sexually Abused Child: What is the Impact on Judgment?

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After attending this presentation, attendees will know how the assumption of the possibility of sexual abuse leads almost systematically to a forensic examination. This fact has implications on the health of the victim and the course of the judicial action. However, it is an examination often poor in clinical elements that is used as material proof of abuse. The goal of this study was to try to better understand the contribution of this examination in the legal process.

This presentation will impact the forensic community and/or humanity by attempting to better understand the contribution of the forensic examination when sexual abuse is suspected, and the expected judicial follow-up in sexually abused child affairs.

Assumption of the possibility of sexual abuse leads almost systematically to a forensic examination. This fact has implications on the health of the victim and the course of the judicial action. However it is an examination often poor in clinical elements that is used as material proof. The goal of this study was to try to better understand the contribution of this examination in the legal process.

A retrospective study on a sample of forensic examinations was carried out on requisition. It concerned 74 children of less than 18 years old, examined between June 1998 and June 2000. With the authorisation of the court of Angers city, the judicial files were consulted on site.

It concerned 58 girls for 16 boys. The average age of the victims at the time of the medical examination was nine and a half years old. In 15 cases there was a history of ill-treatment. For nine percent of the victims, the father had been the subject of a penal judgement with prison sentence.

Nine cases related to acts of sexual improprieties, 58 cases of sexual transgressions and 25 cases of rapes or rapes attempts. In 61 percent of the cases, the victim revealed the facts. In 70 percent of cases, time between the facts and revelations was longer than one month.

The forensic examination did not find any disorder for the great majority of the children. In four cases, it highlighted hymenal damage of which two were assigned to sexual abuse. Forty-two victims underwent a

psychological or psychiatric consultation. For two children, their remarks were not recognised credible by the experts.

The total number authors blamed for abuse was 58. Nineteen had already been condemned for sexual abuse. In 26 cases, the father was the abuser. In 43 percent of the files, the authors acknowledged the facts. The courts pronounced the culpability of the authors for 42 victims. It was more frequently pronounced for the female victims (63 %) than for male sex (21 %).

Young girls are mainly the victims. In many cases they are abused by their father or by members of the close family. Forensic examinations did not often reveal cutaneous or genital disorders. The lesions can be fleeting and are often healed. Without bringing material proof, anatomical description makes it possible to come to a conclusion about the feasibility or not of some denounced sexual abuse. Conclusions of forensic examinations, when they partly contradict denounced facts do not call into question the reality of the sexual abuse. In many cases, the author is condemned despite everything. That highlights the importance of investigation and of the child's words.

Sexual Abuse, Child, Forensic Examination

G106 Sensitivity of Autopsy and Radiological Examination in Detecting Bone Fractures in an Animal Model: Implications for the Assessment of Fatal Child Physical Abuse

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After attending this presentation, attendees will come to realize the limits of the radiological CT scan and autopsy assessment in the detection of antemortem bone fractures in cases of fatal child abuse, and that direct osteological assessment of certain anatomical areas (particularly the rib cage) is advisable.

This presentation will impact the forensic community and/or humanity by demonstrating how the osteological assessment of certain anatomic areas upon autopsy of infants is advisable, since radiology, autopsy, and CT scans may miss fractures.

Skeletal injuries are often strong indicators of child abuse and their detection is crucial. Regardless of whether one is referring to the living or the dead, bone fractures are perhaps the most important and problematic issue as far as detectability is concerned. According to some authors, skeletal injuries occur in 36-50% of abused children. Whereas external and internal soft tissue traumatic injuries will eventually show up at a thorough clinical examination or at the autopsy table, the presence of bone fractures whose distribution, number and age are crucial is not easy to detect, particularly if very recent or if inflicted in the circumstances of a lethal event and therefore just barely antemortem. In cases in which the child dies immediately after infliction of trauma, the signs may consist of very subtle soft tissue lesions and especially bone fractures – the latter being at times, particularly difficult to detect when healing processes (and therefore callus formation) have not taken place. Furthermore, hemorrhaging of soft tissues may be slight and barely visible upon autopsy, particularly in the paravertebral and posterior vertebral regions, or may be hidden by initial decomposition processes. Thus autopsy and radiological assessment are crucial.

However it is not really known how sensitive such procedures are. Although several studies have been performed, little research has been done on the actual sensitivity of radiology, CT scan, and autopsy on control cases. In order to do this in fact, it is necessary to verify, after radiological assessment and autopsy, all fractures, which are actually present on the bone by studying the cleaned skeleton.

The aim of this study was to compare the sensitivity of three diagnostic approaches of autopsy, traditional (conventional) radiology, and computed tomography on "battered" piglets, in order to verify the sensitivity of each method, with respect to the true number of bone fractures assessed once the piglet was skeletonized (osteological control).

Four newborn cadaver piglets that had died from natural causes were severely beaten postmortem in every district of the body. Traditional radiography, computed tomography (CT) and autopsy were performed. The piglet was then macerated until skeletonized and the number of all fractures present recorded (osteological control).

On the cranium, traditional radiology revealed only 35% circa of actual fractures, autopsy detected only 31 % ($P<0.01$ for both comparisons vs. osteological control), whereas CT imaging detected all fractures actually present. For ribs, radiology detected only 47% of all fractures present, and autopsy 65% circa ($P>0.05$ for both comparisons vs. osteological control), while CT scans detected 34% ($P<0.01$).

In suspected cases of fatal child abuse, the authors suggest that the bones of specific districts be directly analyzed either at autopsy or by collecting specific diagnostic sites, such as parts of the rib cage, and subjecting them to maceration. The removed areas could be replaced with artificial material for cosmetic purposes. These findings stress the importance of combined radiological, CT scan, autopsy, and osteological survey in the detection of perimortem bone fractures. This study confirms the possibly low sensitivity of autopsy and radiological analysis particularly in the detection of hairline fractures of head and thoracic osseous elements if fractures are perimortem and show no healing. According to the authors, in cases of suspected fatal child physical abuse, the bones of specific anatomic regions should be directly analyzed.

Child Physical Abuse, Bone Fractures, Radiology

G107 "Homicide by Heart Attack" - An Unusual Pediatric Death

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The goals of this presentation are to illustrate and discuss applicability of previously published criteria for homicide by sudden cardiac death in pediatric cases. An unusual case of fatal child abuse will be presented as an example.

This presentation will impact the forensic community and/or humanity by demonstrating how the possibility of underlying potentially fatal natural disease must be considered in instances where multiple blunt trauma in a deceased child is unassociated with internal injuries of sufficient severity to explain the demise. Although the current example entails obvious natural disease, the presence of more subtle abnormalities should diligently sought in such cases. If a temporal correlation of abuse (with non-fatal injuries) with death can be documented by investigation, the manner of death may be properly classified as homicide.

This 17-month-old Hispanic female child had a history of various types of abuse, including blunt trauma as well as neglect. The mother was the reported perpetrator, and according to family members, this child was targeted because the mother had doubts as to her maternity (she speculated that the hospital had sent her home postpartum with somebody else's child).

On the date of death the mother phoned from home to her brother-in-law and initially indicated that this child had "fallen from the bed." Over the next several minutes she phoned her sister as well, made several other incriminating statements indicating that in fact she had "hit" the child, and even admitted to her sister "I killed the baby." The brother-in-law immediately rushed to her house, while simultaneously phoning emergency medical services. He arrived at the house at nearly the same time as ambulance personnel. Paramedics found the child unresponsive. Aggressive resuscitative efforts were unsuccessful and the child was pronounced dead upon arrival to the emergency room. As paramedics were entering the house the mother rushed out, drove to the local day care, retrieved her other children and fled to Mexico. The mother and siblings have not been returned to this country, despite multiple warrants.

The abusive nature of the child's injuries was undeniable. Contusions of various ages were distributed widely over all body surfaces, including the scalp, face, thorax, and extremities. Pressure type contusions were on the pinna. Multiple contusions were distributed across the mucosa of the lower lip, and a gaping laceration undermined the upper frenula separating the upper lip from the alveolar ridge. Internal findings were less impressive. In fact, no internal injuries were found. Furthermore, no natural disease was grossly evident. The microscopic appearance of the heart was strikingly abnormal; myocarditis was florid, with abundant lymphocytic inflammation, with intramyocyte edema and myocyte necrosis.

To paraphrase Davis's criteria for "homicide by heart attack," 1. the threat must be severe enough to be considered as a threat to the life of the victim; 2. the victim should perceive the incident as a threat to their life; 3. the threat must be an emotionally charged event; 4. death must occur within the emotional response period during or immediately following the threat; and 5. cardiac disease associated with predisposition to arrhythmia should be documented, although no acute cardiac change (ruptured plaque for example) need be found (J Forensic Sci 23:384; 1978). Although Davis's criteria have been applied primarily to instances of a threat without physical contact, more recent literature (J Forensic Sci 49:598; 2004) expands the criteria to include threats with actual physical contact, but the inflicted injuries are insufficient to explain death. Therefore, the investigative and autopsy findings in this case fit the published criteria for homicide by sudden cardiac death. Accordingly, the cause of death was classified as "sudden cardiac death (myocarditis) associated with multiple blunt force injuries." The manner of death was classified as homicide. Implications for similar types of pediatric cases will be described in the presentation.

Child Abuse, Myocarditis, Homicide by Heart Attack

Pathology/Biology

G1 Deaths From Accidental Steam Inhalation During African Traditional Therapy

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The goal of this presentation is to present to the forensic community the injurious effects of steam inhalation on the respiratory system, resulting in the deaths of two children. Death from steam inhalation is a quite rare occurrence. In many countries, steam inhalation is practiced to cure cold, cough, or respiratory ailments, etc.

This presentation will impact the forensic community and/or humanity by highlighting the hazards associated with steam inhalation, if done with the whole body covered with a blanket and if necessary precautions are not taken. Under these conditions, traditional therapy can be risky.

Case history: Two children (aged 17 and 6 years) and their mother were inhaling steam from boiling water in a pot, while covering their bodies (including the face) with a thick woolen blanket. After steam inhalation of about 5 minutes, the 17-year-old knocked down the pot and boiling water spilled on the hot plate, producing a considerable amount of steam. Boiling water also spilled on that child and mother, resulting in focal scalds. Within one to two minutes, both children experienced difficulty in breathing, collapsed, and died in the home.

At autopsy, there was oedema of the larynx with blanched white tracheal mucosa in the younger child and marked congestion in the older child. Grossly, the lungs, brain, and heart showed hypoxia signs. Microscopically, there was oedema and coagulative necrosis of the tracheal mucosa; the lungs showed congestion, oedema, and haemorrhages; and the brain showed congestion, oedema and focal intra-cerebral haemorrhages.

Cause of death was attributed to hypoxia from inhalation of steam.

It is common practice among the black Africans to use steam inhalation (traditional African therapy) known as ARAMELA in local Sotho African language) for respiratory problems or congestion or get rid of unspecified ailments, or for general well-being even when there is no evidence of any ailment (superstitious belief).

Moist air has more heat to give up than has an equal volume of dry air. Severe injuries tend to occur with steam inhalation in the form of oedema of the glottis, severe thermal tracheitis and destruction of bronchial mucosa, and haemorrhagic oedema of the centrally located alveoli which can lead to hypoxia and anoxia.

Steam Inhalation, Respiratory Tract, Hypoxia

G2 Firearm Injuries in Angers: 1990 - 2000

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After attending this presentation, attendees will be able to analyze a series of 168 cases of firearm injuries in a French city.

This presentation will impact the forensic community and/or humanity by analyzing the rate of firearm injuries and deaths in a French city and discussing the different governments' politics.

Firearms are a major cause of injuries and death in many countries, especially in the USA. In France, injuries caused by firearms account for only a small percentage of trauma admissions and deaths but are frequently the subject of media and public attention.

Materials: This study is a retrospective study. The authors examined the epidemiology of firearms injuries presenting to University Hospital of Angers from January 1990 to December 2000 (Institute for Legal Medicine and Unit of Intensive Care). Information was collected from forensic medical files, police reports, and judicial files.

Results: One hundred sixty-eight of firearm injuries were analyzed. The mean age was 42 years. Of the cases reviewed eighty percent were male and 74% died. Of the 90 weapons that could be positively identified, 20% were handguns. Most often, the shooters used a rifle—especially a shotgun. In many of the cases where a rifle was confirmed as the firearm used in the shooting, it was a 0.22 calibre low-velocity weapon. One hundred seventeen (70%) were classified as suicides: victims were often males, about 43 years old and the death rate was high (75%). The head and neck was the most favored site, accounting for 72% of the wounds; the presternal-precordial region of the chest accounted for 17% of the wounds. Twenty-five percent (25%) of cases were homicides: 57% male and 43% female. The presternal-precordial region of the chest was the most favored site (40%). Five cases (3%) were accidents: these injuries were sustained during handgun training, cleaning, or carriage of the weapon. Only four cases (2%) were undetermined.

Discussion: In France, the deaths from firearms represent 3,100 deaths / year (population: about 55 million). This rate is lower than other countries with flexible laws. Stricter gun control laws were enacted by the government, prohibiting the ownership of military-style, high-velocity, semi-automatic rifles. Indeed, no shooting in this series involved high-velocity weapons, and nationally these weapons account for only 1% of all firearm deaths. However, firearms are a frequent means of suicidal death, and the number of homicides committed with a firearm is not insignificant. Continued restricted access to firearms is necessary to maintain France's relatively low rate of fatal injuries.

Forensic Pathology, Wounds Ballistics, Firearms

G3 Evaluation of a Novel Tagging and Tissue Preservation System for Human Remains

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The goal of this presentation is to describe a new, easy-to-use, barcode-based tissue collection, preservation and body tracking system, which might prove instrumental in the containment of mass fatalities such as aircraft accidents, war-related accidents, environmental disasters (e.g., earthquakes, hurricanes, floods), terrorist bombings, or mass murders.

This presentation will impact the forensic community and/or humanity by simplifying the use of this tissue collection and body tagging system, as well as the convenience afforded by working in an ambient temperature environment without the requirement of a refrigerator/freezer or any other additional device, while maintaining DNA integrity for a long period of time, representing potential benefits for the forensic community.

Tissue preservation is a critical issue in forensic investigations where human remains are collected for DNA analysis. The maintenance of a forensically sound chain of custody is also a critical part of field as well as laboratory practice. Low ambient temperatures and rapid recovery of human remains are ideal conditions to ensure successful DNA analysis. However, such conditions are rarely met in disaster areas, which are often encountered in geographically remote regions of the world. The new ear-tag system TypiFix™ works simply by pushing a clamp-like applicator. By

operating the loaded applicator a tissue sample is punched out by a collection stud and automatically introduced into a self-sealing sample container. In the tightly sealed sample container, the tissue and its DNA are preserved through desiccation by molecular sieve beads consisting of sodium-aluminium-silicate. The ear-tag and sample container are preprinted with the same identification number as well as a barcode. They are attached to each other until the sample is introduced in the sample container. Through this simultaneous barcoding of the remains and the tissue sample at the point of recovery, sample switch is excluded.

A feasibility study was conducted to determine the usefulness and the limitations of this device in a forensic setting and to evaluate the effect of long term storage of tissues in the sealed TypiFix™ container on DNA analysis using short tandem repeat (STR) methodology. Ten bodies were selected for this study (time since death 3 - 25 days). Tissue sampling with simultaneous tagging was performed at the interdigital fold between the thumb and the index finger of either hand using the TypiFix™ applicator. Samples were stored at room temperature and processed at 2 weeks and 6 months after collection. Using a special extractor clamp provided by the manufacturer of TypiFix™, the bottom of each sealed sample container was removed and dry tissue samples were transferred to 1.5 ml eppendorf cups. The tissue samples were subjected to DNA extraction using the QIAamp DNA Mini Kit (tissue protocol, Qiagen Inc., Valencia, CA). Quantification of human genomic DNA was determined using real-time PCR (ABI PRISM® 7000 Sequence Detection System) and the Quantifiler™ Human DNA quantification kit (Applied Biosystems). Autosomal STR analysis was carried out with 1 ng of genomic DNA using the AmpFLSTR® SGM Plus® PCR amplification kit. All analyses were performed in accordance with the manufacturer's instructions.

On average 8 ± 5.7 µg DNA (mean \pm SD) were purified from each sample. The success rate of STR genotyping after 2 weeks and 6 month was 100%. DNA profiles after six months of storage were identical to those obtained after two weeks.

Currently, the most commonly used method of preserving tissues for subsequent DNA analysis is freezing. Very few alternative approaches have been developed to preserve soft-tissue samples at room temperature. Using the described system keeps the collection costs low, provides fast and reliable DNA samples from a large number of individuals in a short time, and ensures a forensically solid chain of custody from the point of recovery in the field to the DNA analysis in the forensic laboratory.

The collection of tissue-samples for DNA analyses can easily be achieved under field conditions. In case of mass fatalities it enables investigating authorities to collect numerous specimen for DNA analysis and simultaneously label the remains. Barcodes can be manufactured according to customers' needs. The system is fail-safe and fraud-proof. The specimen container is contamination-proof since only the single-use parts come in contact with biological materials. The tissue sampling for DNA analysis is possible without the need to refrigerate or freeze samples. According to the manufacturer, tissues stored over 4 years in the TypiFix™ system are still suitable for amplification of long fragments by PCR.

Therefore the TypiFix™ system provides a new, reliable and useful tool for the recovery and simultaneously labeling of human remains and tissue samples in mass fatalities.

DNA Analysis, Tissue Preservation, Disaster Identification

G4 Lesch-Nyhan Syndrome and Child Abuse

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After attending this presentation, attendees will understand the importance of distinguishing child abuse from Lesch-Nyhan syndrome (LNS); understand the first description of postmortem verification; and understand the diagnostic significance of the absence of the HPRT-enzyme in the deceased.

This presentation will impact the forensic community and/or humanity by describing how LNS should be suspected chiefly when self-injurious behavior is associated with the typical motor dysfunction and excessive production of uric acid. This may clearly distinguish it from child abuse.

Postmortem analysis of HPRT-enzyme activity is a new and important tool for forensic work-up, enabling—especially in cases of doubt—a first and guiding diagnostic step before parents are confronted with suspicion of child abuse. A confirmation of the HPRT-enzyme deficiency may not completely exclude additional child abuse. However, careful forensic analysis, including enzyme-diagnostics, combined with the presence of injuries typical of self-mutilation, will help to clarify the facts.

LNS is characterized by neurologic dysfunction, cognitive and behavioral disturbances, and uric acid overproduction. It results in complete deficiency of the enzyme hypoxanthineguanine phosphoribosyltransferase (HPRT), which catalyzes the conversion of hypoxanthine to inosine monophosphate (IMP) and guanine to guanine monophosphate (GMP) in the presence of phosphoribosylpyrophosphate (PPP). Thus, the deficiency of HPRT activity leads to accumulation of PPP resulting in excessive uric acid production and hyperuricaemia.

The hallmark feature of the disease is persistent self-injurious behavior with biting the lips, buccal mucosa and/or fingers, often resulting in partial or total destruction of perioral tissues and amputation of tongue and fingers.

The deceased, a four-year-old boy, was born after uneventful gestation and delivery. At the age of six months, he developed marked spasticity, double hemiparesis and choreoathetosis. Because the neurologic deficits were progressive and the serum level of uric acid elevated, LNS was suspected. This suspicion was confirmed after evaluation of HPRT-enzyme activity, which was almost completely missing. Initial self-mutilation occurred around the age of 18 months, following an accidental, pain-producing injury. Feeding was difficult and spasticity developed in upper and lower extremities; the boy could neither sit, nor stand nor walk without help, and he couldn't speak, only babble. He experienced several respiratory infections. One morning he had an elevated temperature of 101° F, without other signs of infection. After breakfast, he fell asleep, and a short time later, his mother found him lying in bed unconscious after vomiting. Paramedics performed resuscitation procedures without success. Although the boy's mother reported the diagnosis of LNS, suspicion of child abuse arose because of his injured fingers and his malnutrition. A forensic autopsy was performed.

Autopsy revealed an undernourished boy with developmental delay. His thumbs were scarred from repeated episodes of biting; his tongue, lips, and buccal mucosa showed abrasions. Both lungs showed pneumonia and discrete food aspiration; internal and microscopic examinations were otherwise unremarkable.

The formation of ¹⁴C-IMP was measured in a radioisotope assay in which ¹⁴C-labeled hypoxanthine was converted to the labeled nucleotide. Purine base and nucleotide were separated by thin layer chromatography, the radioactivity in the nucleotide and base fraction was determined by liquid scintillation counting, allowing the calculation of the amount of purine base converted to nucleotide. The erythrocytes were extracted. The assay was carried out by mixing assay buffer, PPP, and ¹⁴C-hypoxanthine with the sample. The reaction was stopped by cold perchloric acid. After centrifugation, the supernates were neutralized with equivalent amounts of KHCO₃ and KCLO₄ precipitated by centrifugation at 4°C. The supernates were spotted on aluminum backed silica-gel-thinlayer sheets containing a fluorescence indicator using unlabeled hypoxanthine, inosine and IMP as carriers. The spots containing hypoxanthine, inosine, and IMP were identified under UV-light, cut out and the radioactivity quantified by liquid scintillation counting. The controls of the series of postmortem enzyme assays demonstrated the HPRT-enzyme to be in the normal range at least up to five days after death. It was thus concluded that the HPRT-enzyme is relatively stable postmortem as compared to the boy's HPRT-enzyme activity of less than 1.5% one day after death, demonstrating the complete deficiency of the enzyme.

LNS should be suspected chiefly when self-injurious behavior is associated with the typical motor dysfunction and excessive production of uric acid. This may clearly distinguish it from child abuse. Postmortem analysis of HPRT-enzyme activity is a new and important tool for forensic work-up, enabling—especially in cases of doubt—a first and guiding diagnostic step before parents are confronted with suspicion of child abuse. A confirmation of the HPRT-enzyme deficiency may not completely exclude additional child abuse. However, careful forensic analysis, including enzyme-diagnostics, combined with the presence of injuries typical of self-mutilation, will help to clarify the facts.

Autopsy, Child Abuse, Postmortem HPRT-Enzyme Analysis

G5 Determining a Postmortem Submersion Interval (PMSI) Based on Algal/Diatom Diversity on Decomposing Mammalian Carcasses in Brackish Ponds in Delaware

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The goal of this presentation is to share a new technique to utilize a much-neglected biological evidence (aquatic plants) to determine a post-mortem submersion interval. The authors intend to demonstrate how algae and diatoms can be used in medicolegal investigations involving brackish or saline aquatic systems. The attendee will learn how to sample, photograph and identify algae and diatoms useful in forensic science.

Because very little is known on how bodies decompose in freshwater, brackish, and marine environments, and much less is known on how to determine a postmortem submersion interval (PMSI) (i.e., determine the time a body has been submerged in an aquatic environment until the point of discovery), this presentation will impact the forensic community and/or humanity by adding to a much neglected but growing database on decomposition in aquatic environments. The authors hope to provide the first analysis of mammalian decomposition in brackish ponds using botanical evidence to determine a PMSI. This approach has been used in freshwater systems but not in saline environments such as brackish ponds. It is hoped using this technique and type of plant evidence will shed new light in determining how long a body may have been submerged in these types of aquatic systems.

Algae and diatoms have been employed to estimate the location of drowning victims as well as link criminal suspects to specific aquatic crime scenes. However, little or no evidence exists on documenting algal

colonization and succession on mammalian carcasses in brackish or marine environments. The purpose of this presentation is to document how saline environments influence not only the rate that pig carcasses decompose, but also characterize the algal/diatom community at each stage of decomposition in order to use species diversity and composition indices to estimate a PMSI. The objectives of this study include: 1) characterize the physical changes and rate of pig decomposition in saline aquatic systems; 2) compare algal diversity on pigs to a natural substrate such as ceramic tiles and; 3) determine if species richness or diversity differs among stages of decomposition. This study was conducted in two slightly brackish water (brackish is defined as salinity levels between 5-18% parts per thousand-ppt) ponds near Smyrna, Delaware. The stages of decomposition were identified and characterized by physical changes. The duration of each stage was estimated in degree days. Water temperature was recorded for the duration of each trial. Salinity measurements were determined using a refractometer. To examine algal diversity on pig carcasses vs. a natural substrate, samples were collected every 3 days (trial one) and every 2 days (trial two) for approximately 20 days. Algal samples were preserved in Lugol solution and glacial acetic acid and stored in dark conditions until analysis. Algae and diatom species were identified using a light microscope and photographed with a Nikon Digital Camera. Species diversity and evenness among stages of decomposition were determined using Shannon and Simpson's diversity indices. The mean diversity indices for pig carcasses and ceramic tiles were compared using a t-test. Previous studies have revised or suggested that five (not six) stages of decomposition have been identified for mammalian carcasses in freshwater aquatic systems. Five stages are described in this study: Submerged Fresh, Early Floating, Advanced Floating Decay, Floating Remains, and Sunken Remains. Ponds in this study maintained a salinity value of 2-4 ppt. Accumulated degree days for trial one of this study was 893 degree days. Pigs began to float within three days, the duration of the Early Floating stage ranged from 3-9 days; Floating Decay stage ranged from 6-12 days; Advanced Floating Decay stage ranged from 9-21 days, and pigs sank within 15 – 24 days. The submerged fresh stage was characterized as the time the body initially entered the water until it floated to the water surface. Few physical changes were observed during this stage. The Early Floating stage was identified as when the pigs floated and began to bloat, forming indentations from the cage on their skin and with some algal growth. Little to significant disarticulation of limbs was observed on floating pig carcasses. The Advanced Floating Decay stage was characterized as much of the carcass having been removed, with the skull exposed and the loss of limb bones. The Sunken Remains stage was identified when the remains sank to the pond bottom with only bits of bones remaining. Algal diversity was significantly greater on pig carcasses than ceramic tiles. Diversity increased significantly as decomposition progressed until pig carcasses had reached the advanced floating decay stage. Mammalian carcasses will support algal/diatom communities and that these communities experience plant succession similar to terrestrial habitats. However, in terrestrial systems, plant succession/diversity increases over time; in aquatic systems, plant succession/diversity will increase and eventually decrease as the substrate (mammalian carcass) decomposes. This study shows how algal/diatom diversity and taxonomy can be used to determine the duration a submerged victim has been under water.

Brackish Ponds, Diatoms, Postmortem Submerged Interval

G6 Immunocompromised Female, Age 67, With an Angioinvasive Pulmonary Fungal Abscess

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After attending this presentation, attendees will understand the vulnerability of the immunocompromised person to opportunistic organisms that may present unexpected autopsy findings and the necessity of a complete medical history.

This presentation will impact the forensic community and/or humanity by providing an added appreciation for a thorough medical history as an aid to correlate and make sense of unexpected autopsy findings in the immunocompromised.

This poster will present the autopsy of a 67-year-old Caucasian female with a longstanding history of hairy cell leukemia (HCL) refractory to chemotherapy in whom the pertinent autopsy findings included not only residual HCL, but also a large necrotic abscess within the right lung upper and lower lobes containing thrombus and angioinvasive fungal forms consistent with *Aspergillus* species.

The immunocompromised comprise a subset of the general population who are extremely susceptible to opportunistic organisms whether due to their primary disease process, medicines or therapies used to treat their underlying illness, or other medical conditions acting in concert with the above to render them extremely vulnerable to viruses, bacteria, fungi, and parasites.

This particular patient presented to the hospital after having low to moderate grade fever, nonproductive cough, and a sore throat for five days. After a workup revealed anemia, thrombocytopenia, leukopenia, and radiographic evidence of right lower lobe lung infiltrates, she was administered leukoreduced and irradiated packed red blood cells, a course of levofloxacin and erythropoietic drugs, and discharged.

She presented again eight days after her initial presentation complaining of persistent fevers, chills, an increase of coughing (now with pain), and pain on swallowing. She was admitted and made DNI/DNR. New imaging studies showed a mass lesion bridging the right upper lobe and superior segment of the right lower lobe suspicious clinically for acute infection vs. Leukemic infiltration. Despite administration of Zosyn and Ambisone during her inpatient course, there was no improvement in her condition. After a bronchoscopy with BAL, which was positive for *C. albicans*, the patient required oxygen via nasal canula to maintain oxygen saturation above 94%.

On the morning of her death, the patient had episodes of hemoptysis with dark blood, then bright red blood. She emergently underwent repeat bronchoscopy, where it was noted that there was a right tracheal obstruction thought to be clot and tissue. Attempts to remove the obstruction were unsuccessful and the patient entered asystole.

Even though this particular case occurred in the setting of a tertiary care teaching hospital, people having conditions analogous to that of the decedent are often maintained on therapeutic drug regimens in outpatient settings and can present as cases of sudden unexpected death to medical examiner offices. It is not only important, therefore, for primary care givers to be sensitive to changes in the baseline health of their patients as these may be the heralds of opportunistic infection, but also crucial for those performing the postmortem to obtain a complete medical history including medicines used (and if applicable, chemotherapy and radiotherapy) and to keep opportunistic infections in their differential as to the mechanism of death.

Hairy Cell Leukemia, Aspergillus, Autopsy

G7 Teen Fatality by Train: A Multidisciplinary Approach to Determination of Manner of Death

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The goal of this case study is to illustrate a multidisciplinary approach to the death investigation, and highlight unique elements of staging in an attempt to disguise a suicide.

This presentation will impact the forensic community and/or humanity by demonstrating the value of a forensic team approach to the investigation of the circumstances of death for determination of the manner in complicated or staged death scenes.

Attempts by the victim to disguise suicides as homicides are not commonly encountered, and the following case study illustrates the requirement for a multidisciplinary approach to the investigation. Professionals from the disciplines of documents examination, fingerprint comparison, odontology, toxicology, forensic pathology, and law enforcement all provided information essential in the determination of manner of death.

The decedent was a 19-year-old male who resided in a small community in the Midwest. He recently graduated from high school, as class valedictorian, where he had excelled in sports as well as academics. During the early morning hours on a day in July, 2004, the engineer of a train traveling 60 miles per hour, approximately four miles from the decedent's residence, reported that he had struck "something" on the tracks. Upon searching the area, the decedent's unclothed body was discovered. The train traffic in the region where the body was discovered was reportedly fairly busy with trains passing through approximately every 30 minutes. The identity of the subject remained unknown until later that morning when family members reported the subject missing. Law enforcement investigators examined the decedent's bedroom, and discovered a handwritten note, in block letters, which indicated that the decedent had been abducted. The note, signed "The Eliminators," further made mention that the "train took care of him" and that investigators "might find a few pieces of him left at the train crossing" at a specific site. Pillows had been placed beneath the bedding to imitate a body, and the note had been placed on the pillows. There was no evidence of a struggle, and a sibling had been sleeping nearby. An exterior door in the residence near the bedroom had been discovered ajar. Further evidence recovered from the residence was a journal written by the decedent. Additional information provided by family revealed that the decedent was last seen the previous evening following a confrontation with his parents concerning his purchase of alcohol for a minor.

At autopsy, there were extensive blunt force injuries with multiple facial, basilar and calvarial skull fractures; avulsion of the brain and eyes; multiple fractures to the ribs, spine, and extremities; and multiple lacerations to internal organs. Also noted at autopsy were strands of baling wire wrapped loosely around the right wrist, waist and both ankles. Law enforcement investigators indicated that baling wire had been noted at the residence, and later discovered beneath the tracks where the impact occurred. Positive identification of the subject was obtained through dental comparison by an odontologist. A documents examiner analyzed the handwriting on the note, and it was compared with the subject's handwriting obtained from documents produced as schoolwork. The documents examiner determined that the handwriting on the note, though efforts had been made to disguise it, was consistent with the decedents' previously produced documents. A latent print was also obtained from the note, and was identified as the subject's. The content of the journal was also reviewed, and revealed the decedent's increasing despondence and self-doubt.

Despite the decedent's attempts to lead investigators to believe he had been a victim of homicide, the manner of death was determined to be suicide. Staging a homicide may be an effort to gain notoriety, install guilt or protect family members. Following this investigation, the decedent's motive for disguising the suicidal act remains unclear.

Staging, Multidisciplinary, Train Fatality

G8 A Fatal Case Due to Abdominal Compartment Syndrome (ACS)

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The goal of this presentation is to present to the forensic community a case of death due to a rare systemic syndrome: abdominal compartment syndrome (ACS).

This presentation will impact the forensic community and/or humanity by presenting a case worthy of reporting for the rareness of the syndrome and its great surgical and forensic interest.

This case has been studied by means of autopsy and histological examinations.

Abdominal compartment syndrome (ACS) is broadly defined as organ dysfunction derived from increase in intra-abdominal pressure. Prolonged, unrelieved increased intra-abdominal pressure at more than 20 mm Hg can produce pulmonary compromise, renal impairment, cardiac failure, shock, and death. This presentation discusses the clinical-pathologic features, the postmortem findings and microscopic features of a fatal case due to ACS.

Case Report: A 35-year-old Caucasian female went to the emergency room with increasing abdominal pain. The woman, admitted to the surgery unit, underwent a physical examination. It showed a sharply distended and painful abdomen, no peristalsis, and rebound tenderness. At abdominal ultrasonography, stomach and bowel loops appeared distended with copuscolated liquid material. Abdominal x-ray showed small bowel distended with air-fluid levels. Three years before, the woman had undergone an appendectomy. She was taken into the operating room for intestinal occlusion due to adhesions. On the first postoperative day, the patient had shock with numbness, cutaneous pallor, sweating, cutaneous marbling on upper and lower limbs, tachycardia, tachypnea, peripheral pulselessness, oliguria, and severe metabolic acidosis. After another day of continuous deterioration of her clinical condition, she was moved to the Intensive Care Unit. Her abdomen seemed distended, with no peristalsis; CT-scan confirmed bowel distention due to fluid and gas, with perihepatic and perisplenic fluid collections. Laboratory tests demonstrated leukopenia, neutropenia, and metabolic acidosis. Gynecologic examination revealed a rectocele. On the second day in the Intensive Care Unit the woman continued to get worse. She had anuria and hypotension; her intra-abdominal pressure, measured inside the urinary bladder by means of an ordinary Foley catheter, was 35 cm H₂O. Taken into the operating room for surgical abdominal decompression, the woman died. A complete autopsy was performed 48 h after death.

At autopsy the body was that of a well-developed adult with pale and dehydrated skin, ostia, and oral and scleral mucosae. The brain was congested and edematous. The left pleural cavity contained 200 ml of red liquid; the right pleural cavity contained 400 ml of the same liquid. The lungs were hypoexpanded and atelectatic. The peritoneal cavity contained 1000 ml of red liquid. The intestines appeared distended, with brown liquid material and pseudomenbranes in the large bowel. Examination of other organs was unremarkable.

The histological findings of the liver revealed necrosis in acinar zone 3. The kidney showed characteristics of shock: collapse, swellings of endothelial and surface cells, broadening of the basal membrane, and impairment of the loops in the glomeruli. The epithelia of tubules were flattened, and their nuclei were enlarged. The bowel wall showed areas of epithelial necrosis, fibrinous stratification, and inflammatory infiltration spread up to the muscularis mucosae.

It was concluded that the cause of death was fatal shock due to Abdominal Compartment Syndrome (ACS).

ACS is a clinical syndrome that occurs as a consequence of intra-abdominal hypertension. ACS is characterized by a tensely distended abdomen, elevated peak airway pressure, and impairment of cardiac and renal functions, leading to oliguria or anuria. Any insult that causes an acute increase in intra-abdominal volume can trigger ACS, including trauma to the abdomen as well as to distant sites, pancreatitis, hemorrhage, intestinal occlusion, ruptured abdominal aortic aneurysm, massive fluid resuscitation, and burns. The syndrome usually occurs in critically sick patients after major abdominal trauma or operations. Several cases were described where the syndrome developed without direct abdominal insult. These cases, however, were associated with severe hemorrhagic shock, burns, massive ascites, ileus, ovarian mass, or the use of anti-shock trousers.

According to clinical symptoms and measuring of intra-abdominal pressure, it is possible to make a timely diagnosis of ACS and operate for a prompt abdominal decompression. Clinical studies show a significant difference in mortality between ACS patients undergoing abdominal decompression and untreated patients (59% vs 100%). Further studies point out that a timely abdominal decompression and early treatment reduce both the incidence of ACS (64% vs 43%) and mortality of ACS (44% vs 28%) in patients at risk.

Abdominal Compartment Syndrome, Histological Findings, Postmortem Diagnosis

G9 Cane Corsos Attack: Two Fatal Cases

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The goal of this presentation is to present the case of two spouses who were slaughtered by their three pet Cane Corsos. Investigations of the death scene and autopsy findings are described.

Although dog bite related fatalities on humans appear to be a breed-specific problem (Rottweiler and Pit Bull), other breeds may bite and cause fatalities at higher rates. Here the authors present the cases of spouses slaughtered by their own three Cane Corsos, an Italian Molossoid dog breed. This presentation will impact the forensic community and/or humanity by confirming the inadequacy of breed-specific ordinances.

The most common animal bite injuries in the United States are inflicted by dogs, accounting for 80-90% of all bites. It is estimated that between 1 and 4 million Americans are annually bitten by "man's best friend;" approximately 1 in 20 dogs will bite a human being during the dog's lifetime. The vast majority of these dog bite wounds produce minor injuries, and the victims never seek medical attention, but serious sequelae, and even death, may occur. In 2001, the U.S. Centers for Disease Control and Prevention (CDC) estimated that 368,245 persons were treated in U.S. hospital emergency departments (EDs) for dog bite-related injuries (rate: 129.3 per 100,000 population). Bite wounds, in fact, account for approximately 1% of all emergency department visits and more than \$30 million in annual health care costs.

Annual mortality rates from dog attacks are reported at 7.2 cases for 100 million inhabitants. Many victims of these fatalities, unfortunately, are young children (often <1-year-old), and old people (mainly women); in fact, these two groups are made up of weak and defenseless individuals, generally unable to protect themselves properly.

There is a strict relationship between the victim's age, severity of injuries, and injury site. The majority of dog bites to adults are directed to the extremities; conversely, the most frequent targets of dog attacks towards children are head and neck. This explains why the highest mortality is seen among children.

About 50% of fatal attacks towards human beings involve two or more dogs; on the contrary, non fatal bites almost always involve only one dog. In fact, belonging to a pack usually makes dogs behave more aggressive, and increases the probability of causing the victim's death.

The most commonly reported breeds are Pit Bull, Rottweiler, German Shepherd, Golden Retrievers, Husky, and Akita. Presented the case of a couple slaughtered by their three Cane Corsos, in the garden adjacent to their own house. The husband, a 76-year-old man, was found lifeless, lying face down in the bloodstained ground, completely covered with blood. He wore trousers and a pair of shoes, but his legs were hidden by leaves. His trunk was completely naked, but numerous shards of clothes were scattered

all around the area of aggression, abundantly blood stained. Injuries were localized to head, neck, trunk, and upper limbs, while the genitalia and lower limbs remained intact. The scalp was almost totally absent, so that the frontal, part of the temporal, parietal and occipital bones lay bare. The left lower eyelid and the left zygomatic region showed a stretch laceration of 4.5 x 3.2 cm, with exposure of the underlying bones; the left external ear presented a grossly semicircular recession of 3 x 2.5 cm. On the left supracleavicular region there was a deep oval shaped laceration of 5.4 x 4.7 cm, with the exposure of the clavicle, muscles, nerves, and resected vessels. There were numerous lacerations on the right side of the neck, the main one was a deep oval shaped gaping wound of 9.2 x 8 cm, which exposed part of the mandible, lacerated musculature and vessels. The left upper arm showed numerous gaping wounds, in particular the deepest were localised on the upper and lower part of the arm, on the elbow, and on the radial face of the forearm exposing, respectively, the humerus and the radius, lacerated muscles, tendons, nerves and vessels. Similar injuries were on the right upper arm, and in particular in the axillary cavity and on the elbow, where underlying tissues appeared completely destroyed. All these torn wounds presented ragged and irregular margins with adjacent puncture wounds, the so called a-hole-and-a-tear combination. In the vicinity of the bites described, but in particular on the back, were found the typical claw-marks: narrow, superficial, linear abrasions, parallel to each other, four or five in number. The wife, a 70-year-old woman, presented similar wounds over the upper extremities, neck and trunk. The internal examination of both deceased revealed mainly multiple transmural vessels tears. Deaths were attributed to exsanguination by external bleeding.

These represent unique cases, because, there appears to be no previous reports of fatal attacks with the involvement of the Cane Corso, an Italian breed of Molossoid dog. This confirms that all types of dogs may inflict injuries—even fatal—to people, and reveals the inadequacy of breed-specific ordinances.

Dog Bite, Fatal Dog Attack, Cane Corso

G10 Fatal Dog Maulings Associated With Infant Swings

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After attending this presentation, attendees will become familiar with the phenomenon of dog bite-related fatalities involving children left unattended in infant swings. In addition, attendees will become familiar with the epidemiological, medical, and forensic aspects of fatal dog maulings in children.

This presentation will impact the forensic community and/or humanity by suggesting an as yet undescribed association between infant swing use and dog attacks, which may have significant child safety implications. It will also impact the forensic community by increasing its awareness of the general features of dog-bite-related-fatalities.

Two cases of fatal dog maulings of children left unattended in wind-up infant swings are presented, an event not previously described in the literature. In addition, a review of dog bite fatalities in children autopsied in Baltimore over the last ten years and a review of the existing literature on this topic will be presented.

Case 1: A two-and-a-half-week old male infant was left in a wind-up swing by his parents, who went outside to smoke cigarettes. The family dog, a one year-old pit bull named “Jigga,” remained in the room with the infant. Upon their return, the parents discovered that the swing was overturned and the infant was on the floor, unresponsive, with bite marks to the body and face. Postmortem examination revealed multiple injuries, including contusions, abrasions, lacerations, and puncture wounds of the

head and torso, fracture of the parietal skull, subarachnoid hemorrhage, multiple anterior and posterior rib fractures bilaterally, contusions of the lungs and heart, and lacerations of the liver.

Case 2: A three-month-old male infant was asleep in a wind-up swing when his parents went to bed in a separate bedroom. Three hours later, the mother awoke and, upon checking the infant, found him on the floor unresponsive with the swing tipped over. The family dogs that were present, an eight year-old Chow Chow named “Sandy” and a nine year-old Dachshund named “CoCo,” were removed by Animal Control. Postmortem examination revealed multiple injuries consistent with attack by a medium to large sized dog, including numerous contusions, abrasions, lacerations, and puncture wounds of the skin; damage to the atlanto-occipital joint; fractures of the skull, mandible, clavicle, and ribs; rupture of the spleen and left kidney; laceration of the liver; and contusions of the lung.

Dog bite-related fatalities are uncommon events. Children are at particularly high risk, because the majority of dog bites occur in children and children are more susceptible to severe injury from dog bites. Other known risk factors for fatal dog attacks include male gender of the victim and dog breed; a majority of attacks occur on the dog-owner’s property and often without any known provocation.

Canine aggression is a well-described behavioral phenomenon and has been subdivided into various types; of these, predatory aggression refers to the hard-wired instinctual drive to chase, catch, and kill prey. A distinguishing feature of predatory aggression is that it is usually triggered by movement, often with little change in the dog’s mood. In each of the above cases, infants were left unattended in mobile wind-up swings in the presence of trusted household pets. These cases not only underscore the importance of not leaving young children unattended in the presence of pet dogs, but also raise the possibility that mobile swings may trigger a predatory response in dogs and thus may represent an additional risk factor for dog attack.

Dog, Infant, Swing

G11 Contribution of Burn Injury in a Blunt Trauma Case With Incineration

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The goal of this presentation is to discuss a complex case in which incineration, not the primary cause of death, may have occurred just prior to death from blunt head trauma, in a homicide. In addition, the authors review recent literature on significance of carbon monoxide, traces of tracheal soot, and other findings, in determining whether incineration occurred antemortem or postmortem.

This presentation will impact the forensic community and/or humanity by discussing the issues involved in determining whether incineration of a body, on which lethal blunt head trauma had been inflicted, occurred before or after death.

Assailants in homicide have often made use of incineration in an attempt to conceal the evidence of the crime. Incineration usually occurs postmortem. Accelerants are sometimes used. This case illustrates the questions that arise when autopsy findings suggest that burn injury may have begun before death.

The Virginia Beach Fire Department responded to a rubbish fire in a field. On extinguishing the blaze, they discovered the unburned shoes and lower legs of an unidentifiable, partially incinerated decedent, extending from the burned rubbish. Local law enforcement was called to the scene, and the body was transported to the Medical Examiner’s Office.

The body proved to be that of an adult male, with charring present over most of the body surface area, but with sparing of both lower legs and

portions of the upper arms. There was exposed muscle, partial skeletonization of the face, and a postmortem epidural hematoma. In addition to the charred body, a distinct odor of accelerant was noted on the debris and clothing transported with the body. Autopsy revealed blunt impact trauma to the right side of the victim's head, traces of soot in the trachea, and cherry red discoloration of the muscles.

Investigation suggested that an assailant had attempted to destroy evidence of homicide by pouring an accelerant over the victim's body and igniting it after inflicting blunt trauma to the head. The literature states that traces of soot in the trachea may occur postmortem. The contribution that burning may have made to this blunt trauma homicide, the role of carbon monoxide determination in flashover burns, and evidence in general for antemortem vs. postmortem incineration, will be discussed.

Incineration, Antemortem Burn Injury, Blunt Trauma Homicide

G12 A Field Study of the Foraging Behavior of Blowfly Maggots

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After attending this presentation, attendees will understand the possibility that the largest blowfly maggots found on a body may be relatively recent arrivals, having crawled over to the fresh remains when their initial food source (e.g., a dead mouse) became depleted, resulting in the risk of significant errors by investigators attempting to calculate postmortem interval.

This presentation will impact the forensic community and/or humanity by alerting the forensic community to the possibility that if foraging behavior by food-deprived blowfly maggots is a reasonably common phenomenon, larger (older) blowfly maggots that have managed to find their way to a fresh body can be a source of large errors when investigators attempt to calculate postmortem intervals based on published rates of maggot development times. On the other hand, foraging by food-deprived blowfly maggots could also provide a possible explanation for the presence on bodies of anomalous maggots that are larger than expected according to other independent evidence.

It is generally assumed that the largest, and presumably the oldest, blowfly maggots (i.e., larvae of Calliphoridae) found on a body initially arrived as eggs deposited by flies attracted to the remains. There is the possibility, however, that at least some of the large maggots crawled over to the body from some other piece of carrion in the immediate environment. For example, if a body is dumped in a field near the remains of a dead mouse, and if the mouse remains had been nearly consumed by blowfly maggots, at least some of the maggots may abandon the depleted mouse remains and crawl over to the fresh food source, greatly complicating the situation for forensic entomologists. During the late summer of 2003 and the late spring of 2004, field studies were conducted of the foraging response of blowfly maggots feeding on a depleted, or nearly depleted, food source. The field studies were conducted in cages that excluded vertebrate scavengers but not blowflies and other invertebrates. The experimental situation was manipulated such that the maggots were presented with three choices: (1) remaining on a low quality and rapidly deteriorating food source, (2) abandoning the deteriorating food source and crawling approximately 45 cm across bare soil to a shelter containing a moist cloth and a fresh food source, or (3) abandoning the deteriorating food source and crawling approximately 45 cm across bare soil in the opposite direction to a shelter containing a moist cloth but no food.

In every cage at least some maggots remained on the deteriorating food source until it had either been consumed, dried out, or the experiment was terminated. However, during the late summer experiment of 2003, in 6 of 12 test cages, early third instar maggots of *Lucilia* sp. abandoned a deteriorating food source (i.e., a nearly consumed and/or rapidly desiccating piece of liver), and crawled across the bare soil to reach the shelter containing the fresh food source (approx. 40 gm of fresh beef liver) and began feeding. Similarly, during the late spring experiment of 2004, in 6 of 12 cages, early third instar maggots of *Phaenicia* sp. exhibited the same foraging behavior. The number of foraging maggots that crawled into the food shelters varied greatly, ranging from 1 – 2 individuals (4 cages) to more than 100 (3 cages). In one cage at least 387 maggots, as confirmed by rearing the adult flies (*Lucilia* sp.), had crawled into the food shelter. Although there were 7 cases where maggots crawled into shelters that contained only a moist cloth, the numbers were much lower. In 5 cages where maggots had crawled into the food shelters, one maggot in each cage moved in the opposite direction and crawled into the non-food shelter. In two cages where no maggots had crawled into the food shelters, a single maggot in one cage, and two maggots in the second cage, crawled into the non-food shelters. Finally, in 10 cages no maggots crawled into either shelter.

Blowflies, Maggots, Foraging

G13 Cavotricuspid Isthmus Rupture and Hemopericardium: A Delayed Complication of Cardiac Radiofrequency Catheter Ablation

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After attending this presentation, attendees will become aware of delayed fatal complications of cardiac radiofrequency ablation.

This presentation will impact the forensic community and/or humanity by providing heightened awareness of potential complications of cardiac radiofrequency ablation that may occur weeks or months following the procedure.

Radiofrequency ablation (RFA) has been used in humans since 1981 for the treatment of cardiac dysrhythmias. Numerous studies have shown that it has a high success rate with infrequent complications. The indications for RFA include atrioventricular (AV) nodal re-entrant tachyarrhythmias, accessory pathway dysrhythmias, focal atrial tachycardia, atrial flutter and idiopathic ventricular tachycardia. Reported complications include AV block, post-pericardiectomy syndrome, atrio-esophageal fistula, coronary artery stenosis, acute hemopericardium, and delayed right ventricular aneurysm.

A 47-year-old woman had a history of atrial flutter and underwent radiofrequency ablation with an 8-mm catheter. The initial ablation line consisted of 17 radiofrequency applications (maximum power 70 watts and maximum temperature 70 degrees), most for 60 seconds. The line of block extended down from the cavotricuspid region to the inferior vena cava (IVC). A procedural follow-up study showed unidirectional block with a questionable area near the IVC. An additional 20 RFA applications were applied superior to the previous line but the applications were also extended into the IVC. A repeat follow-up study showed successful RFA of her atrial flutter and bidirectional block across the cavotricuspid isthmus at baseline and following an isoproterenol challenge.

Six weeks following her cardiac RFA she presented to another hospital complaining of chest pain. Troponin levels, a cardiac stress test and an echocardiogram were described as normal and she was discharged. Five days later she had a witnessed collapse at home. Emergency medical services responded and found her asystolic. Further resuscitative efforts

were unsuccessful and she was pronounced dead in the emergency department.

At autopsy, she had a cavotricuspid isthmus disruption with a 450 mL hemopericardium. Microscopically, the site of disruption had homogenization, necrosis, fibrosis and extravasated blood. Associated with the fibrosis and necrosis were chronic inflammatory cells and granulation tissue. Elastic fibers were disrupted near the site of rupture and hemosiderin laden macrophages were present.

The authors were unable to find a previous report of delayed cavotricuspid rupture and hemopericardium following cardiac radiofrequency ablation; however, in experimental animal studies damage to the tricuspid valve and IVC occurred most frequently with high energy pulses and 8-mm catheters.

Radiofrequency Ablation, Cardiac Dysrhythmias, Complications

G14 Sudden Death of a Fourteen-Year-Old Female With Hb S-C Disease

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The goal of this presentation is to review the sudden death of a child with sickle cell anemia – Hb S-C type. The attendees will learn the different genetic forms of sickle cell disease, their complications, and the potential mechanisms of death with sickle cell anemia.

This will impact the forensic community and/or humanity by demonstrating an unusual sudden death in an adolescent with an element of past physical abuse.

According to her caretakers (mother and a grandmother), this 14-year-old black female child had been complaining of vague headache and back pains for several days. At the morning of her death she had complained of her “eyes turning color,” increased headache “behind her eyes,” and difficulty in “straightening out the fingers of her left hand.” Her mother interpreted her daughter’s complaints as predominantly an attempt to avoid school that day, and dismissed them from having any serious medical implications. At 1:00 p.m. that day, she was found lethargic and unresponsive. The mother and grandmother attempted to help her stand up, but failed. Of note, despite the grandmother’s wish to immediately call for help, the mother rejected such initially, and the 911 call was not placed until some time later when the mother “could not feel a pulse.” Paramedics arrived at 3:30 p.m., and she was pronounced dead after resuscitative efforts.

On initial external examination at the Medical Examiner’s Office healed, patterned loop-type scars were noted on the deceased’s torso, buttocks, and extremities. No acute injuries were present. Autopsy examination revealed a well-developed, well-nourished young adolescent female with scleral icterus and an overall slight jaundice appearance. Internal examination was remarkable for bilateral pulmonary edema, massive splenomegaly (spleen weight of 1,190 grams), and evidence of extreme anemia. No internal injuries were present. Microscopic examination was remarkable for extensive sequestering of sickled red blood cells within the spleen and a hypercellular bone marrow with areas of scarring. Postmortem toxicology was negative for alcohol or drug/medication substances other than a small quantity of acetaminophen. Vitreous electrolytes were unremarkable. Postmortem viral and bacterial cultures were negative, although a blood sample was positive on immunoassay for parvovirus B 19 antibodies IgM and IgG.

Sickle cell anemia is an autosomal recessive disease caused by a point mutation in beta hemoglobin gene chromosome 11p 15.4 (Hb S; 6 Glu leads to Val and Hb C; 6 Glu leads to Lys.). Approximately 8% of black Americans are heterozygous HbS. The carrier rate for HbC is about 2%

to 3%. HbC has a greater tendency to aggregate with HbS that does HbA, and hence those with HbS and HbC (designated HbSC) have a more severe disease than do those with HbS and HbA. On deoxygenation, abnormal hemoglobins undergo aggregation and polymerization. This converts the hemoglobin from freely flowing liquid to viscous gel and results in distortion of the red cells, which acquire a sickle shape. Patients have to deal with problems ranging from severe anemia, vaso-occlusive complication, and chronic hyperbilirubinemia to severe infection. In children painful vaso-occlusive crises are extremely common, as well as hand-foot syndrome. An aplastic crisis represents a temporary cessation of bone marrow activity usually induced by parvovirus infection of erythroid cells. Sequestration crisis may occur in children with splenomegaly. With modern treatment approximately 90% of patients survive to the age of 20 years, and close to 50% survive beyond the fifth decade. No reported case of rapid death from Hg S-C type sickle cell anemia was found in the literature.

In this case the child had an acute infection with parvovirus B19, which was confirmed by blood serology. It is believed the cause of death was acute sequestration of blood with an aplastic crisis induced by the parvovirus, and thus ruled the death as natural. The mother of the deceased did not promptly call for medical help. She acted such in fearing the discovery of previous child abuse – which does suggest possible medical neglect and, thereby, a potential for other interpretations as to manner of death.

Sickle Cell Anemia, Hb SC Type, Parvovirus B19

G15 Interpreting Lesions to the Conduction System of the Heart in Case of Death Pursuant to Cocaine Ingestion

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The goal of this presentation is to evaluate the potential role of the pathological lesions of the conduction system in the pathomechanism of death in cocaine users and to demonstrate the difficulties of forensic investigations when death is preceded by cocaine ingestion.

This presentation will impact the forensic community and/or humanity by presenting several cases in which it was concluded that pathological lesions in the conduction tissue may play a role in the occurrence of death attributed to intoxication following cocaine ingestion.

Since 2000, there has been a considerable increase in cocaine use and cocaine traffic in Switzerland. This trend is matched by an increasing number of deaths attributed to intoxication in the presence of cocaine and of its metabolites. However, it is not always clear whether intoxication is the sole cause of death.

Any forensic scientist will agree that death can be attributed to intoxication only after a complete autopsy, which includes histological analyses. Potentially lethal levels of a drug must be found and any other cause of death must be excluded. A rigorous approach is especially important in the case of drug users, which may occasionally present very high levels of certain substances without any sign of severe intoxication.

In the case of death after cocaine ingestion, the interpretation of the results of toxicological analyses carries an additional difficulty. Some victims present pathological lesions, such as cardiovascular lesions, that may or may not be linked to repetitive cocaine ingestion. The long-term and short-term cardiovascular toxicity of cocaine is well established. Some pathologies, caused by cocaine ingestion and which may in fact explain the observed death, can be identified through a macroscopic examination. Such is the case for a cerebral hemorrhage or the rupture of an atherosomatous plaque in the coronary artery.

Cocaine use is also known to cause cardiac rhythm disorders, some of which have morphological substrates that can be detected through a microscopic examination. A survey of the literature shows that there have been few investigations of the conduction system of the heart in cocaine users and that no studies have ever examined conduction tissue in chronic users whose drug ingestion was confirmed by hair analysis. It thus appeared of interest to identify pathological lesions in the conduction system of the heart in chronic cocaine users that may explain cardiac rhythm disorders and even some deaths.

This presentation focuses on the different lesions found in the conduction system of the heart in cocaine addicts. Many authors believe that such lesions may be the cause of sudden death. The most frequently observed lesions consist of severe thickening of the atrioventricular node artery, intranodal and perinodal fibrosis, and microscopic foci of myocarditis.

Several cases with observable pathological lesions will be presented. The victims were young subjects: all were known to the police as long-term drug users, and some were undergoing a methadone treatment. In each case, a forensic autopsy and toxicological analyses were performed, including hair analysis to establish chronic drug use in general, and cocaine use in particular. This study included only cases in which toxicological analyses revealed the presence of cocaine in the blood, in the urine and in the hair.

It was concluded that pathological lesions in the conduction tissue may play a role in the occurrence of death attributed to intoxication pursuant to cocaine ingestion.

Cocaine, Conduction System, Hair Analyses

G16 Defibrillator/Pacemaker Evaluation in the Los Angeles County Medical Examiner Office

Lakshmanan Sathyavagiswaran, MD, Daniel Rieders, MD, and Joseph Muto, Department of Coroner, Los Angeles County, 1104 North Mission Road, Los Angeles, CA 90033*

After attending this presentation, attendees will be updated on the usefulness of soliciting cardiology consultations on deaths involving Implantable Cardioverter Defibrillator (ICD)/Implantable Pulse Generator (IPG) (pacemaker) as they relate to determination of cause/manner of death; and will be provided guidelines on disposition of equipment.

This presentation will impact the forensic community and/or humanity by providing examples of quality evaluation on implanted ICD and pacemakers. Mortuaries/medical examiners/coroners are provided with vital information related to their safety in handling decedents with implantable ICD/pacemakers, and disposition of same.

LA County Coroner's Office uses the services of a cardiologist/electrophysiologist to conduct forensic evaluations of implanted defibrillators/pacemakers. In some cases the device is explanted by the medical examiner and the cardiologist conducts interrogation with the programmer testing of the pulse generator. This provides information of device function, events, and whether the battery is depleted.

In other cases the device and lead system is intact in the decedent, in which case the integrity of the lead system can be verified by the cardiologist with similar interrogation techniques. The cardiologist also reviews the clinical records and pacemaker tracings, and provides opinions on the pacing system.

Implantable cardioverter defibrillators have to be turned off using a programmer to prevent morticians getting a shock. Pacemaker and ICDs should be removed prior to cremation because of sealing techniques, they will rupture during cremation due to pressure buildup.

In California, the IPG/ICD is the property of the family. If removed for evidentiary and cause of death reasons they have to be returned to the

family or, after testing is completed, disposition by the coroner needs family consent. They cannot be reused or refurbished, as U.S. Federal law prohibits it. Nuclear pacemaker must be removed to satisfy nuclear regulatory agency requirements for 100% removal of all radioactive modules. Pacemakers have been used for identifying decedents. Several case examples from the LA County Coroner will be discussed. A newly developed pacemaker policy will be shared.

Pacemaker Evaluation, Cardiology Consultation, Defibrillator Disposition

G17 Traumatic Cardiovascular Complications of Catheter-Based Procedures: Relevance to Medicolegal Death Investigation

Edward J. Tweedie, MD, London Health Sciences Centre, 339 Windermere Road, London, Ontario N6A 5A5, Canada*

After attending this presentation, attendees will be aware of potential traumatic cardiovascular complications of catheter-based procedures and will be able to recognize them at autopsy and determine their significance in the context of a medicolegal death investigation.

This presentation will impact the forensic community and/or humanity by underscoring the scope and utilization of catheter-based procedures. The forensic community must be aware of these uncommon but well-recognized adverse events because many of these deaths become medicolegal death investigations due to their often unexpected nature related to a medical procedure.

Using several case examples, the audience will become aware of potentially life-threatening traumatic cardiovascular complications that can result directly from a wide variety of catheter-based procedures.

There are a wide variety of procedures, both diagnostic and therapeutic, which involve catheterization of the heart and great vessels. These include standard, well-established procedures such as central venous catheterization for fluid, nutrition or medication administration, and pulmonary artery catheterization for pulmonary pressure monitoring. Specific cardiac interventions include endomyocardial biopsy, radiofrequency endocardial ablation for arrhythmia control, cardiac pacemaker and implanted defibrillator placement, diagnostic coronary angiography, and angioplasty procedures. These all carry with them a low but well-recognized risk of traumatic perforation. In addition, more novel procedures, including intravascular ultrasound, and laser and rotational atherectomy, continue to be developed.

The following autopsy case examples will be presented: brachiocephalic vein perforation by a central venous catheter in a dialysis patient resulting in fatal hemothorax, right ventricular perforation by a pacemaker electrode in an elderly woman with heart failure, coronary artery dissection caused by diagnostic coronary angiography, and pulmonary artery perforation by a pulmonary artery catheter after open heart surgery.

When perforation occurs, the outcome may be fatal and—due to the nature of such deaths—many are investigated in a medicolegal context. The pathological findings at autopsy must be properly recognized and then interpreted. Factors impairing pathological recognition may include a delay from the time of intervention to the time of death, no prior clinical awareness of the adverse event, prior removal of the catheters, inadequate availability of clinical history, and medical examiner or pathologist unfamiliarity with the nature of the procedure. When such events are identified, it may be difficult to determine the relative contribution of the resultant hemorrhage or damage to the cause of death in the presence of other major co-morbid conditions. Furthermore, it may be difficult to decide upon the manner of death, whether accidental or natural, when other significant disease is present. Proper investigation requires careful review of the medical record and a complete autopsy. Care must be taken to leave catheters and lines in place so that they can be properly inspected in-situ.

Associated hemorrhage should be quantified, and photographs should be taken. Microscopy may aid in dating lesions if healing reaction has developed at the site of injury.

Medical examiners and pathologists who perform autopsies in a hospital-based setting should familiarize themselves with the ever-expanding array of catheter-based endovascular procedures so that when adverse complications occur, they will be properly recognized. It is noted that potential complications are not limited to vascular perforations. As new procedures and equipment are introduced, vigilance for adverse events may assist in assessing their overall safety.

Cardiovascular, Catheter, Complications

G18 Increasing Heart Valve Donation by Utilization of a Cardiovascular Registry

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After attending this presentation, attendees will understand the benefits of utilizing established cardiovascular registries to increase the number of heart valve donations by medical examiners/coroners.

This presentation will impact the forensic community and/or humanity by providing the forensic community details of how an office in a large metropolitan area was able to allow a significant number of heart valve donations by requiring that the remnant myocardium be examined by a cardiovascular pathologist. There were no significant delays in time to sign the death certificate nor in determination of the cause of death by requiring this specialized review.

The Minnesota Regional Coroner's Office (MRCO) is the smallest of four offices covering the greater Minneapolis/St. Paul area, serving a population of 642,000 persons, the second smallest in the area. The other three offices have a combined jurisdictional population of 2,489,600. Two of these offices also have large numbers of referral cases from rural Minnesota.

MRCO made the decision to allow heart valve donations whenever possible and to require the tissue services organization to document cardiac findings and to send the remnant myocardium to the Jesse E. Edwards Cardiovascular Registry for examination by a cardiac pathologist.

This study examines the result of this change in practice. The number of heart valve donations was 15 in 2002 and 23 in 2003. The total number of heart valve donations from other offices combined was 11 in 2002 and 6 in 2003.

There was no significant increase in the average number of days until death certificate completion (14 vs. 21 days).

Heart valves were donated in 21 accidental death cases. The age range was 15 to 54 years. Significant cardiac findings included: atherosclerotic coronary artery disease (4), cardiomegaly (3), myocarditis (2), moderate myxomatous change of mitral and/or tricuspid valves (3), focal subendocardial fibrosis (1), and 80-90% stenosis of a large intramyocardial artery (1). Six of the hearts were normal.

Heart valves were donated in 10 suicidal death cases. The age range was 16 to 54 years. Significant cardiac findings included atherosclerotic coronary artery disease (4), cardiomegaly (2), probable arrhythmogenic right ventricular cardiomyopathy (1), biventricular hypertrophy (1), and focal subendocardial fibrosis (1). Two of the hearts were normal.

Heart valves were donated in seven natural death cases. The age range was 23 months to 58 years. Significant cardiac findings included atherosclerotic heart disease (2) and one case each of possible arrhythmogenic right ventricular cardiomyopathy, healing myocarditis, and myocardial small vessel disease. One heart was normal.

Four of the seven natural deaths were cardiac related and three were non-cardiac related. The structurally normal heart was found in a 23-month-old child with severe developmental delay and microcephaly. In one case, the cause of death was due to a pulmonary thromboembolus. In the third case, the only cardiac finding was medial hypertrophy of intramyocardial arteries. This particular case involved a witnessed arrest 30 minutes after ingestion of sildenafil citrate (Viagara). The cause of death in this case was certified as "sudden cardiac death."

The practice of utilizing cardiovascular pathologists at a cardiovascular registry for examination of post valve recovery hearts has lead to significant numbers of heart valve donations at the authors' institution. This process has not resulted in a delay in death certification and has not compromised the determination of the cause or manner of death. In fact, it has been beneficial in several areas. There are some inheritable cardiac conditions that are well known to cause sudden death. Recognition of these conditions is sometimes subtle, but the diagnosis may have enormous implications for family members. Examination of the remnant heart by cardiovascular pathologists who are accustomed to studying cases of sudden death and working with families also provides the pathologist with additional physician resources. Furthermore, as seen by review of these cases, many cases of non-natural deaths have a significant cardiac abnormality. These conditions may not have been evaluated completely without donation, if a complete autopsy had not been required. Some of these conditions also may have genetic implications for family members.

Tissue Donation, Cardiovascular Pathology, Cause of Death

G19 A Review of Pathologic Findings in Specimens Following Heart Valve Donation

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After attending this presentation, attendees will understand cardiopathologic examination of hearts following heart valve donation is beneficial and may yield important information in determining cause of death.

This presentation will impact the forensic community and/or humanity by increasing awareness of the forensic community in the nationwide shortage of cardiac tissue grafts and the role of the Medical Examiner in tissue donation.

The Cardiovascular Registry was founded in 1960 by Dr. Jesse E. Edwards in St. Paul, MN, for the purpose of studying, classifying, and categorizing heart disease. The Registry, under the direction of Dr. Edwards, was very involved in describing congenital and acquired heart disease. Since its formation, the Cardiovascular Registry has examined over 27,000 cardiac specimens and cardiovascular surgical specimens.

In 2001 the Cardiovascular Registry was approached by one of the nation's largest tissue donation procurement agencies for the purpose of performing cardiovascular pathologic examinations of post valve recovery hearts. This collaboration began in 2001.

The current study was undertaken to review the type of remnant hearts received and to tabulate the abnormalities identified. All remnant hearts received over the period of 33 months were included in the study, for a total of 492 cases.

The information received for each case includes the body height, weight and suspected cause of death. Comprising the 492 cases were 206 accidents, 75 suicides, 91 natural deaths, 5 homicides, and 116 cases in which the cause of death was undetermined at the time of heart valve procurement.

Of the suspected natural deaths, 13 were classified as non-cardiac related. The remaining 78 were suspected cardiac deaths. Seventy-seven of the 78 cases had significant cardiac findings; some had more than one major abnormality for a total of 83 significant cardiac findings. Only one heart was structurally normal.

Significant atherosclerotic coronary artery disease with a >75% stenotic lesion was identified in 59 cases. One decedent was less than 25 years of age. Thirty-six of the 59 did not have infarction; 22 had myocardial infarction. Other significant cardiac abnormalities in the natural group included: myocarditis (6), cardiomegaly (4), bicuspid aortic valve with stenosis (3), arrhythmogenic right ventricular cardiomyopathy (2), acute aortic dissection (2), anomalous origin of a coronary artery (1), aneurysmal coronary artery (1), hypertrophic cardiomyopathy (1), dysplastic intramyocardial arteries (1), mitral valve prolapse (1), coronary artery thrombo-emboli (1), and prior valvular disease with mechanical valve replacement (1). In the natural death group, 33 incidental cardiac findings were identified including: moderate atherosclerotic coronary artery disease, myocardial bridge, acute angle of origin of the coronary artery, cardiomegaly, myxomatous change of a valve, patent foramen ovale, and post inflammatory mitral valve disease.

Accidental death constituted the largest group, with 205 cases (42%). Fifty-one had significant cardiac abnormalities and 107 had incidental cardiac findings, including 9 congenital abnormalities. Twenty-three had traumatic injuries, which were either contusions or lacerations. Injuries were found only in this accidental group of cases. One hundred and three of the remnant hearts were normal.

Of the 75 suicides, 22 had significant cardiac abnormalities including two cases of arrhythmogenic right ventricular cardiomyopathy, an inheritable condition. A third case of possible arrhythmogenic right ventricular cardiomyopathy and one case with focal areas of myocyte disarray were present in this group. Twenty-three incidental cardiac abnormalities, including congenital abnormalities, were also identified.

Five remnant hearts were from homicides. Three cases had severe atherosclerotic coronary artery disease or cardiomegaly. One case had mitral valve prolapse. Only one heart was structurally normal.

The second largest group of cases, 116, were those in which the manner of death was undetermined at the time of heart valve procurement. Included in this group were cases in which only the mechanism of death was reported. In 93 of the cases the cause of death was listed as "pending." In this group were 63 with significant cardiac abnormalities including severe atherosclerotic coronary artery disease (33), myocarditis (12), cardiomegaly (11), and one case each of hypertrophic cardiomyopathy, bicuspid aortic valve with stenosis, non-infective endocarditis, severe coarctation of the aorta, acute angle of origin of a coronary artery, thrombo-embolus, and dysplastic intramyocardial arteries. Thirty-eight cases had normal hearts. In 58 cases, incidental cardiac findings were identified including 5 congenital abnormalities.

The study demonstrates that significant and/or incidental cardiac abnormalities may be identified following heart valve donation.

The study also demonstrates that potentially inheritable conditions such as hypertrophic cardiomyopathy and arrhythmogenic right ventricular cardiomyopathy may be present when death was due to other causes. The diagnosis of these conditions is critical, with significant implications for surviving family members.

In summary, due to the nation wide shortage of bioprosthetic materials, tissue donation is critically needed. A thorough cardiopathologic examination remains possible in remnant hearts and may be beneficial in determining the cause of death.

Tissue Donation, Heart Disease, Sudden Death

G20 Sudden Death in a Calipatria State Prison Inmate With a Single Coronary Artery

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After attending this presentation, attendees will understand how to determine the presence of a "true" single coronary artery and to utilize this cardiac malformation as the cause of sudden and unexpected death in the absence of other pathophysiology.

This presentation will impact the forensic community and/or humanity by demonstrating the pathophysiology with a single right coronary artery, and by classifying the finding of a "true" single coronary artery as a pathological entity of functional significance potentially leading to sudden death in the absence of other cardiac malformations.

This presentation is the case of a 31-year-old black man who had been incarcerated for approximately six years prior to his death. The decedent was an inmate at the Calipatria State Prison located in Southern California. He was in the midst of doing exercises in the exercise yard when he suddenly collapsed. He was subsequently taken to the prison infirmary and transferred to a local hospital for treatment, however, was pronounced dead despite resuscitative efforts. The decedent had no significant past medical history and no history of any drug usage. Postmortem examination revealed a slightly enlarged heart with a single right coronary artery and complete absence of the left coronary artery and corresponding circulation. Gross and microscopic evaluation of the heart revealed subendocardial fibrosis of the anterior and anteroseptal left ventricle characteristic of chronic myocardial ischemia. Also grossly and microscopically evident was superimposed acute myocardial infarction in the same region of the heart. Changes consistent with poor vascularization, lack of blood flow and oxygenation of the myocardium of the heart in the distribution of the absent left anterior descending coronary artery were identified.

A brief review of congenital malformations of the coronary artery circulation will be presented, including criteria for a true single coronary artery. A single coronary artery without other cardiac malformations should be considered as a pathological entity potentially leading to sudden death. Training and experience have demonstrated that this entity is usually of no functional significance unless the single artery becomes occluded. This is usually reported as an "incidental" finding, not contributing to death. This rare pathological entity may in itself lead to acute and chronic myocardial ischemia, myocardial infarction and sudden death. In this particular case, the decedent had a six-year history of incarceration during which time he had a history of chronic exercise, which apparently exacerbated the cardiac ischemia and ultimately resulted in acute myocardial infarction with sudden death.

Single Coronary Artery, Sudden Death, Myocardial Ischemia and Infarction

G21 An Accident Waiting to Happen: The Chicago Porch Collapse of 2003

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After attending this presentation, attendees will understand the various injuries, both traumatic and asphyxial, associated with a structural porch collapse.

Disasters with multiple fatalities are common, and this presentation will impact the forensic community and/or humanity by assisting medical examiners and forensic pathologists to understand injuries that are sustained in a porch collapse, the mechanism of the injuries, and how best to certify the cause of deaths based on autopsy and death scene investigation findings.

The authors present a mass casualty during a party in the upscale Lincoln Park neighborhood of Chicago. On the warm summer evening of June 29, 2003, a party was underway within the upper two floors of a 3-story building that spilled out onto the two attached wooden porches. At approximately 12:30 a.m., the 3rd floor porch began to shake. Some partygoers exited the porch into the adjacent apartment. Others remained on the porch and began to jump up and down. The porch floor separated from the building and the side vertical supports and "pancaked" down onto the second floor porch. The second floor porch floor likewise separated and collapsed onto the first floor porch, which then collapsed to the ground and into a basement stairwell. Approximately 50 people were on the 2nd and 3rd floor porches at the time of the collapse; no one was on the first floor porch or in the basement stairwell.

Emergency medical services responded quickly and extricated victims from the debris. Fifty-seven people were injured at the time of the collapse, and of these, 12 were pronounced dead at the scene. One person died after surviving approximately 19 hours in the hospital. The body positions of the victims on the two decks when they collapsed are not known.

Five of the victims were female and eight were male. They ranged in age from 19 to 30 years. At autopsy, all subjects had extensive cutaneous injuries consisting of abrasions, lacerations and contusions. All subjects also had identifiable petechiae on or over more than one body surfaces, including face (12/13), conjunctiva (10/13), oral mucosa (2/13), laryngeal/epiglottic mucosa (3/13), visceral pleura (3/13) and epicardium (1/13). High cervical spine fracture/dislocation were found in 5/13. Bony fractures were identified in four subjects. Visceral injury was identified in one. The cause of death in 5/13 cases was compressional asphyxia due to porch collapse, with a significant contributing factor of cervical spine fracture/dislocation. The cause of death in 6/13 was compressional asphyxia due to porch collapse. One of 13 had extensive skull fractures with brain injury and the cause of death was multiple injuries due to porch collapse. The one delayed fatality died from anoxic encephalopathy due to compressional asphyxia due to porch collapse. The wooden porch remnants were torn down and quickly replaced with a steel porch. Structural engineering analysis of the porch was performed, with the results to be summarized during the oral presentation.

Traumatic asphyxia, originally described by Ollivier and later refined by Perthes, is currently defined as asphyxia caused by external pressure to the thorax, inhibiting respiration. The main anatomic finding is cutaneous, mucosal and serosal petechiae of the head, chest and upper extremities. The term compressional asphyxia is a more descriptive term, better understood by the lay public as a relatively gradual compression as opposed to a sudden crushing mechanism.

Following the accident, the city of Chicago revised its inspection criteria for building porches, and in a 2-month sweep, inspected 4,000

porches. Approximately 1,200 building owners were cited for construction faults. There are an estimated 300,000 porches within the city of Chicago. At the one-year anniversary of the collapse friends and family held a candlelight vigil for the victims at the collapse site. Nineteen days after the one-year anniversary of this deadly porch collapse, another smaller, similar wooden porch in the same neighborhood collapsed, causing seven people to fall 8 – 10 feet. Fortunately, no one was injured or killed.

Traumatic Asphyxia, Porch Collapse, Compressional Asphyxia

G22 Forensic Medicine in France

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After attending this presentation, attendees will understand the organization of forensic medicine in France and the interest in clinical forensic medicine.

This presentation will impact the forensic community and/or humanity by highlighting new fields for forensic doctors.

Medicolegal activity: Few teams perform the whole scope of medicolegal activity: "classical" forensic pathology, but also "clinical forensic medicine." These teams are based in CHUs (Centre Hospitalier Universitaire, or university hospitals, of which there are 25 in France) where usually forensic toxicology from biological samples, DNA, physical anthropology, and forensic histology are also available. Entomology and diatom identification are only done in one center for each. Several of these teams are also in charge of medical care to detainees.

Around 7,000 forensic autopsies are performed yearly for a population of more than 60 million people. This low level of autopsy performance is not only due to a low crime rate, but also to French judicial particularities. Only in four cities is more than one autopsy is performed every working day.

When possible, a forensic doctor will be called to the death scene; 14,000 to 25,000 scene examinations per year in France seems a reasonable hypothesis.

Clinical Forensic Medicine includes the examination of people in custody (around 250,000 per year nationally) and also of living victims: child abuse, battered women, assaults, and rapes cases. It is estimated that 45,000 living victims are examined each year by forensic physicians.

Forensic Doctors: Two hundred fifty physicians are employed full time in forensic medicine throughout the country. As a result of this limited number, only in some university hospitals will it be possible to have a forensic doctor on duty around the clock every day of the year, for all the types of clinical forensic activities mentioned above. In smaller cities and rural areas, forensic doctors will focus on serious penal case such as rape, homicide, and child abuse, the rest being done by general practitioners.

A majority of forensic doctors are now trained through a national diploma called "**Capacité des Pratiques Medico-Judiciaires**." The diploma requires that during 2 years, the students will have 30 days practical instruction per year in an accredited hospital unit. The other possibility is **D.E.S.C.** (Complementary Specialized Study Diploma) reserved to the medical interns; after 4 years of internship in any speciality, the candidate becoming a forensic medicine specialist will need 2 more years of practical and full time training in a medical forensic unit plus 200 hours of lectures. The graduate will be able to perform all types of forensic medicine activities (including autopsies).

A recent survey showed that around 750 forensic doctors were needed to provide the appropriate and basic emergency forensic medicine services (clinical and crime scene examination) to each local judicial court.

Teaching and Research: INSERM (National Institute of Medical Research) has no forensic medicine section (nor a forensic science section) and there is no PhD program in forensic medicine.

State funded research programs in forensic medicine are limited to scattered projects (fewer than 10 so far). During the medical curriculum of general practitioners, between 20 to 40 hours of lectures will be dedicated to forensic medicine (medical certificates about living victims and death certificates, principles of medical liability, and medical confidentiality).

Conclusion: The role of forensic medicine in France is increasing as the forensic doctors are turning to “Violence Medicine” specialists. The relative importance of autopsies is decreasing, a rather positive point with regard to the (worldwide) difficulties for funding this activity, but has an adverse effect on the experience of practitioners. Concentrating forensic autopsies in regional hospital-based centers seems to be the only solution, for the sake of quality.

Forensic Medicine, France, Organization

G23 Near Miss Incidents: Feasibility Studies Assessing Forensic Physicians' Perceptions of Near Misses in Police Custody Suites in London, United Kingdom

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After attending this presentation, attendees will gain an understanding of the causes of near miss incidents and how they may be applied to the care of prisoners in custodial settings.

This presentation will impact the forensic community and/or humanity by raising awareness of the need for further research into the care of prisoners in custody, in order to try and prevent harm or death occurring.

Background: Deaths of prisoners in police custody are tragedies for all those involved. Potentially preventable deaths in police custody include those which involve illicit drugs, alcohol and deliberate self-harm. Near miss incidents (NMI) that did not result in death have a crucial role in understanding risk factors in custody. A program of research has been developed to study near miss incidents. For the purposes of this research NMI, have been defined as ‘an unplanned and unforeseeable or unforeseen event that could have resulted, but did not result, in human death or may have resulted in injury or other adverse outcomes.’

Aims & Methods: An initial study was undertaken with pilot interviews of 3 forensic physicians (FP) practising in London, U.K., to create a structured questionnaire for all forensic physicians working in London. The questionnaire was the basis of a retrospective recall survey of all FPs working in London as Forensic Medical Examiners (FME) designed to assess numbers of NMIs, patterns in occurrence and relevant learning points within the previous 6 months. A cover letter, background questionnaire (exploring the background of the medical practitioner), copies of NMI survey, and reply paid envelopes were sent to each FME ($n = 134$) in London, working for the Metropolitan Police Service. Data about all incidents were anonymised.

Results: There was an overall response rate of 73% ($n=96$). Of FME respondents, 18% were Principal grade, Senior (24%), Standard (35%) and Assistant (23%). 20% of FMEs had specific mental health training and qualification. 52% had forensic qualifications such as the Diploma of Medical Jurisprudence, and the Diploma of Forensic Medical Sciences. FMEs had been qualified in medicine for a mean of 27 years and had been FMEs for a mean of 11 years. Thirty-eight NMIs were reported by 27 FMEs (of all levels) although the retrospective method meant that some data are incomplete. The reason for police contact was recorded as alcohol ($n=8$), theft and robbery ($n=7$), warrants ($n=4$), violence ($n=3$), traffic violations ($n=2$) and single cases of drugs, murder and immigration offences.

Twenty-seven NMIs involved white Caucasians, 4 involved Asians, and 2 involved blacks (origin not known). Form 57M (a screening questionnaire used in police custody to identify medical and mental health problems) was positive in 12 cases, and the Police National Computer had warnings in 6 cases. Of the main perceived cause of each NMI, illicit drugs were involved in 12/38; alcohol in 17/38; deliberate self-harm in 11/38; problems with searches, checks or rousing in 8/38; failure of inter-agency communications in 5/38; and insufficient resources in 4/38. In a number of cases more than one factor was involved. Examples of type of NMIs were: illicit drugs – overdose, drug swallowing, drug concealment, theft of drugs from FME; alcohol – self-harm, physical injuries (ruptured spleen, head injury), hypoglycemia; self-harm – concealed knife, self-hanging on paper suit, drug swallowing.

Summary and Conclusions: Using the figures generated by this study, the reported rate of NMIs is 0.4 NMI per FME which gives a total annual rate of 107 NMIs in this setting. These data reflect the incidence of NMI in one of 43 police forces in England and Wales. These data are broadly consistent with documented patterns of deaths in police custody that would appear to reinforce the validity of the data. The need for a prospective study is supported. The next stage is a prospective 6 month study in which NMIs will be recorded around the time of occurrence, with analysis of each incident subsequently conducted by a research team, in order to learn lessons which may be utilised to attempt to prevent potentially avoidable deaths in police custody.

Deaths in Custody, Forensic Physicians, Near Miss Incidents

G24 Fatal Pulmonary Thromboembolism and Hereditary Thrombophilias

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The goal of this presentation is to present to the forensic community the role that hereditary thrombophilias may play in deaths due to venous thromboembolism (VTE). Forensic pathologists will understand the availability and usefulness of postmortem DNA testing for hereditary thrombophilias in deaths due to thromboembolic events.

This presentation will impact the forensic community and/or humanity by showing how any and all data generated by increased post-mortem testing could bring illuminating information to the medical literature, allowing forensic practice the ability to keep pace with this important and rapidly developing field, and potentially contribute to the reduction of morbidity and mortality and the enhancement of public health.

The autopsy dissection, personal and family medical histories, and ancillary studies pertaining to pulmonary embolism (PE) are important components in the investigation of these deaths. But, the detection of a PE at autopsy and even that of apparent underlying risk factors do not necessarily signify the end of the investigation. Molecular analysis for genetic risk in selected cases might further explain fatal outcomes in persons in whom causality is inadequately explained. Also, on occasion, no apparent predisposing conditions are identified. Hereditary thrombophilias may play a causal role in the development of PE in some of these deaths. With the availability of postmortem molecular testing, their significance in such deaths may be better understood. Most importantly, beyond more accurate death certification, these tests have the potential to reduce morbidity and mortality for surviving family members.

Pulmonary thromboembolism is commonly diagnosed in forensic pathology practice, as it often causes sudden death. It is attributed to a wide variety of predominantly acquired etiologies. Although likely etiologically multifactorial, some commonly diagnosed proximate causes include: surgery, pregnancy, injury or relative inactivity of any cause, cancer, obesity, or serum hyperviscosity. On occasion, no apparent predisposing conditions are identified. In these instances, occult hereditary thrombophilias may play a contributory causal role.

Currently, there are DNA techniques that allow for the postmortem diagnosis of some hereditary thrombophilias. These include Factor V Leiden (FVL), Prothrombin (PT), and Methylenetetrahydrofolate reductase (MTHFR) mutations. Less common abnormalities involving antithrombin III, protein C and S, plasminogen, dysfibrinogenemia, hyperhomocysteinemia, and antiphospholipid antibodies were not tested for, as functional and serologic diagnostic assays are ill-suited for postmortem blood.

Resistance to activated protein C, the most potent endogenous anticoagulant, is due to a mutation of the factor V gene (i.e., the Leiden mutation) which results in decreased control of thrombin generation. The G20210A autosomal dominant mutation in the prothrombin gene is associated with an increased amount of prothrombin, which promotes the formation of thrombin. Hyperhomocysteinemia (plasma homocysteine concentration >15 μmol/L) is a risk factor for venous (and arterial) thrombosis. Increased concentrations of homocysteine are partly determined by enzymes involved in its metabolism. Some mutations in methylenetetrahydrofolate reductase (MTHFR) and cystathione-B-reductase (CBS) are associated with elevated concentrations of homocysteine.

At the Office of Chief Medical Examiner of the City of New York, 124 deaths (of 15,280 undergoing autopsy) were caused by PE between December 2000 and September 2003. Of those, 34 postmortem blood samples from persons having one or more of the selection criteria were analyzed by a molecular fluorescence method (FRET) for FVL, PT, and MTHFR mutations. Characteristics of decedents who were candidates for these tests were based on widely used clinical criteria and included: age < 45 years, pregnancy-related deaths, history of recurrent or unexplained stillbirths, oral contraceptive pill use, hormone replacement therapy, treatment with chemotherapy, weak risk factors (long flights, car rides, or slight obesity), or deep venous thrombosis of undetermined etiology.

Heterozygous mutations involving FVL (1 case), PT (3 cases), and MTHFR (8 cases), as well as a single homozygous mutation for MTHFR, were detected, a total of 35% of those tested. Five deaths were clearly causally related to one or more of these mutations. The possibility of causal relationships in the remaining 29 deaths is discussed.

Venous Thromboembolism, Thrombophilia, Hereditary

G25 An Expert Witness Requests Re-evaluation of SOP in Autopsy Reporting, Supported With Case Examples

Anita K.Y. Wonder, MA*, Wonder Institute, PO Box 1051, Carmichael, CA 95609-1051

After attending this presentation, attendees will gain an appreciation for the importance of listing all breached arteries by name and injury on autopsy reports.

This presentation will impact the forensic community by suggesting a standard operating policy revision in autopsy reporting where arterial injury is ignored if absent from direct cause and/or manner of death.

Medical experts should name all breached arteries and include interpretation of injury to facilitate reconstruction of criminal events. This presentation will illustrate with case examples where knowledge of arterial injury, even if not listed in the autopsy report, could have saved time and concern for justice and assisted reconstruction of incidents from bloodstain pattern evidence.

Arterial injury is often encountered in casework, yet not all injuries are mortal. Breach may occur to the carotid, temporal, brachial, and deltoid arteries, which may project considerable arrays of blood drops without resulting in death. On the other hand, even minor arterial vessel injury may shift results from a survivable assault to death from homicide, suicide, or accident via hypovolemic shock. When reconstructing crime events, it is essential to know that arterial blood vessels were breached. The identification and interpretation of arterial injury requires medical expertise.

For example, a gunshot wound to the head which nicks the temporal artery may be reported as GSW to the head, without listing arterial injury. This omission may limit time and detail in reporting, but can create inconvenience and embarrassment later when investigators attempt to place the origin of an assault. Without specific information regarding arterial damage, reconstruction conclusions may err. Three less than satisfactory ways in which information regarding arterial damage may be obtained after the autopsy report:

1. Law enforcement representatives attending the autopsy may ask the pathologists technical questions.
2. The bloodstain pattern experts may interview the pathologist at a later date.
3. Attorneys may bring out the information during direct or cross examination at trial.

The least desirable consequence may be ignoring the distinct arterial damage bloodstain patterns because no arterial injury was mentioned in the autopsy. Arterial damage from even minor injury may contribute to rapid blood loss. In such cases the cause of death may be listed as exsanguination. Identifying where the artery was breached positions the victim where the crime emphasis of survival (assault) versus death (homicide) occurred.

Three case examples are shown to emphasize the essential information possible when arterial damage is recognized.

Case 1: A homicide occurred in a dormitory building. Bloodstain patterns were found at two locations: in the victim's room and along the hall outside the room. An expert was hired to answer the question of where the fatal assault began. The identification and position of the injured artery, and behavior of blood drops distributed best answered the question.

Case 2: Statements of an assailant placed a victim over a large pool of blood when the assailant left the scene. When photographed, the victim's body was in an entirely different position with evidence of considerable arterial rain between positions. Information obtained during the investigation suggested that a second assailant could have committed the murder after the first one left. Because no interpretation of the bloodstains was initially made, and the police took the confession without verification, it is possible that justice was not served in this case.

Case 3: An alleged drive-by shooting was shown to be a homicide within the vehicle when the tracking of the blood was aligned with arterial damage to the carotid artery. Death was by hypovolemic shock 24 hours later.

In conclusion, adding the name and injury of breached arterial blood vessels to autopsy reports will supply essential information and prevent later inconvenience and possible reverses of justice.

Arterial Injury, Autopsy Reporting, Bloodstain Patterns

G26 Sudden Death Following Brief Compression of the Neck

John W. Eisele, MD*, Forensic Consultants Medical Group, 2291 March Lane, Suite 179E, Stockton, CA 95207; Gerald J. Berry, MD, Stanford Pathology Consultants, 300 Pasteur Drive, Room H-2110, Stanford, CA 94305; and Michael J. Ackerman, MD, PhD, and David J. Tester, BS, Long QT Syndrome Clinic and Sudden Death Genomics Laboratory, Mayo Clinic College of Medicine, 200 First Street, SW, Hilton 11, Rochester, MN 55905

The goal of this presentation is to present a well-documented case of sudden death following brief compression of the neck, and to discuss the possible mechanisms for this phenomenon and methods to evaluate these mechanisms.

This presentation will impact the forensic community and/or humanity by providing a well-investigated case of a type of death which has been poorly documented in the past, and has caused extensive debate

in the forensic pathology community and court system. The presentation will emphasize proper procedures in investigating this type of death.

Nearly all forensic pathology texts make reference to sudden death following brief compression of the neck; these deaths are attributed to a hypersensitive carotid sinus reflex. Review of the medical literature, however, reveals that reports of death by this mechanism refer to elderly individuals with significant cardiovascular disease or other factors that could explain their deaths independent of the neck compression. The vast majority of references to a hypersensitive carotid body discuss only fainting as opposed to sudden death. A case recently investigated in which the death of a 14-year-old youth following brief neck compression was witnessed and thoroughly investigated.

Three reliable witnesses reported that there was a brief tussle with another youth, during which the decedent attacked the other youth and held his neck with both hands. The other youth pushed the decedent against a wall and compressed his neck with one hand while he faced the decedent. The compression continued for 15 to 30 seconds, at which time the decedent collapsed. He was pulseless and apneic; cardiopulmonary resuscitation by a trained bystander as well as paramedics and emergency room personnel continued for nearly an hour before he was declared dead.

A thorough autopsy was performed. This included a complete gross examination with layered, *in situ* dissection of the neck structures, and complete histological and toxicological examination. Multiple microscopic sections of the heart and serial sections of the conduction system were examined during the initial autopsy and re-examined by a cardiac pathology consultant. In addition the carotid bodies and adjacent arteries were serially sectioned and examined by this consultant. None of these procedures revealed an anatomic cause of death or any significant disease or injury. Molecular autopsy for long Q-T syndrome is underway.

The presentation will include detailed history and autopsy results, a review of the pertinent literature, a discussion of possible mechanisms of death in this and similar cases, and a discussion of procedures to be followed in performing a complete investigation of these deaths.

Sudden Death, Neck Compression, Long Q-T Syndrome

G27 The Spontaneous Oesophagus Perforation: A Forensic Point of View

Renaud Clement*, and Olivier Rodat, PhD, Department of Forensic Medicine, University of Nantes, 1 Rue Gaston Viel, Cedex, 44 093, France

After attending this poster, attendees will understand a case report of forensic autopsy of an unusual cause of death.

This presentation will impact the forensic community and/or humanity by demonstrating the contribution of Boerhaave syndrome to sudden death.

An autopsy was performed on a young adult, who apparently died during his sleep. Mediastinitis was established and empyema was also found in the left pleural cavity. The esophagus examination showed a tear in left side. The lesion occurred in the distal esophagus and showed the leak communicating freely with the left pleural space. Esophageal perforation was the cause of empyema, and death resulted from barotrauma to the lower oesophagus during the effort of vomiting. The disease is Boerhaave syndrome, a serious and rapidly fatal spontaneous esophagus rupture. Forceful ejection of gastric contents in an unrelaxed esophagus against a closed glottis is the mechanism described. The tear thus produced is vertical, akin to the "Mallory-Weiss" tear. The poster discusses the historical, statistical, pathophysiological, diagnostic and therapeutic aspects of Boerhaave syndrome.

Spontaneous Oesophagus Rupture, Autopsy, Death

G28 Human Wicks: The Almost Complete Destruction of Major Portions of the Human Body by Fire Fueled at Least Partly by the Body Fat of the Victim

Phillip M. Burch, MD*, Office of the Medical Examiner, 1300 Clark Avenue, St. Louis, MO 63117

After attending this presentation, attendees will be able to assess a fire scene that involves a human body that provided its own fuel for the fire.

This presentation will impact the forensic community and/or humanity by assisting the attendee in the reconstruction of a fire scene to establish if a human body was a source of fuel for the fire.

The charred remains of an adult human female were discovered in an abandoned house in St. Louis, MO, in early January of 2004. The female was determined to be the victim of a blunt trauma homicide. Much of the torso and lower extremities were basically destroyed by the fire, in some places even down to the bones (not even the hot, prolonged fire of the kind applied at crematoriums totally destroys the bones). Although it is thought that the fire occurred where the body was discovered, nothing else at the scene was altered by the fire. How such a fire could occur and go undetected by passersby during the fire will be discussed. The remains of this case, and others like it, resemble those described in cases of so-called "spontaneous human combustion" and this phenomenon or myth will also be discussed.

Scene Reconstruction, Body Fat, Human Wick

G29 DNA Extraction and Anthropological Aspects From 6th to 7th Century A.D. Bone Remains

Nunzio Di Nunno, MD, PhD*, Sezione di Medicina Legale, Bari University, Piazza G. Cesare n. 11, Bari, 70125, Italy; Vito Scattarella, BSc, Sandro Sublimi Saponetti, BSc, and Patrizia Emanuel, BSc, Bari University, Piazza G. Cesare n. 11, Bari, 70125, Italy; and Stefania Lonero Baldassarra, BSc, and Cosimo Di Nunno MD, Sezione di Medicina Legale, Bari University, Piazza G. Cesare n. 11, Bari, 70125, Italy

After attending this presentation, attendees will be able to implement the knowledge of the DNA extraction.

This presentation will impact the forensic community and/or humanity by proposing a modified protocol for DNA extraction.

In the archeological site of the early Christian Episcopal complex of Saint Peter, in Canosa di Puglia (Bari, Italy), during the operations of archaeological excavations, tombs were discovered. They were dated between the 6th and 7th centuries A.D. with Carbon 14 methodology. Five skeletons were found in the five tombs:

28A: male individual, 43 years old. The height was 170 cm, the biomass was 65.7 kg. The analysis of the bones indicated several noteworthy pathologies, such as a number of hypoplasia lines of the enamel, the presence of Shmorl hernias on the first two lumbar vertebrae, the outcome of subacromial impingement syndrome.

28E: male individual, with a biological age of death between 44 and 60 years. The height was 177 cm. He had a post-traumatic fracture callus of the medial third of the clavicle with an oblique fracture rima.

29B: female individual, 44-49 years old. The height was 158.8 cm, the biomass was 64.8 kg. There was Wells' bursite on the ischial tuberosity, on both sides.

29E: male individual, 45-50 years old. The height was 169.47 cm, the biomass was 70.8 kg. The third and the fourth vertebrae showed the Bastrup syndrome (compression of the vertebral spine). There were radiological signs of deformity on the higher edge of the acetabula and results of frequent sprains of the ankles.

31A: male individual, 47-54 years old. The height was 178.65 cm, the biomass was 81 kg. The vertebral index showed a heavy overloading in the thoracic-lumbar region. There were bony formations under the periosteum on both on the higher and medium facets of the first metatarsus, and on the higher and lateral facets of the fifth metatarsus on both sides. As the topography indicates, these small ossifications coincided with the contact points between the back of the foot and parts of the upper of the shoes.

From the osseous remains, in particular from the teeth (central incisors), the DNA was extracted and typed in order to identify potential family ties among all the subjects. The extraction technique used came from the DNA Promega technique, partially modified by the authors. Stay times of the sample in the extraction buffer were increased and were increased the PCR cycles.

Ancient Bone Remains, DNA Extraction, DNA Fingerprint

G30 Risk Factor Analysis and Characteristics in Community Acquired MRSA

Julia M. Braza, MD*, Karoly Balogh, MD; and Anthony Martyniak, MD, Beth Israel Deaconess Medical Center at Harvard Medical School, 330 Brookline Avenue, Boston, MA 02215

The goal of this presentation is to increase awareness of community acquired methicillin resistant *Staphylococcus aureus* (MRSA) infections, and its shift in epidemiology. It is relevant to the medicolegal and public health fields to identify such cases, especially in younger individuals, as it is a reportable disease and a cause of sudden death.

This presentation will impact the forensic community and/or humanity by identifying the risk factors for community acquired MRSA infection in patients without underlying chronic illness, and discussing different and atypical presentations, so that the forensic community can better recognize MRSA in individuals who acquire the agent outside of a hospital setting.

The focus of this case report is patient J.V., a 28-year-old Puerto Rican man who presented to the Emergency Department with a two day history of increasing shortness of breath, chest pain, and bloody sputum. His past medical history was significant for previous herpes infection, and a right thigh abscess that was drained two weeks prior to admission. The patient's social history was significant for incarceration for 5 years (he was released one year prior to admission) and being a smoker. The patient denied intravenous drug use, and maintained a negative HIV status. J.V.'s hospital course initially manifested as a pulmonary process (consistent with necrotizing pneumonia), with an almost complete opacification of the left lung on chest x-ray. On the third day of admission, J.V. deteriorated with septicemia, shock, acidosis, anuric renal failure, disseminated intravascular coagulopathy, paralysis, and a purpuric rash involving his face, anterior chest, right arm, lower extremities, and back. Blood cultures revealed gram positive cocci in pairs and clusters, consistent with the organism *Staphylococcus aureus*. Histologic findings at autopsy revealed extensive bilateral acute pneumonia with multiple pulmonary infarctions, hemorrhage, and necrotizing vasculitis.

The patient had a rapidly progressive course (6 days) of methicillin resistant *Staphylococcus aureus* infection, with no known underlying chronic illness or health-care associated risks factors such as recent hospitalization, recent outpatient visit, recent antibiotic exposure, chronic illness, diabetes, or malignancy. Therefore, by exclusion, this is a case of community acquired MRSA. However, the severity and very rapid progression of the infection, which led to his death, raises the question of the possibility of other risk factors, such as intravenous drug use, underlying HIV infection, or contact with a person or persons with the above-stated risk factors. There is also an associated chance of increased MRSA transmission in certain community clusters such as in correctional facilities,

athletic teams, and nursing homes (JAMA, 2003). Such populations have a higher incidence of sharing common personal objects or facilities that would make transmission of MRSA (especially via cutaneous and respiratory inoculation) more common. The patient's history of five years of incarceration places him within this risk category.

MRSA was first acquired outside of a hospital setting in the 1980s when intravenous drug users in Detroit were reported to have a MRSA bacteremia, according to Collins *et al.* (*Medical Journal of Australia*, 2002). Currently, the Centers for Disease Control (CDC) is conducting an active population-based surveillance for community acquired MRSA (CA-MRSA) in selected regions of the U.S. to help characterize the incidence and risk factors for MRSA in the community (JAMA, 2003). Iyer *et al.* have studied local outbreaks of CA-MRSA, specifically related to cutaneous presentations, with the finding that cutaneous abscesses were the most common presentation, (*J Am Acad Dermatol*, 2004). This finding is pertinent to the patient presenting with a cutaneous abscess on his thigh 2 weeks prior to his pulmonary symptoms.

In conclusion, J.V.'s clinical picture and autopsy findings demonstrate a case of CA-MRSA. MRSA is now emerging as a community based agent, and with its varied presentations, such as cutaneous abscesses, shock, and pneumonia, clinicians and pathologists need to include MRSA in the differential diagnosis.

MRSA, Risk Factors, Community Acquired Disease

G31 Commotio Cordis: Sudden Death Among Young People During Sporting and Recreational Activities

Sunil K. Prashar, MD*, and Karoly Balogh, MD, Beth Israel Deaconess Medical Center, 330 Brookline Avenue, ES-112, Boston, MA 02115

After attending this presentation, attendees will have an improved understanding of sudden deaths due to commotio cordis including its definition, demographics, mechanisms, treatment, prevention, and potential medicolegal consequences.

This presentation will impact the forensic community and/or humanity by improving awareness among the forensic community of sudden deaths due to commotio cordis. Increased understanding of commotio cordis may lead to more accurate determination of cause of death by forensic professionals, improve preventive and safety measures in the community, and help avoid inappropriate charges and convictions in the criminal justice system.

A 21-year-old white man with no significant medical history was hiking and rock climbing with friends and sustained a 15-foot fall which led to immediate loss of consciousness. A policeman was the first rescuer to the scene. He found the young man to be apneic and pulseless. The policeman administered defibrillation and cardiopulmonary resuscitation. The man was airlifted to a local hospital where he was pronounced dead shortly after admission. The case was referred to the medical examiner's office. At autopsy, multiple horizontal abrasions were observed on the face, thorax, and legs. There was no intracranial or spinal pathology. There was no evidence of cardiomyopathy and the coronary arteries had normal anatomy. There was focal petechial hemorrhage on the posterior epicardium. Blood toxicology was positive for cannabinoids and ethanol (0.010 gram %). The cause and manner of death were determined to be commotio cordis and accident, respectively.

Commotio cordis is defined as cardiovascular collapse secondary to cardiac arrhythmia caused by low energy impact blunt trauma to the chest without structural injury to the sternum, ribs, or heart.

Maron *et al.* (JAMA, 2002) reviewed 128 cases entered into the U.S. Commotio Cordis Registry. The ages ranged from 3 months to 45 years with a median age of 14 years. Seventy-eight percent were under 18 years old and 95% were male. Eighty-one percent involved precordial blunt impact from a projectile, most commonly a baseball, softball, or

hockey puck. Twelve percent involved a fight, play fighting, or parental discipline. One case involved a fall on playground monkey bars. It is thought that the narrow, compressible chest of youth increases the risk for commotio cordis.

Link *et al.* (Prog Biophys Mol Biol, 2003) conducted a series of experiments on a swine model to improve understanding of the mechanisms of commotio cordis. Using projectiles fired at anesthetized juvenile swine, the researchers found that ventricular fibrillation could be consistently produced when impact occurred 10-30 milliseconds prior to the T-wave peak. Impacts led to premature ventricular depolarization. Ventricular fibrillation was most consistently produced by impacts at the center of the left ventricle. The authors found that early defibrillation was a critical factor in survival.

It has been suggested that soft core baseballs, improved chest protection, and the presence of defibrillators at organized sporting events may decrease commotio cordis events and deaths.

Of particular importance to the medicolegal community, Maron *et al.* (American Journal of Cardiology, 2002) described six cases of commotio cordis which entered the criminal justice system. The cases involved parental discipline, domestic dispute, and gang initiation. In all cases, there was no intent to cause death and none of the victims showed sufficient trauma to cause death. Convictions ranged from reckless homicide to first degree murder, with sentences from 8-20 years. The authors purport that criminally negligent homicide is not the appropriate charge in many cases of commotio cordis and that it is the responsibility of the physician community to educate the justice system regarding the nature of commotio cordis deaths.

Commotio cordis is an important cause of sudden death in young people during sporting and recreational events. It is caused by low energy impact blunt trauma to the chest which causes fatal cardiac arrhythmia. Rapid defibrillation is critical to survival. Protective measures may decrease commotio cordis events and deaths. It is of great importance to increase awareness of commotio cordis within the medicolegal community to prevent inappropriate criminal charges and convictions.

Commotio Cordis, Sudden Death, Cardiac

G32 Guidelines and Medical Malpractice in Minor Head Injury Management

Luigi Viola, MD, Nunzio Di Nunno, MD, PhD, Roberto Quaranta, MD, Alessandro Dell'Erba, MD, PhD, and Francesco Vimercati, MD, Bari University, Piazza Giulio Cesare, 11, Bari, 70124, Italy*

This presentation will impact the forensic community and/or humanity by showing the limitations of guidelines used in the management of minor head injuries.

The use of therapeutic-diagnostic protocols and guidelines is spreading more and more within healthcare systems. The guidelines are based upon the latest scientific discoveries of Evidence Based Medicine, and oriented to suggest the most appropriate procedures, optimal recovery time, and tools and resources for every patient in order to identify the best clinical practice and the best possible treatment for that patient.

According to some experts' opinions, the international standardization of the best possible treatment of the most widespread pathologies implies some negative aspects, such as the restriction in being free to make diagnostic and therapeutic decisions by doctors.

Regarding forensic medicine, these guidelines are gaining significant importance: from defensive medicine to medical malpractice. In the forensic medical field, protocols and guidelines are used as scientific references to confirm or contest the doctors' behavior in the cases in which there is the suspicion of professional error.

As minor head injuries (1.6 million victims per year in U.S.A.) may have grievous disabling consequences, the guidelines on this topic have great importance. They provide that patients without neurological signs

and symptoms and with a Glasgow Coma Score of 15 should not be hospitalized.

This study is aimed at verifying the effective reliability of these guidelines in order to make them more complete and to prevent potential malpractice events.

For this purpose, 1,035 case histories, representing all the hospitalizations occurring during the year 2002 in all seven hospitals in a province in Southern Italy, were examined. Two hundred fifty-eight hospitalized people (25%) were negative for loss of consciousness, vomiting, amnesia, cephalgia, and risk factors (clotting pathologies, use of anticoagulant drugs, alcoholism, use of narcotics, previous surgery of the cranium, disabled elderly people), and the physical examination at admission showed a Glasgow Coma Score of 15. All of these patients were admitted to the hospital contrary to guidelines. In fact, for this kind of patients the guidelines suggest discharge, with an instruction sheet in case of the onset of neurological symptoms. An observation period in the hospital and C.T. scanning by the first six hours would be for the patients with loss of consciousness only.

During hospitalization, these patients underwent plain film radiography and/or CT scanning of the head that documented cranial fractures in 7 cases and intracranial lesions in another 5.

Conclusions: the study shows that in the 5% of the patients with minor head injury, noamnesia, and normal neurological examinations—patients that should not be submitted to any medical treatment in accordance with the guidelines—performing additional diagnostic tests could reveal the presence of lesions more serious than initially suspected. The non-diagnosis of these lesions could produce forensic-medical problems resulting in potential malpractice allegations.

Guidelines, Medical Malpractice, Minor Head Injuries

G33 Sudden Death Due to Bilateral Spontaneous Pneumothoraces in a Marijuana User

Joseph A. Felo, DO, Cuyahoga County Coroner's Office, 11001 Cedar Avenue, Cleveland, OH 44106*

After attending this presentation, attendees will realize the rare, and potentially fatal, complications of chronic marijuana smoking.

To the author's knowledge, there have been no previous reports in the medical literature of sudden death due to bilateral spontaneous pneumothoraces in an individual known to use marijuana. This presentation will impact the forensic community and/or humanity by demonstrating the adverse pulmonary effects of marijuana smoking, and focusing on a rare complication that may result in sudden death.

Marijuana remains the most commonly smoked illicit substance in American society. There is a public perception that marijuana smoking has little adverse effect on physical health. However, habitual marijuana smoking may produce lesions in the conducting airways and lung parenchyma similar to those lesions caused by repeated inhalation of tobacco smoke. 9-tetrahydrocannabinol and combustion products of *Cannabis sativa* are respiratory irritants. Compared to tobacco smoke, marijuana smoke causes a fivefold greater increment of blood carboxyhemoglobin level, a threefold increase in the amount of tar inhaled, and retention of one-third more inhaled tar in the respiratory tract. The pulmonary effects of chronic marijuana smoking include epithelial remodelling of airways and barotrauma.

Inhalation of marijuana smoke involves deep, sustained inspiratory effort, often followed by frequent and prolonged Valsalva maneuvers. As a consequence of increased intraalveolar pressure, there may be rupture of alveoli with air leakage into the septal connective tissues. Peripheral dissection of air within the pulmonary interstitium may lead to the formation of visceral pleural blebs or bullae.

Rupture of the visceral pleural bullae may result in a pneumothorax, which is rarely fatal. The reported case documents the gross and micro-

scopic autopsy findings of a 23-year-old male who was a known habitual user of marijuana, whose sudden death was due to bilateral spontaneous pneumothoraces with bilateral apical bullous lung disease. Although giant bullae and nonfatal pneumothoraces have been documented by chest x-ray and CT scan in smokers of marijuana, there have been no known previous reports in the medical literature of sudden death due to bilateral spontaneous pneumothoraces in an individual known to use marijuana.

Marijuana, Pneumothorax, Bullous Lung Disease

G34 Venous Bullet Embolism of a Large Caliber Bullet From the Right External Iliac Vein to the Heart: Case Report and Review of the Literature

Mary G. Ripple, MD*, and David R. Fowler, MD, Office of the Chief Medical Examiner, State of Maryland, 111 Penn Street, Baltimore, MD 21201

After attending this presentation, attendees will understand the importance of pre-autopsy radiographs in the evaluation of gunshot wounds, become aware of the possibility of large caliber bullets embolizing through the venous system, and become familiar with the literature on venous bullet embolism.

This presentation will impact the forensic community and/or humanity by emphasizing the importance of pre-autopsy radiographs in the evaluation of gunshot wounds, providing the forensic community with a recent literature review on venous bullet embolism, and highlighting the possibility of a large caliber bullet embolizing through the venous system.

This poster will report a case of an unusual venous embolism of a large (.45) caliber bullet from the right external iliac vein to the right ventricle of the heart, and present a literature review of venous bullet embolism to better familiarize the forensic pathologist with this rare entity.

Arterial embolism of a bullet is rare; however, venous embolism is an even more rare occurrence. In both circumstances the bullet is usually a low velocity, small caliber bullet. The literature to date has not reported a case of a .45 caliber venous bullet embolus.

A 30-year-old African-American male was found lying on the floor in a storage room of a convenience store with a gunshot wound to the left lower quadrant of the abdomen. The victim had been standing in front of the store when an unknown suspect approached the victim and began shooting at the victim. The suspect chased the victim into the store and fired additional shots at the victim inside the store. The victim was taken to University of Maryland Shock Trauma and surgery was performed, which revealed a very large hemoperitoneum and retroperitoneal hematoma emanating from the pelvis. Complex vascular injury to the pelvis was repaired, as were the stomach and small bowel, including resection of two portions of the small bowel. The victim arrested on the operating table two hours into the surgery. A preoperative x-ray revealed a large bullet projecting over the right cardiophrenic angle. By report, the victim was supine from the time of the shooting until the autopsy was performed. Autopsy showed a typical gunshot entrance wound on the left side of the front of the abdomen with no soot or gunpowder stippling on the skin surrounding the wound. The bullet traveled front to back, left to right and downward, injuring the stomach, multiple loops of small bowel, the confluence of the left common and external iliac veins and arteries, the bifurcation of the aorta, and the right external iliac vein just proximal to its bifurcation. A minimally deformed, .45 caliber, copper-jacketed bullet was recovered from the right ventricle of the heart.

Bullet embolization should be suspected when there is an entrance wound and no exit wound and the bullet cannot be located in the suspected region after following its path either by visual or x-ray examination. The pattern of bullet embolization depends on body position during and subsequent to the injury; gravity; muscular and respiratory movements; the missile's size, weight and shape; the diameter of the vessel lumen; blood flow; and the blood volume status at the time of injury. Venous bullet

emboli usually end up in the right side of the heart or the pulmonary arteries, with the origin most commonly being the vena cavae or iliac veins. The literature has documented 76 cases of venous bullet embolism from 1834 to present. The vast majority of literature describing venous bullet emboli has been surgical, and therefore items of forensic importance, such as the caliber of the bullet, tend not to be reported. The largest review of 53 cases of venous bullet embolism did not report the calibers of any of the bullets. Of those cases reviewed, the largest caliber bullet found that resulted in a venous embolism was a .38 caliber.

This case emphasizes the importance of pre-autopsy radiographs in the evaluation of gunshot wounds, and points out that one cannot exclude the possibility of a venous bullet embolus simply because of the use of a large caliber bullet.

Venous, Bullet, Embolism

G35 Factors Affecting the Formation of Adipocere in Soils

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The goal of this presentation is to demonstrate to the forensic community the effect of particular burial factors on the formation of adipocere in a soil environment.

The presentation will impact the forensic community by promoting the significance of adipocere formation in burial environments and encouraging further studies in the field of forensic taphonomy.

This presentation will discuss particular factors that are regularly identified in a burial environment and their effect on the formation of adipocere. The research represents a major component of a three year study investigating adipocere formation in grave soils.

Adipocere refers to a soap-like substance that can form during the decomposition process. It is well known as a later postmortem change, particularly in burial environments. Adipocere formation occurs by the alteration of the soft, fatty tissue of a cadaver into a greyish-white substance which comprises mainly saturated fatty acids. The occurrence of adipocere in a burial environment leads to the inhibition of postmortem changes which subsequently preserves the human remains. The degree of decomposition and differential preservation observed depends on the surrounding environment.

Various conditions associated with the burial environment are believed to contribute to the formation of adipocere in soils. Conditions include temperature, moisture, soil type, soil pH, anaerobic environment and the presence of factors such as clothing, coffin, and lime. In the past there have been numerous observational studies commenting on these particular physical factors and methods of burial. However, the literature demonstrates a distinct lack of chemical studies confirming these observations. As a result, a three-year study was conducted to chemically investigate the effect of individual burial factors on adipocere formation in a soil environment.

In order to determine the effect of particular burial conditions on adipocere formation, experiments were conducted in a laboratory environment so that the individual variables could be adequately controlled. The experiments utilized porcine adipose tissue collected from the abdominal region of pigs (*Sus domesticus*) reared on identical diets for commercial use. The fatty tissue samples were buried in soil environments and allowed to decompose for a period of 12 months under individual burial factors. At the completion of this period the samples were analyzed to confirm the formation of adipocere and compared with control samples to determine the effect of the burial factors on its formation.

This presentation will discuss the results of the chemical study and identify those factors which accelerate and retard adipocere formation. Adipocere samples collected from grave exhumations and forensic cases were also analysed and the results will be compared with the controlled laboratory experiment. The research findings will highlight the effects of adipocere formation, particularly with regard to overcrowding in cemeteries due to its regular occurrence in grave sites, and its forensic implications when present in shallow burials or mass graves.

Adipocere, Burial Factors, Grave Soils

G36 Seasonal Distribution and Abundance of Forensically Important Flies in Santa Clara County

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The goal of this presentation is to identify any seasonal or geographical patterns among forensically important flies within the county that may be important to future investigations using a simple and cost-effective method.

Entomologists working with local law enforcement often encounter gaps in the collective entomological knowledge due to local variation within and among important fly species. This presentation will impact the forensic community and/or humanity by attempting to help close such a gap within Santa Clara County, California.

Forensic entomology has become relatively common in criminal investigations. As insects become more common as indicators of post-mortem interval, gaps in information at the local level become apparent. While flies as forensic indicators are well studied, they exhibit great variation in both successional patterns and seasonal abundance due to microclimates. It is this variation that causes the forensic entomologist the most difficulty. The entomologist must adapt data from studies that have taken place miles away or create new, tailored studies to gather data specific to the current case. While the second option is ideal, time and monetary constraints can make it impossible, leaving the scientist to glean what general information is available in the literature. This does yield acceptable postmortem interval estimation, but accuracy suffers. These issues were brought to the forefront in the bay area by two cases in which general data had to be used due to a lack of local studies. The cases were completed successfully, but the entomologists on the cases identified several glaring gaps in the entomological data specific to Santa Clara County, California. The existence of these cases led to a two-year study of seasonal distribution and abundance of forensically important flies in Santa Clara County, designed to identify and quantify any patterns of fly succession that may be useful in future investigations.

Local homicide investigators were consulted, and three areas within the county were identified as the most common dump sites for human remains: urban areas (specifically within the city of San Jose, California), mountainous areas, and along rivers or streams. Four traps baited with beef liver were placed in each of these areas, one mile apart, and checked for flies once a week for two years beginning in 2001. The liver was changed as needed, and temperature data was collected for all corresponding days from the local airport. The insects collected were then pinned and stored for identification. The resulting collection consisted of over 16,000 flies and 3,000 beetles representing several families. In order to expedite the identification process, only flies belonging to the family *Calliphoridae* were identified, although any other insects were preserved in San Jose State's Entomology Museum for future reference and study. The identification process lasted one year, and the results were entered into a database where seasonal and geographical patterns were easily recognized. The results supported the findings in the two cases that prompted the study, while giving additional insight into current investigations within the county.

Entomology, Calliphoridae, Succession

G37 Establishing a Protocol Between Clinical and Forensic Institutions to Treat and Investigate Violence Against Women Cases

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After attending this presentation, attendees will understand that most aggression against women are not treated correctly because they are unknown, although this does not mean that symptoms are not visible. Only 10% of cases are reported, but 100% of them go to medical institutions asking for assistance for symptoms direct or indirectly related to violence. This study highlights this situation, and underscores the need to coordinate and collaborate through a protocol between forensic and clinical institutions to solve medical and forensic issues and to avoid victimization.

The forensic and clinical medical community must consider violence against women as a global problem. This presentation will impact the forensic community and/or humanity by giving an integral answer that helps the forensic investigation and the recovery of victims.

Introduction: Violence against women is not only a crime, but a social behavior rooted in cultural values given by a patriarchal conception of society and couple relationships. This means that when a case occurs, any of these cultural values may arise to explain and justify the aggression. Only a small percentage of cases (no more than 10%) are reported, and only these cases can get social help. However, all these women go to clinical institutions with symptoms related direct or indirectly to domestic violence.

Material and Methods: The study was performed in medical institutions (Emergency Service and General Practitioner Service) using different questionnaires about domestic violence (physical and psychological) and recording social and demographic features of the patients. The sample was all the women that went to the institutions a period of time of two months, and the tests were reviewed by a physician during a regular consultation.

Results and Discussion: There is no significant difference among the social and demographic features. Of this group of women (patients), 17.9% complained of domestic violence, but paradoxically 51.8% considered their relationships as "good" or "very good." Asking all of women if they would like doctors to ask regularly about family and couple matters, they answered "yes" in 88.5% of cases. Asked if they would like doctors to ask if they suffer violence and aggression, they answered "yes" in 88.6% of cases. But at the same time, 35% of women would not confirm domestic violence if the doctor reported the case.

Legal regulations on this subject need to be reviewed to try to help women and solve the cases. In this sense, a global approach needs to be introduced that considers not only the legal and forensic implications, but also the clinical and the health issues behind this violence. A protocol under this global perspective would help women recover, avoid victimization, assist in answering forensic questions, and ensure appropriate legal action against the aggressors.

Violence Against Women, Domestic Violence, Protocol of Assistance

G38 Analytical Electron Microscopic Detection of Aluminum Received Intravenously

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The goal of this presentation is for the attendees to realize the feasibility of detecting and identifying postmortem heavy metals in non-environmental exposure cases (i.e., mineral pneumoconioses).

This presentation will impact the forensic community and/or humanity by illustrating the utility of applying alternative methods, specifically scanning electron microscopy with electron dispersive spectrometry, for demonstrating the presence of aluminum intravascularly.

This presentation details the postmortem detection of aluminum inadvertently received intravenously. Careful consideration of investigative details can occasionally generate hypotheses that are difficult to conclusively prove using conventional forensic methods; however, focused collaboration with specialists from other fields can yield definitive causes of death as in this case of postmortem detection of aluminum as a result of a therapeutic misadventure.

A 77-year-old man with a past medical history of coronary artery disease and prior brachytherapy for localized prostate cancer was admitted to the hospital for continued urinary bleeding following direct visual internal urethrotomy for urethral stricture. At surgery, a persistent clot in the bladder and an inflamed prostate were discovered. The clot was removed and the prostate resected.

Alum bladder irrigation, containing aluminum ammonium sulfate, aluminum potassium sulfate, ammonium alum and potassium alum, was ordered, prior to and following the operation. The morning following the operation the man was discovered unresponsive. Both a nurse and doctor noted during resuscitative efforts that a bladder irrigation bag was connected to the man's intravenous catheter. In such cases, the involvement of hospital risk management is paramount; however, risk management from the hospital in this case could not conclude whether the Alum solution had infused intravenously, and if so, how much he had received.

The deceased underwent an autopsy. Gross autopsy findings were those of hypertensive and atherosclerotic coronary artery disease. Microscopic findings were most notable for thrombi in pulmonary arterioles and capillaries, which stained with periodic acid-Schiff stain.

Scanning electron microscopy (SEM) with back scattered electronic imaging (BEI) and energy dispersive spectrometry (EDS) was performed on the lung sections. The forensic community is more familiar with the role of analysis of gunpowder primer residues with SEM/EDS. These techniques are more often used on lung sections to determine composition of intrapulmonary materials that cause the different pneumoconioses. These same techniques were used in this case to determine if the aluminum-containing bladder irrigation material was present intravascularly. Smudgy material within some of the blood vessels demonstrated distinct peaks for aluminum with energy dispersive spectrometry.

Nitrogen and sulfur are commonly seen as endogenous tissue components; aluminum is not. It was concluded that the deceased had received intravenous Alum bladder irrigant solution and that this therapeutic misadventure was his underlying cause of death. This case demonstrates the benefit of selective use of non-conventional methods to solve a forensic case by the use of SEM with BEI and EDS in order to demonstrate intravascular aluminum.

Aluminum, Intravascular, SEM/EDS

G39 Evaluation of Clinical Diagnostic Accuracy in Post-Coronary Artery Bypass Graft Surgery Mortality

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The goal of this presentation is to demonstrate the medical and legal value of autopsy in non-forensic deaths, specifically those occurring after coronary artery bypass graft surgery.

This presentation will impact the forensic community and/or humanity by examining the value of performing autopsies in post-surgical deaths. The commonly held view amongst clinicians is that autopsies are of value for plaintiffs in medical malpractice suits. This paper shows that the autopsy can answer questions and provide valuable information on surgical technique, thereby decreasing the chances of litigation.

This presentation compares the accuracy of clinical diagnoses in post-coronary artery bypass grafts (CABG) mortalities to those made via postmortem diagnosis.

In accordance with relevant Australian legislation, all deaths within 24 hours of surgical anesthesia must be reported to the coroner. As part of this notification, detailed medical, surgical and anesthetic information is provided, medical charts are perused and a postmortem examination is conducted. Clinicians who treated the decedent are required to provide an opinion on the likely cause of death prior to being informed of the autopsy findings. The autopsy pathologist is therefore in an ideal position to ascertain the accuracy of clinical diagnoses after a comprehensive postmortem examination is performed.

A total of 140 deaths within 24 hours of CABG surgery were identified in the Department of Forensic Medicine in Central Sydney, Australia database spanning an 8 year period between 1996 and 2003. Of these, detailed information was available in 134 cases. Comprehensive autopsies, including histology, and—where relevant—toxicology and a range of other investigations, were conducted in all cases. Deaths were examined from seven hospitals, and all hospitals providing a cardiac surgery service in the Department's geographic coverage area were represented.

At autopsy, 23% of cases demonstrated clear discordance between clinical and pathological diagnoses. These deaths occurred despite intensive care monitoring, which presumably supplies exceptional vigilance in post-surgical care. Commonly misidentified conditions included pump failure, peri-surgical myocardial infarction, aortic dissection, and arrhythmia. Clinicians were more likely to diagnose acute myocardial infarction than autopsy pathologists. Errors in cause of death formulation were identified in the vast majority of cases on the basis of gross pathological findings, with histologic examination being of assistance in supporting the diagnosis rather than identifying a different or additional cause of death. Though there is a significant rate of diagnostic error in determining cause of death in post-CABG deaths, fewer than 1% of study deaths were a result of surgical error. The single error identified was a case of iatrogenic rupture of the iliac artery.

Hospital autopsy rates have fallen from a high of 30-40% in the 1960s to single digit rates today. This precipitous decline represents a myriad of lost opportunities to improve post-surgical outcomes. A reason frequently given for the decline in autopsy rates is a fear that the autopsy could be used as a tool to assist the plaintiff's attorney in malpractice litigation. Studies like this one suggest the opposite. Not only are autopsies an important clinical and post-surgical audit tool, but helpful in minimizing uncertainty in relation to possible errors in clinical management and surgical technique. The findings of this study suggest that the postmortem examination is far more likely to shield a clinician from liability than to expose technical mistakes.

Autopsy, CABG Surgery Deaths, Postmortem Diagnosis

G40 Adolescent Death: A 15-Year Retrospective Study

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After attending this presentation, attendees will know the most common causes and manners of death in the adolescent population; understand the typical victims, perpetrators, and trends in violent deaths; and be aware of the most common drugs of abuse in the adolescent age group.

This presentation will impact the forensic community and/or humanity by providing a thorough classification of adolescent deaths which could be useful in various ways to coroners, medical examiners, pathologists, and investigators when confronted with an adolescent death. Knowing common relationships of perpetrators to victims in violent deaths could help to find and convict the perpetrators. Also, understanding the typical victim and circumstances surrounding his or her death could help to prevent future violent adolescent deaths. A review of the toxicology in these cases could help delineate any trends in drugs of use and abuse in the adolescent age group, making it possible to prevent some accidental deaths through public health and safety measures. Finally, a review of natural deaths will demonstrate the most common natural disease processes, which could help in determining the causes of sudden, unexpected deaths in this population.

Adolescents, defined by the World Health Organization (WHO) as children ages 10-19, are a diverse group of people undergoing many changes in life as they develop, mature, and become adults. Still, pediatric forensic literature is dominated by reports, reviews, and studies of fetal, infant, and early childhood death. Previous studies have looked at specific aspects of adolescent death, but there remains a paucity of literature reporting the most common causes and manners of death along with other pertinent demographics of these victims.

The authors reviewed all cases of pediatric death referred to the Medical University of South Carolina Forensic Pathology section over the fifteen years between January 1989 and December 2003. In accordance with the WHO definition, only children 10-19 years of age were included. In all, 542 of 9540 total cases were studied. The authors examined the cause and manner of death along with the age, sex, and race of the victim. The toxicology results, perpetrator identification, death scenario and location, and victim traits were also analyzed. Homicides and suicides were due to gunshot wounds, blunt force trauma, sharp force injury, and asphyxia. Accidents were subdivided into environmental exposure, drug/inhalation toxicity, vehicle collision, and other. Natural deaths were classified by organ system. Adolescents comprise an eclectic mix of people vitally important to society, yet long-term comprehensive studies on the circumstances of their deaths are lacking in the literature. With a solid understanding of these circumstances it may be possible to predict, and hopefully prevent, future cases of adolescent death. The authors present their findings in this 15-year retrospective study to better aid forensic pathologists, death investigators, law enforcement, and epidemiologists.

Adolescent, Death, Forensic Medicine

G41 Heightened Awareness of Bioterrorism: Three Cases of Unusual Skin Lesions

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Attendees will learn of the heightened awareness of bioterrorism since the terrorist attacks in 2001, and how this has raised the suspicion of law enforcement and medical personnel in evaluating skin lesions. The attendee will also learn the cutaneous manifestations of several bioterrorist agents.

This presentation will impact the forensic community and/or humanity by providing an increased understanding of how recent historical events involving terrorism and bioterrorism have affected the law enforcement and medical communities. They will gain an understanding through the case reports presented of how these events have increased the suspicion of bioterrorism when evaluating unusual skin lesions. They will increase their understanding of, and ability to recognize, the cutaneous manifestations of bioterrorist agents through the review of those agents.

The goal of this presentation is to discuss three cases of unusual skin lesions that presented in February of 2004, to the OCME in Baltimore, MD, and how the recent heightened awareness of bioterrorism affected the medical community and handling of these cases. In addition, skin lesions associated with bioterrorism will be reviewed.

Since the terrorist attacks on September 11, 2001, and the anthrax attacks that began two weeks later, there has been an increased awareness of possible terrorist and bioterrorist attacks throughout the United States. The media, in particular, has elevated this awareness not only with reports on the anthrax attack, but with reports of other possible agents that could be used in a bioterrorist attack, such as smallpox or plague. This increased awareness has lowered the threshold of the medical community in the suspicion of bioterrorist attack in the evaluation of skin lesions. The following three cases illustrate this heightened awareness and suspicion of bioterrorism, and also reinforce the role of the medical examiner in public health surveillance.

Case Report: A previously healthy 40-year-old Hispanic female had complained of rash and shortness of breath for one week. Her family found her on the floor and transported her to the Emergency Department. There she was noted to be asystolic, with fixed and dilated pupils and no respirations. Numerous crusted and scabbed lesions varying in size and stage of healing were noted on her face, torso, and extremities. The Emergency Department expressed concern about Varicella lesions other than Varicella-zoster (chicken pox), and the body was sent to the medical examiner's office to rule out smallpox.

Case Report: A previously healthy 46-year-old white male was found facedown in the hallway of the lower level of his home. The residence was secure and the family entered the dwelling after not being able to reach him for several days. According to a coworker, several days earlier, the decedent said that he would be out of the office for a week after being diagnosed with a viral infection at a local walk-in clinic. At autopsy, multiple crusted ulcers on his head, chest, left upper thigh, and anterior aspect of the right leg were noted. There was also a crusted eschar noted on his abdomen, and multiple non-crusted necrotic ulcers on his right buttock, right posterior medial thigh, left axilla, back of the neck, lower lumbar spine, and left upper chest. Law enforcement officials expressed concern about possible cutaneous anthrax because the deceased was employed by the National Security Agency.

Case Report: A previously healthy 61-year-old Chinese female that reportedly arrived from China 20 days earlier collapsed in her bathroom. Her family, who called 911, heard the fall. Upon EMS arrival she was found to be asystolic and ACLS was initiated. She was pronounced dead upon arrival to the Emergency Department. While in China she had contracted a pruritic skin disease of unknown cause, and since her arrival had also reportedly felt weak and experienced a gradual decline in appetite. The disease started on her right arm and spread to the rest of her body. For

the three days prior to her death she was bedridden. At the hospital multiple skin lesions in various stages of healing ranging from bullae to ruptured bullae, raw erosions, dried erosions, crusted lesions, and hypopigmented scars were noted. The local health department expressed concern about possible bioterrorism.

The heightened awareness of bioterrorism has stimulated an increased response to unusual and aggressive appearing skin lesions among the medical and law enforcement communities. These three cases illustrate that response, and also provide examples of possible mimickers of bioterrorism for comparison to the cutaneous bioterrorist agents reviewed.

Bioterrorism, Skin Lesions, Case Reports

G42 Amended Cause and Manner of Death Certification: A Six-Year Review of the New Mexico Experience

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After attending this presentation, attendees will understand the state medical examiner office's experience with the amendment of cause and/or manner of death on death certificates, including frequency of amendment, time between original certification and amendment, reasons for amendment, and in what way death certification was changed. This presentation will impact the forensic community and/or humanity by providing information about how, why, when, and how often the cause and/or manner of death is/are amended on death certificates completed by forensic pathologists. While the answers to these questions are of value to the forensic community, little formal study has been undertaken in this area.

At the end of June 2003, the New Mexico Office of the Medical Investigator (OMI) computer database was searched for all amended death certificates signed by OMI pathologists from 1997 through 2002. Each case file was reviewed in order to identify only those death certificates (DCs) with amended cause and/or manner of death fields. Cases that were initially external examinations only and subsequently became autopsies, DCs originally signed out by someone other than an OMI pathologist, "brain only" research-oriented autopsies, and DCs originally signed out as "pending" were excluded. Cause of death (COD), amended cause of death (ACOD), manner of death (MOD), amended manner of death (AMOD), the time elapsed (TE) between the original and amended DCs, and the reasons for the changes were recorded for the remaining cases. The reasons for the changes were categorized as medical records review, histology, investigations, family concerns, microbiology, or error. "Family concerns" included any family member, as well as third parties such as friends, caretakers, or primary physicians. Statistical analyses were performed using SAS version 8.02 statistical analysis software for Windows and EpiInfo 2002.

The database search identified 108 cases that fit the above criteria, 0.86% of all cases handled at OMI over the study period. This total included 81 autopsies and 27 external examinations. One of the 108 cases was amended twice, increasing the total number of amended DCs to 109. Autopsy DCs from 1997 to 1999 were significantly more likely to be amended than those from 2000 to 2002 ($P=0.02$). COD was amended on 62 of these 109 DCs. Twenty-three different CODs were used in these 62 DCs, with arteriosclerotic cardiovascular disease (ASCVD) accounting for almost a quarter. Twenty-nine different ACODs were used on the resulting 62 amended DCs, with intoxicant(s) comprising nearly a third. MOD was amended on 72 of these 109 DCs. Natural deaths had the greatest percentage of amended DCs (1.39%), followed by suicides (1.22%). Overall, there was a significant association between manner of death and the number of DCs amended ($P<0.001$). For external examinations, natural and suicide DCs were significantly more likely to be amended than accidents ($P=0.0002$ and $P=0.019$, respectively). Natural-to-accident (N-A)

was the most common direction of change (28 DCs), followed by suicide-to-undetermined (S-U; 14 DCs). The mean TE between the original DC and amended DC was 3.83 months (SD 6.6 months). DCs amended secondary to investigations went the longest between signatures, with a mean of 8 months. The direction of change was significantly associated with TE ($P=0.04$). The directions most associated with an increasing TE were N-S, U-H, N-U, A-U, S-U and N-A. Toxicology was the most common reason for DC amendment (40 DCs) and MOD amendment (28 DCs), followed by family concerns (23 and 19 DCs, respectively) and investigations (13 and 12 DCs, respectively). Toxicology was also the most common reason for amending COD (26 DCs); histology was the second most common reason for COD amendment (11 DCs), followed by both family concerns and medical records review (8 DCs each). Of the fourteen DCs that changed from suicide-to-undetermined, eleven were triggered by family concerns. Of the twelve DCs in which MOD was amended secondary to investigations, nine moved to a MOD of undetermined. Twelve of the 109 DCs had "gunshot wound of head" as the COD, all but one of which had suicide as the MOD. Eight of these eleven suicides were subsequently amended to undetermined, and in ten the impetus was family concerns.

In conclusion, approximately 1% of death certificates signed by OMI pathologists had either cause or manner of death amended, with a slightly higher amendment percentage for external examinations than autopsies. ASCVD was the most commonly amended COD, and intoxicant(s) was the most common ACOD. There was a significant association between MOD and number of amended DCs. By percent, natural and suicide DCs were the most frequently amended. Natural-to-accident and suicide-to-undetermined were the most common directions in which MOD changed. Toxicology was the most common reason for amendment; family concerns were the impetus behind most suicide-to-undetermined amendments, with most of these cases involving gunshot wounds of the head. The average time to amendment was just under 4 months, and direction of change was significantly associated with the time elapsed. This information on how, why, when, and how often cause and/or manner of death certification is amended is both interesting and useful to the forensics community.

Death Certificate, Manner of Death, Autopsy

G43 The Relationship of Drug Abuse to Unexplained Sudden Death

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The goal of this presentation is to define the relationship between drug abuse and deaths where neither anatomical nor toxicological cause for death is found.

This presentation will impact the forensic community and/or humanity by recommending that decedents with a convincing history of drug abuse and no other anatomical or toxicological findings at autopsy have their cause of death certified as being due to chronic drug abuse.

Rationale: Cases of young adults with a history of drug abuse who have died suddenly and unexpectedly in whom neither anatomical nor toxicological cause for death is found at autopsy are received regularly. The common presence of a history of drug abuse, however, has led researchers to hypothesize that drug abuse not only induces some change that increases the risk of sudden death, but that this change persists after the drug is no longer detectable in the body. The first part of this study was presented at the 2004 Annual Meeting of the American Academy of Forensic Sciences in Dallas, Texas, where it was shown that deaths certified as undetermined

in cause and manner have an increased likelihood of having a history of drug abuse when compared to a control group of medical examiner cases. In this second part of this study was tested the null hypothesis, "There is no difference in the frequency of drug abuse in a study group dying of undetermined cause when compared to the frequency of drug abuse in a matched control group of patients admitted for cholecystectomy," with the intent of establishing whether a history of drug abuse increases the likelihood of sudden death.

Methods: A retrospective case-control study conducted of deaths investigated by the Jefferson County Coroner/Medical Examiner Office, Alabama between 1986 and 2003. The study group consisted of decedents between 10 and 70 years of age whose cause and manner of death remained undetermined following an autopsy and toxicological analysis for ethanol and drugs of abuse. The control group was chosen from living patients who underwent cholecystectomy at the indigent care hospital serving Jefferson County, Alabama, a population similar to that seen in the medical examiner office. Three controls were matched to each study group member to within 5 years of the age of the study decedent and within two calendar years of the date of death of the study decedent (to keep social trends and testing methods comparable). The charts of both the study group (decedents) and of the control group (patients) were reviewed for evidence of drug abuse. All toxicology results were noted in the decedents, including the presence of cocaine, any other drugs or medications, and ethanol. Decomposed remains were included in the study group. The charts of the living control group were reviewed for a history of drug abuse and hypertension in accordance with the hospital Institutional Review Board.

Results: The study group of undetermined deaths consisted of 62 decedents, 24 of whom had some evidence of drug abuse (history, physical signs, positive toxicology for cocaine or its metabolites in urine or bile, opiates, or methamphetamine). In the matched control group 9 of 186 patients had a known history of drug abuse. Cases in the study group were seven times (odds ratio 7.0; 95% confidence interval 3.5-14.1; p<0.0001) more likely to have a history of drug abuse than the controls. In other words, given the design of this study, an individual with an undetermined cause of death is seven times more likely to have a history of drug abuse than is a living patient chosen from a similar population. Given the small p-value, chance is an unlikely explanation for these results. Heart disease can cause sudden death by dysrhythmia, and should be considered as a cause of death in the decedents, but cases with heart disease sufficient to account for death were not considered undetermined as to cause of death and were thus excluded from the study group. This exclusion is reflected by statistical analysis that showed hypertension was less common in the study group than in the control group of cholecystectomy patients.

Conclusion: This is the second study to show that a history of drug abuse is far more common in decedents with an undetermined cause of death than it is in a control group chosen to represent a random sample of the population. Epidemiological theory indicates that for rare events, such as the death of an individual with a history of drug abuse, the measure of the association between the risk (here drug abuse) and the event (here death) is a valid and accurate predictor of the incidence of death due to a given risk factor. In other words, individuals who abuse drugs are at increased risk of dying suddenly because of their habit of abusing drugs, even if not acutely intoxicated at the time of death. Based on these findings, the authors recommend that decedents with a convincing history of drug abuse and no other anatomical or toxicological findings at autopsy have their cause of death certified as being due to chronic drug abuse.

Drug Abuse, Sudden Death, Pathology

G44 Natural Causes of Death Among a Federal Medical Center Prison Population

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The goal of this presentation is to review the natural causes of death among federal prisoners treated at a Federal Medical Center during the period 1986-2004, in order to understand the spectrum of complicated natural disease present in the federal prisoner population and to use that knowledge towards a more accurate determination of manner and cause of deaths that occur while in custody.

This presentation will impact the forensic community and/or humanity by adding to the available knowledge base concerning natural causes of death in prisoner populations. Because of the referral medical center population studied, particular attention will be paid to complicated and severe natural diseases. An understanding of complex disease patterns present in prisoners will assist in accurately determining manner and causes of deaths in custody.

Outcome: To understand the spectrum of complicated natural disease present in the federal prisoner population and to use that knowledge towards a more accurate determination of manner and cause of deaths that occur while in custody.

Deaths that occur while in custody are routinely investigated, and often require an autopsy to determine the manner and cause of death. A thorough medicolegal investigation protects the interests of the prisoners, the custodians, and the general public by assisting in the prosecution of prison homicides, documenting natural causes of death when unnatural causes may be suspected, and identifying contagious diseases that may pose a public health risk to prisoners and facility personnel. As in non-incarcerated populations, the task of determining manner and cause of death in an apparently unnatural death is sometimes complicated by potentially lethal natural disease present in the deceased. Therefore, it is important for forensic pathologists and death investigators to understand the unique patterns of natural disease that occur in prisoner populations.

This paper will review natural causes of death among federal prisoners who were treated at the Rochester Federal Medical Center during the period 1986-2004. The Federal Medical Center system is a network of seven specialized medical centers located throughout the U.S. and operated by the Federal Bureau of Prisons. The Rochester Federal Medical Center is a major medical and mental health referral center for male prisoners. In some instances, consultations are provided through the Mayo Clinic.

Since 1986, the Mayo Clinic has performed 323 autopsies on deaths occurring at the Rochester Federal Medical Center. Of the 323 deaths, 320 were natural deaths and 3 were suicides, all by hanging. The vast majority of natural deaths could be attributed to one of 4 general categories, cancer-related (148), liver disease-related (63), AIDS-related (57), and cardiovascular disease-related (37). The average age at death for each category was: cancer-related, 54.2 years; liver disease-related, 49.6 years; AIDS-related, 39.9 years; and cardiovascular disease-related, 57.0 years. Less common natural causes of death included pulmonary embolism (3), stroke (3), sepsis (2), end stage renal disease (2), aspiration pneumonia (2), chronic obstructive pulmonary disease (1), warfarin toxicity (1) and sarcoidosis involving the heart (1). Among the cancer-related deaths, the five most common primary sites were lung (45), hematolymphoid (17), colon (16), pancreas (12) and head and neck (10). In addition, hepatocellular carcinoma was identified in 17 prisoners who died of liver disease. Some of the more unusual tumors included malignant fibrous histiocytoma (1), gallbladder carcinoma (1) and osteosarcoma (1). Among the 37 cardiovascular causes of death, 34 were due to ischemic heart disease and 3 were due to idiopathic dilated cardiomyopathy. Among the 63 liver-disease related deaths, 55 were associated with chronic hepatitis C infection, 3 with alcohol abuse without evidence of hepatitis C infection, 3 with no known cause, and 2 due to primary sclerosing cholangitis. The highest number of liver-related deaths occurred in 1999, accounting for 12 of 29 deaths that

year. AIDS-related deaths peaked in the year 1995, accounting for 11 of 23 deaths that year.

This study differs from previous studies of prison deaths because the study population consisted only of prisoner deaths occurring at a Federal Medical Center. Unnatural and sudden deaths are notably lacking due to the population studied, but the three suicides by hanging corroborate previous reports of an increased risk for suicide while incarcerated; the preferred modality being hanging. The over-representation of cancer-related deaths reflects the referral center population of this study. Previous studies have found cardiovascular disease to be the most common natural cause of death among prisoners. The distribution of cancer types suggests an increased number of deaths from hemato-lymphoid and head and neck cancers, and a decreased number of deaths from prostate cancer, compared to the general population.

Overall, the spectrum of disease present in federal prisoners appears to be as wide as would be expected in a prisoner population numbering over 2 million in 2003. With frequent allegations of prisoner maltreatment bringing increasing scrutiny into deaths occurring while in custody, further studies of natural disease in prisoners will assist in determining manner and cause of deaths in custody.

Natural, Deaths, Custody

G45 Distribution Pattern of Pulmonary Surfactant Protein A (SP-A) in Drowning and Opiate-Related Deaths

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After attending this presentation, attendees will understand the immunohistochemistry of pulmonary surfactant and the usefulness of SP-A staining as diagnostic marker of alveolar injury in drowning compared with agonal changes such as pulmonary edema in opiate-related deaths.

This presentation will impact the forensic community and/or humanity by demonstrating to the forensic pathology community a finding supporting the final diagnosis of drowning by routinely using SP-A staining.

Pulmonary surfactant covers the surface of the alveoli and prevents alveolar collapse by lowering surface tension. It is composed of phospholipids (90%) and proteins (10%). Four surfactant-associated proteins (SPs) have been identified: hydrophilic SP-A and -D, and hydrophobic SP-B and -C. SP-A is the most prevalent form, and is produced in the alveolar type II cells. Under normal conditions, SP-A is immunohistochemically detected in the alveolar type II cells, but also on the alveolar interior surface since a small quantity of SP-A is secreted into the alveoli. The immunohistochemical distribution pattern of SP-A in the intra-alveolar space has been previously reported as a useful tool to distinguish mechanical asphyxia from other hypoxic cases (Zhu *et al.*, 2000). It can also be considered a valuable marker of the pulmonary dysfunction in drowning, showing partial differences in pulmonary pathophysiology depending on the immersion medium (Zhu *et al.*, 2002). Many prominent, massive aggregates of granular SP-A staining observed in the intra-alveolar space have been considered the result of an enhanced secretion caused by strong forced breathing that often takes place in the mechanical asphyxia, or by over-excitement of the autonomic nervous system or, even more, by the Ca^{2+} ions in the edema fluid. The above-mentioned aggregated form may also indicate an early biochemical alteration of SP-A in asphyxial deaths.

To evaluate the role of plasma components exuded into the alveolar space and its relationship with the distribution pattern of SP-A, the authors

have retrospectively investigated a total of 48 forensic autopsy cases. They have been divided into three main groups: 18 cases of drowning (12 in salt water and 6 cases in fresh water), 20 cases of opiate-related deaths showing gross pulmonary edema and, as a control group, 10 cases of rapid deaths by gunshot injuries to the head without pulmonary edema. The study was carried out on paraffin tissue blocks from which serial sections (4 μm thick) were used for hematoxylin-eosin and immunostaining. For immunohistochemistry, anti-human SP-A mouse monoclonal antibody (Novo Castra Laboratories Ltd; U.K.) was used at 150-fold dilution, with a 1-hour incubation at room temperature, using the universal Avidin-Biotin Complex (ABC). The expression of the SP-A staining was scored semiquantitatively based on two staining patterns: membranous or linear staining on the interior surface of alveolar epithelia, and the interface of intra-alveolar effusion and granular staining showing many prominent massive aggregates of SP-A within the intra-alveolar space.

The results show that aggregated granular SP-A staining in the intra-alveolar space was frequently observed in drowning victims. A high intensity of this pattern was frequently found in these victims, suggesting a molecular alteration caused by a direct effect of aspirated water and/or subsequent metabolic disturbance in the alveolar type II cells. Granular deposits of SP-A in the intra-alveolar space were never observed in the control group of non-asphyxial deaths (10 cases of fatal gunshot injuries). The group of gross pulmonary edema observed in narcotic deaths showed a prevalent distribution of membranous or linear pattern staining and only scattered SP-A aggregates in the intra-alveolar space. The granular SP-A staining detected in pulmonary edema is consistent with previous findings of SP-A positive staining in lungs with secondary damage such as acute respiratory distress syndrome (ARDS) or a bronchial lavage causing both a biochemical alteration of pulmonary surfactant. These results suggest some molecular alterations of SP-A due to abnormal surfactant metabolism caused by edema fluid. Based on the comparison of SP-A distribution pattern between drowning, agonal changes such as pulmonary edema, and non-asphyxial deaths, the expression of intra-alveolar SP-A aggregates can significantly support the final diagnosis of drowning.

Pulmonary Surfactant, Drowning, Opiate-Related Deaths

G46 Drowning vs. Trauma and Other Causes of Asphyxia in Deaths in Water

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The goal of this presentation is to review three cases which reveal the necessity of looking more closely at cases that involve water. They are ideal instances where the cause of death appeared obvious, but because a body of water was involved things were not what they seemed. These cases reinforce the need to perform autopsies on any case involved with submersion in water.

This presentation will impact the forensic community and/or humanity by reinforcing the need to closely evaluate violent deaths that involve water.

Drowning appears to be an easy cause of death to diagnose whenever a person is found not breathing in water. In reverse, drowning is not the first diagnosis that comes to mind when only a little amount of water is present at a scene. These three case histories illustrate some of the difficulties in evaluating the role of drowning in complicated cases, particularly when autopsy findings are found to be inconsistent with initial impressions gained from scene investigation. External examination of bodies in such cases may be misleading.

Case One: A 47-year-old male was standing on a dock pier performing martial arts exercises. He had a history of violence and substance abuse. A bystander witnessed this man finish warming up, tuck a necklace into his shirt, and dive off the pier head first. The man rose to the surface of the water, and floated as if unconscious. He was rescued within five minutes of the incident, but could not be resuscitated. External examination revealed a small abrasion along the vertex of his head. His face was congested, and he had some jugular venous distension. There were no other obvious external traumatic injuries. Death was initially attributed to drowning, with consideration of a cardiac event, possibly related to intoxication with cocaine.

Case Two: A 39-year-old male was driving alone in his sports car, without seat belt restraint, along a two-lane road. He lost control of the vehicle, which went off the roadway, flipped into the air, and landed on its roof in a ditch that contained four inches of water. It is not known how long the man was in the car prior to the arrival of the first bystanders who attempted to render aid, but the time interval was less than 10 minutes. The first bystanders attempted to pull the man from the passenger window of the car. When police arrived at 10 minutes from the time of the initial accident, the man was found face down outside the passenger window of his car. Emergency medical personnel failed to find a pulse, and he was pronounced dead. External examination of the body revealed adherent leaves and mud, with dicing injury to the forehead, left flank, and left thigh. Lacerations and bruising were apparent on the chin and lower extremities. Conjunctival and intraoral petechiae were identified. No other major trauma was obvious on external physical exam. Drowning was not considered among the causes of death at initial examination. Positional or traumatic asphyxia was considered.

Case Three: A 46-year-old male with a history of alcohol abuse was riding his bicycle at night along a street. He was struck by a motor vehicle, thrown into the air, and landed in a ditch, face down, in 6-7 inches of water. He remained in the water for several minutes, because the woman whose car had hit him was unable to pull him out unassisted. Ultimately, other bystanders pulled the man out of the water, but by that time emergency personnel could not revive him. External exam was remarkable for lack of injury, other than superficial abrasions on his hip and thigh. Cervical fracture was considered the likeliest possibility at initial examination.

These three cases underscore the difficulty in identifying what role drowning may play in death. Evaluation of the scene, the body, and the history may suggest a misleading cause of death. Autopsy may be required to make an ultimate diagnosis.

Drowning, Asphyxia, Violence

G47 Study of the Diagnostic Value of Iron in Freshwater Drowning

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After attending this presentation, attendees will be able to test the diagnostic value of iron (Ir) in freshwater drowning by investigating the postmortem levels of hemodilution in drowning cases compared to control cases.

This presentation will impact the forensic community and/or humanity by demonstrating the importance of postmortem biochemistry for the diagnosis of freshwater drowning.

Material and Methods: Twenty-six typical freshwater drowning cases were selected from all immersion cases autopsied in the Department of Forensic Pathology between 1998 and 2004 (n=128). The exclusion criteria were a long postmortem interval (more than one week) and causes of death other than drowning (acute intoxication or trauma). For all selected

cases, the diagnosis of drowning was based on the presence of autopsy findings (including overinflated lungs, pulmonary edema, frothy contents in the airways) and positive diatom test. The diatom test was performed after treatment of the samples with Soluen-350. The test was considered positive when a significant number of diatoms were detected in lungs and other internal organs (liver, kidney, bone marrow) and when concordance of diatom types recovered from organs and the putative drowning medium were found. A control population of 12 cases was also selected. For each case, age, sex, manner of death, postmortem interval, and resuscitation attempts were reported from the postmortem records. For each drowning and control case, blood iron levels were measured in the left ventricle (LV) and right ventricle (RV) of the heart. The mean difference of iron concentration (RVIr-LVIr) between the drowning group and the control group was compared. Furthermore, iron measurements were performed in 19 drowning cases showing advanced putrefaction.

Results and Discussion: The mean age of the drowning cases was 43.2 years. The mean age of the control population was 36.2 years. In the majority of the drowning cases, manner of death was suicide (n=14). The mean difference of iron concentration was significantly higher in the drowning cases compared with age and sex-matched controls ($p<0.001$). All drowning cases showed hemodilution. Four control cases showed hemoconcentration. No overlap was found in the RVIr-LVIr levels between the two groups. In the control group, the maximal RVIr-LVIr level was equal to 11 micromol/l. In the drowning group, the difference levels ranged from 12 to 387 micromol/l. Resuscitation seemed to have no effect on the results. In cases of drowning showing advanced putrefaction, the iron test was not reliable because biochemical iron measurement was often prevented by inability to obtain postmortem blood.

Conclusion: According to the results, iron seems to be a good biochemical marker for freshwater drowning with a short postmortem interval.

Drowning, Iron, Postmortem Biochemistry

G48 Elder Abuse and Neglect Death Review: Use of an Interagency Team

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After attending this presentation, attendees will understand the organization and implementation of an elder death review team, using the San Diego experience as an example.

This presentation will impact the forensic community and/or humanity by providing general awareness of efforts of local governments to address the issue of elder abuse and neglect deaths. The experience of San Diego County's elder death review team may be helpful to other jurisdictions in developing teams.

There is a growing national concern about abuse and neglect of the elderly. San Diego was one of the first counties in California to develop an Elder Death Review Team in response to legislation enacted in 2001. The California law provides for the development of an interagency review team "to assist local agencies in identifying and reviewing suspicious elder deaths and facilitating communication among persons who perform autopsies and the various persons and agencies involved in elder abuse or neglect cases." The law lists suggested team membership, including experts in the field of forensic pathology, experts in geriatrics, coroners and medical examiners, district and city attorneys, law enforcement, public administrators, ombudsmen and representatives from adult protective services.

San Diego County chose to set up the committee through a Memorandum of Agreement (MOA) between the District Attorney's Office, the Sheriff's Office, the Medical Examiner's Office, and the Health and Human Services Agency (which includes Aging and Independence Services). Representatives of these agencies are permanent members of the committee and rotate the chairmanship. The MOA provides guidelines for

membership of the committee, objectives, recommendations, and confidentiality. The objectives include identification of risk factors and the facilitation of communication between agencies in order to reduce the number of elder deaths due to abuse and neglect.

The Elder Death Review Team borrowed ideas from existing Domestic Violence and Child Fatality review teams. All information is considered confidential, and all members must sign a confidentiality agreement. Paperwork is kept to a minimum. The committee has opted to discuss only one case per meeting. Discussion goals include determination of the nature of the abuse or neglect, if any, whether it played a role in the death, and an assessment of its preventability. A case review-investigative report form was developed to summarize each case. The committee discussions conclude with recommendations, which can range from changing individual departmental policies to public education to proposing legislation.

The committee has had its share of growing pains, and some issues have yet to be resolved. However, the authors believe the development of a County Elder Death Review Team is one step in raising awareness of elder abuse and neglect and reducing its prevalence.

Elder Abuse, Elder Neglect, Elder Death Review

G49 Adolescent and Young Adult Suicide: A Ten-Year Retrospective Review of Kentucky Medical Examiner Cases

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The goal of this presentation is to present a comprehensive review of findings gleaned from postmortem examinations on suicide victims between the ages of 11 and 24 in Kentucky between 1993 and 2002, and to offer strategies aimed at the prevention of adolescent and young adult suicide.

This presentation will impact the forensic community and/or humanity by showing how adolescence represents a tumultuous period in a young individual's life as the youth strives to gain independence and flourish into a productive member of society. This period of transformation is often associated with anxiety and stress, encouraging feelings of hopelessness, personal failure, and suicidal ideation. The prevalence of youth suicide by firearm necessitates restricting unsupervised household access to firearms and identifying adolescents and young adults who are at risk for suicide.

According to the *National Vital Statistics Report* in 2001, suicide, as a manner of death, ranked as the third leading cause of death in the United States between the ages of 15 and 24 and accounted for 3,971 deaths. The rate of completed suicide in this age group has tripled since 1950. The estimated ratio of attempted suicides to completed suicides for adolescents is 200:1, which is significantly higher than that of the general population, with an estimated 10-25 attempts for every completed suicide. A host of biopsychosocial factors contribute to adolescent suicidal behavior. The majority of adolescent suicide victims suffer from either single or combined psychiatric disorders, including affective and personality disorders, substance abuse, anxiety or conduct disorders, eating disorders, and aggressive and antisocial tendencies. Youths often display risk-taking behaviors, including reckless motor vehicular operation, running away from home, auto theft, gun carrying, lack of seatbelt use, assault, and truancy. A lack of a cohesive family unit may provoke suicidal ideation; specifically, poor parent-child communication, parental violence, and loss of a primary caregiver. Suicide clusters are most commonly associated

with youths ages 15 to 24, precipitated by either experiencing the suicide of a member of a young individual's peer group or gaining media exposure and imitating suicidal behavior.

This study presents 466 medical examiner cases of suicide ages 11 to 24 in Kentucky between 1993-2002, with 108 victims ages 11 to 17 and 358 victims ages 18 to 24. The majority of victims in both age groups were males (88.9% and 87.4%) and Caucasian (88% and 90.8%). A paucity of black females committed suicide, consisting of only 0.92% and 0.84% of victims in each group, respectively. The leading causes of death were the same for the two age groups, specifically, firearm injury (72.2% and 70.7%), hanging (22.2% and 18.7%), and drug intoxication (2.8% and 5.3%). The head was the most likely target of the firearm wound for both males and females, accounting for 93.6% and 85% of victims in each age group, respectively. Suicide peaked in September for group ages 11-17, most likely reflecting the tension associated with the initiation of a new school year. The highest percentage of cases for the group ages 18-24 was documented in January. Ten (9.2%) subjects ages 11-17 had previously attempted suicide, in most cases, by incised wounds of the upper extremities; 60% of these victims fatally succumbed to a cranial firearm wound. Of the 35 (9.8%) victims ages 18-24 who had previously attempted suicide, 48.6% died as a result of a firearm injury to the head and 31.4% selected hanging.

Toxicological studies constitute an important component in the investigation of a suicide. In the suicide group ages 11 to 17, blood and urine were collected in 93.5% and 72.2% of cases, respectively. Approximately 62% of victims in this group had negative blood toxicology, and 71.2% of urine toxicology screens yielded no drugs. The blood alcohol concentration (BAC) was negative in 83.2% of cases, while 7.9% had a BAC ≥ 0.1 mg%, and 8.9% < 0.1 mg%. A minority of victims had been prescribed psychoactive medications as discerned in the blood, specifically, benzodiazepines in 4.9% and antidepressants in 3.9%. Cannabinoids were detected by urine screen in 23.1% of the decedents. Of the victims ages 18 to 24, blood and urine were collected in 92.4% and 71.8% subjects, respectively. The blood toxicological results were negative in 40.3% of cases. The BAC was negative in 59.2% of cases, ≥ 0.1 mg% in 26.9%, and < 0.1 mg% in 13.9%. The following prescription psychoactive medications were quantitated in the blood: benzodiazepines (8.4%), opiates (6%), and antidepressants (5.1%). Urine screen revealed cannabinoids in 31.5% and cocaine in 8.2%.

This comprehensive analysis incorporates a myriad of factors that may have contributed to suicidal behavior, specifically, psychiatric illness, domestic turmoil, employment unrest, and legal difficulties.

Suicide, Adolescent, Firearm

G50 Which Field Method is Best? A Comparative Study of Four Entomological Methods for Sampling Forensically Important Arthropods on Human and Porcine Remains at the Anthropology Research Facility in Knoxville, Tennessee

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The goal of this presentation is to present to the forensic sciences community the latest findings from the Anthropology Research Facility (ARF) in Knoxville, Tennessee, on the topic of which field sampling methods, when used singly and in combination, yield the largest fraction of forensically-important insect species from human and porcine remains.

This presentation will impact the forensic community and/or humanity by providing recommendations on which field methods forensic entomologists and crime scene investigators should use when sampling forensically-important arthropods from human remains in medicolegal death investigations.

The obvious constraints imposed on the scientific study of human corpses speak to the urgency for forensic entomologists to have comparative field data on human and surrogate (non-primate) remains to insure that the recommendations offered for one are valid for the other. In 1989, the on-campus Anthropology Research Facility (ARF) at the University of Tennessee, Knoxville, became the site of the first comparative field test of four arthropod sampling methods used by forensic entomologists.

Over a 35-day period in summer, aerial sweep nets, pitfall traps, sticky traps, and hand collections were taken from one unembalmed, unautopsied human cadaver and two freshly-euthanized 50-lb pigs. (Due to limitations in procurement, replicate human corpses were unavailable in this study.) A third pig, also placed at the site, was not sampled in order to monitor possible sampling effects on rates of decay and arthropod succession. Depending on carcass age, the daily sampling schedule included up to four collections (early morning, noon, afternoon, early evening), for a total of 96 sampling periods and 1,370 individual samples; by season's end, the corpses at this site became the most intensively sampled remains of any previous study. Where arthropod life stages and taxonomic keys permitted, specimens were identified to the lowest possible taxon (family, genus or species). From the arthropod counts, the fraction of forensically-important arthropods captured by each method and combination of methods was calculated. Forensically-important taxa include members of the sarcophagous fauna (e.g., blow flies, flesh flies, hide beetles) and certain predators (e.g., rove beetles, clown beetles, ham beetles), both of which have been used as forensic indicators in medicolegal death investigations.

Based on analysis of 16 days of samples, different sampling methods captured between 35 and 100% of the forensically-important taxa and between 30 and 100% of the sampled individuals. Hand collection, when performed by an experienced forensic entomologist, was found to be the single best method for sampling forensically important insects at a crime scene, followed by aerial netting, pitfall traps, and sticky traps. Hand collection and aerial net sampling were found to offer the best combination of methods for sampling forensically-important insects. This ranking held regardless of whether the remains sampled were human or pig. Human-pig comparisons revealed a high degree of similarity in catch statistics, regardless of method, leading researchers to conclude that enough elements of the forensically-relevant fauna were found on pig carcasses in southeastern Tennessee to reflect what crime scene investigators are likely to find there on human remains in future death scene investigations.

The authors gratefully acknowledge the logistical and field assistance of the Anthropology Department of the University of Tennessee, Knoxville, and financial support of the National Institute of Justice (Grant #94-IJ-CX-0039).

As forensic entomologists they hope to see future field-tests and eventual adoption of these recommendations by crime scene investigators and other members of the forensic sciences community.

**Forensic Entomology, Anthropology Research Facility (ARF),
Field Sampling**

G51 The Decomposition of a Pig Carcass in a Mesophytic Biotope, Oahu, Hawaii

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The goal of this presentation is to assist in the understanding of the stages of decomposition and the succession fauna on decomposing carcasses, an aid to estimation of postmortem interval.

This presentation will impact the forensic community and/or humanity by providing additional information confirming successional stages of decomposition and allied fauna.

The decomposition of an exposed pig carcass (*Sus scrofa*) was monitored for approximately 43 days. The carcass progressed through fresh (2 days), bloat (3 days), decay (5 days), post decay (30 days), and skeletal (2 days) stages and attracted suites of necrophagous species as well as predators, parasites and opportunistic feeders. The calliphorid blow flies *Chrysomya rufifacies* and *C. megacephala* were initial colonizers and made up the bulk of the initial arthropod abundance; the coleopterans of families Histeridae, Dermestidae, Trogidae, Staphylinidae, Tenebrionidae and Cleridae appeared in later stages. Most maggot activity occurred during the bloat and decay stage, which lasted from day 3 through day 9 of exposure. By this time only 25% of the carcass remained. During peak maggot activity, the difference between internal carcass temperature and ambient air temperature peaked. The greatest number of taxa (22 of 27) and the lowest total abundance of arthropods were observed during post decay. A total of 27 taxa were identified, of which about 64% were dipterans and coleopterans combined. The suite of arthropod taxa identified in this study was not significantly different from other outdoor pig decomposition studies done in Hawaii.

Arthropod Succession, Maggot Masses, Forensic Science

G52 A Comparison of Pig and Human Tissue in Studies of Decomposition: Can Flies Tell the Difference?

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The goal of this presentation is to provide preliminary studies that demonstrate how some forensically significant fly species may be attracted to different types of carrion in varying degrees and to determine if blowflies are differentially attracted to human or porcine carrion via olfaction.

This presentation will impact the forensic community and/or humanity by providing preliminary studies which indicate that currently practiced research methods may not deliver the most accurate results.

These studies asked whether adult scavenger insects respond differently to volatile compounds emanating from human or porcine remains, in an effort to determine if porcine surrogates may legitimately be substituted for human remains in forensic entomology research. No difference in the arthropod fauna attraction to either type of carrion was anticipated.

Natural insect populations were exposed to odors from human or pig tissue samples contained in traps that bar visual cues. Traps consisted of a small tub filled with carrion suspended within a covered five-gallon plastic bucket or 35-gallon plastic trashcan and above propylene glycol poured four centimeters deep. Holes six centimeters in diameter were drilled six centimeters below the rim of the outer bucket or trashcan to allow insects to have access to the carrion. Once inside the trap, insects drowned in the propylene glycol. They were periodically sieved from this preservative then rinsed and stored in ethanol. For identification to species, forensically significant insects were first rinsed in acetone then pinned.

In a preliminary experiment, equivalent weights of pig or human thigh and forearm tissue in five-gallon bucket traps were used. Eight species of

flies arrived at either carrion. Five were common to both types of carrion. Three species of flies were recovered solely from traps baited with human carrion, and no species were recovered exclusively from porcine carrion.

In the later experiment, employing 35-gallon trashcan traps, the plastic tubs were baited with a human or pig cephalic specimen. These tissues attracted a greater diversity of fly species, totaling 15. Eight of these were common to both types of carrion, three were found associated only with human tissue, and four only with porcine material.

Over both experiments, a total of 16 species of flies were collected and identified. Of these, 11 were found on both types of carrion. Two were consistently identified only on the human specimens, and four species were found solely on the porcine tissue.

Although the results of these experiments remain preliminary, they suggest that adult fly populations on human or porcine carrion may be qualitatively different. The impact on current methods of postmortem index (PMI) can only be determined through the collection of additional data sets.

Olfaction, Forensic Entomology, Carrion

G53 Inter-Observer Variability in Entomology-Based PMI Estimates: A Single Blind Study

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Attendees will develop an understanding of the variability in current techniques used to estimate the postmortem interval based on entomological evidence. The primary goal of this presentation is to open a dialogue within the forensic entomology community regarding the development of uniform protocols.

This presentation will impact the forensic community and/or humanity by demonstrating a need within the forensic entomology community to standardize its methods and practices.

Although reports of the utility of arthropods in forensic investigation date as early as 1235 AD, the field of forensic entomology remains in its adolescence, with many avenues of basic research largely unexplored. In particular, the method by which the postmortem interval (PMI) is estimated, one of the most important applied methods in forensic entomology, remains a highly controversial and problematic process. Indeed, it would seem that there might be as many such methods as there are forensic entomologists. Herein the authors acknowledge the need for standardization of this process within the community, investigate the variation in methods employed by forensic entomologists in a single-blind study, and suggest elements of a uniform protocol. Accordingly, a simulated crime scene was arranged in which fresh human remains were exposed to insects at the outdoor decomposition facility operated by the University of California, Davis, Institute for Medicolegal and Surgical Sciences (IMSS). Following an undisclosed period of exposure (herein referred to as the PMI), researchers sampled insects from the remains, recorded typical crime scene and meteorological data, and photographed and videotaped the scene and data collection efforts. Copies of all materials were sent to a number of practicing forensic entomologists in North America who had previously agreed to participate and render a PMI estimate. The degree to which these estimates vary and bracket the actual PMI will be discussed.

Forensic Entomology, Postmortem Interval, Standards

G54 Viral Testing of Adult Mosquitoes Collected in West Virginia for West Nile Virus Using NASBA Assay

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After attending this presentation, attendees will understand the collection methods for mosquitoes, testing of mosquito samples for viral RNA, and how forensic equipment and methods can be used for viral testing.

This presentation will impact the forensic community and/or humanity by demonstrating the use of forensic methods and procedures that can be used to implement viral testing of field collected samples.

Since its discovery in the United States in 1999, West Nile Virus has spread across North America. Though not endemic to the continent, mosquitoes of the genera *Culex* have become vectors of the serocomplex that causes West Nile. Public health concerns have prompted laboratories across the nation to develop reliable and rapid tests to detect the virus in order to initiate surveillance methods. By combining efforts between public health and forensic agencies, testing protocols can be developed and performed on not only possible vectors but also infected individuals. Current microbial forensic techniques and equipment can be manipulated to detect viral pathogens using analytical extraction methods. The West Virginia Department of Health and Human Resources, Division of Surveillance and Disease Control (WVDHHR/DSDC) in conjunction with the West Virginia Office of Laboratory Services (WVOLS), and the Marshall University Forensic Science Center (MUFSC), collected adult mosquitoes for viral RNA testing. Viral RNA was isolated and detected by Nucleic Acid Sequence Based Amplification (NASBA) to ensure appropriate quality control measures necessary in microbial forensics applications.

West Nile Virus, TaqMan®, RNA

G55 An Instructional DVD on Collecting Entomological Evidence for Court

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After attending this presentation, attendees will learn that there is now available a training video on how to properly collect, preserve, and process entomological evidence for court. This training aid will benefit law enforcement agencies, death scene investigators, medical examiners, and forensic entomologists.

This presentation will impact the forensic community and/or humanity by standardizing the practices which are critical to the development of postmortem intervals and the utilization of insects as evidence during criminal investigations.

This DVD was created by forensic entomologists to fulfill the immediate need to standardize practices for collecting entomological evidence. The material is intended to instruct forensic investigators on how to collect specimen samples and field data in a way that will be scientifically valuable and credible in court. The DVD includes an overview of forensic entomology and the decomposition of an animal model has been time-lapsed to demonstrate the association of insects with various stages of decay. Insects commonly found with human remains are shown and factors that influence

insect activity and development are described. Crime scene photographs and video are used to aid in the recognition of what information should be collected during death investigations. A list of equipment needed to process entomological evidence is given, and the collection and preservation of insect specimens is clearly demonstrated in a step-by-step procedure. The main purpose of this DVD is to standardize the practices that are critical to the development of postmortem intervals, and demonstrate the utilization of insects as evidence during criminal investigations. The entire training video is 25 minutes; however, the multi-media format provides self-paced instruction and allows the viewer to select specific modules for quick referencing.

Forensic Entomology, Collection, Evidence

G56 How Cadaver Decomposition in Soil is Affected by Moisture: Part I: A Field Experiment to Investigate Seasonal Effects

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After attending this presentation, attendees will understand how the rate of cadaver decomposition in soils can differ according the soil texture and season of burial.

This presentation will impact the forensic community and/or humanity by demonstrating the influence of seasonal variation in moisture on decomposition processes associated with cadavers buried in soils of contrasting texture.

Soil moisture resulting from rainfall affects decomposition processes by directly influencing the activity of soil organisms and the leaching of soluble materials. The amount and distribution of moisture in association with an organic resource, such as a cadaver, is dependent upon precipitation, uptake by vegetation and losses via evapotranspiration and drainage. These factors are, in part, influenced by soil texture (which is defined by the soil particle size distribution). The predominance of large soil particles (sand) results in greater pore space (the area between soil particles) and increased rates of drainage and aeration. Thus, a soil that is dominated by small soil particles (clay) may be subject to waterlogging. The most accurate assessment of the availability and distribution of moisture is the measurement of matric potential (the pressure with which moisture is held between soil particles). This measure can be used to determine the ease with which soil microorganisms can take up moisture.

In order to investigate the effect of soil texture and seasonal moisture variation on cadaver decomposition, a field experiment was conducted at two disparate field sites. Site 1 comprised a sandy loam soil (84% sand, 11.1% silt, 4.9% clay) and was located in Yabulu, Queensland, Australia (19°12'S, 146°36'E). Site 1 receives an average rainfall of 995 mm during the wet season (November-April) and 140 mm during the dry season (March-October). The mean maximum/minimum temperature during the wet season is 30.5 °C/27°C. Dry season mean maximum/minimum temperature equals 22.9 °C/16.7°C. Site 2 comprised a loamy sand soil (97.7% sand, 1.3% silt, 1% clay) and was located in Pallarenda, Queensland, Australia (19°11'S, 146°46'E). On average, Site 2 receives 1005.1 mm rainfall during the wet season and 120.3 mm rainfall during the dry season. The mean maximum/minimum temperature during the wet season is 30.7 °C/23.1°C. Dry season mean maximum/minimum temperature equals 26.9 °C/16.4°C. The resulting vegetation at the two sites was dominated by grasses with scattered trees. These characteristics are typical of a savannah ecosystem. Cadavers (*Rattus rattus*: ~18 g) were buried at a depth of 2.5 cm. Each cadaver was located in the centre of a 2 m² plot. Cadaver mass loss, soil microbial activity and nutrient concentration was measured over a period of 28 days in order to determine if an increase in

soil moisture during the wet season would result in an increased rate of cadaver decomposition. This experiment was replicated six times and controls (soil without cadaver) were used.

The soil at Site 1 reached a matric potential of -0.03 megapascals (MPa) (equivalent to 15% moisture content v/v) during the wet season and was a constant -1.5 MPa (55% v/v) during the dry season. The soil at Site 2 reached a matric potential of -0.005 MPa (25% v/v) during the wet season and -1.5 MPa (3% v/v) during the dry season. All decomposition processes were greater during the wet season as demonstrated by the quantification of cadaver mass loss, microbial activity and nutrient concentration. This is most likely due to an increase in the activity of soil organisms and the leaching of soluble cadaveric materials as an effect of rainfall. Some differences were observed between soils within seasons.

Cadaver Decomposition, Soils, Seasonal Effects

G57 How Cadaver Decomposition in Soil is Affected by Moisture: Part II: A Controlled Laboratory Experiment

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After attending this presentation, attendees will understand the interaction between soil moisture and soil texture can have a significant effect on processes associated with cadaver decomposition in soils.

This presentation will impact the forensic community and/or humanity by demonstrating the influence of moisture on processes associated with cadaver decomposition in soils of contrasting texture.

Decomposition processes associated with an organic resource, such as a cadaver buried in soil, can be affected by the nature of the soil physico-chemical environment (e.g., soil texture, moisture status) and the activity of soil organisms. In a laboratory setting, matric potential (as defined in Part I) can be manipulated in order to test the effect of soil moisture status on decomposition processes associated with a cadaver buried in soil. Other measurements of soil moisture status, such as a simple gravimetric moisture content (g H₂O g⁻¹ dry soil) and the estimation of moisture content in relation to saturation or field capacity (% water holding capacity), do not provide an assessment of the availability of moisture to soil microorganisms. Hence, the calibration and maintenance of matric potential can be used to exclude the activity of larger organisms such as protozoa and nematodes. Peak soil microbial activity is typically associated with a matric potential of approximately -0.01 megapascals (MPa).

Soil from the sites described in Part I were sampled (0-10 cm depth) and sieved (2 mm) field fresh. The soil from Site 1 was a sandy loam soil. The soil from Site 2 was a loamy sand soil. Sieved soils (500 g) were weighed into sealable 2 L polyethylene incubation chambers and calibrated to a matric potential of -0.3 MPa (to simulate dry conditions) or -0.01 MPa (to simulate wet conditions). Following an equilibration period of seven days, juvenile cadavers (*Rattus rattus*: ~18 g) were buried at a depth of 2.5 cm and incubated at 22°C. Cadaver mass loss and soil microbial activity were measured over a period of 28 days in order to determine if an increase in soil moisture would result in an increased rate of cadaver decomposition. The present experiment also tested the hypothesis that burial in loamy sand soil will result in an increased rate of decomposition. This experiment was replicated 4 times and controls (soil without cadaver) were used.

In the sandy loam soil a matric potential of -0.3 MPa resulted in an increase in the rate of all decomposition processes. Conversely, increased decomposition was observed in the loamy sand soil calibrated to a matric potential of -0.01 MPa. Significant differences in the rate of decomposition processes were observed between soils of similar matric potential.

These contrasting results demonstrate that the rate of cadaver decomposition can be affected by an interaction between soil texture and moisture content. Reduced activity in the loamy sand calibrated to -0.3 MPa may be due to the inability of the soil microbiota to utilize the little water that is tightly bound between soil particles under dry conditions. Reduced activity in the sandy loam is likely due to a decreased diffusion coefficient of gases (e.g., O₂, CO₂) associated with an abundance of moisture and a high microbial demand for O₂ during the aerobic catabolism of an organic resource. These conditions may lead to anaerobiosis. Greater cadaver mass loss took place in the field experiment described in Part I. This phenomenon may be due to the presence of arthropods in a field setting. Unlike the findings from the field experiment in Part I, cadaver decomposition in soil from Site 1 decreased with an increase in moisture. This might indicate that the aerobic threshold for the sandy loam soil following cadaver burial is between -0.005 MPa and -0.001 MPa.

Cadaver Decomposition, Soil, Moisture

G58 Clinically Stable Skull Fracture and Fatal Acute Pneumonia: An Unexpected Combination

Christie L. Elliott, MD*, Forensic Pathology Consultants, PO Box 12815, Reno, NV 89510-2815

After attending this presentation, the forensic pathologist and treating clinician will be aware of an unexpected and rare complication of head injuries.

This presentation will impact the forensic community and/or humanity by educating the pathologist and the treating clinician about a rare but serious complication of clinically mild head injuries, and stimulating more studies in the area of possible treatments for this complication.

Aspiration pneumonia and acute meningitis are well-recognized complications in head-injured patients.¹⁻³ Most commonly, the pneumonia results from aspiration of gastric and oropharyngeal material into the lungs because of unconsciousness and/or altered gag and swallowing reflexes from the head injuries. Acute meningitis most often occurs in the presence of basilar skull fractures, which result in communication between the underlying sinuses and the CSF. Very little information is available in the medical literature addressing the issue of blood aspiration in head-injured patients, particularly those with maxillofacial injuries. The following case report will illustrate an unexpected complication of such an injury.

The patient was a 13-year-old female involved in a single car motor vehicle accident. She had epistaxis and abrasions and contusions of the face, but suffered no loss of consciousness or neurological symptoms. A CT scan showed non-displaced facial fractures, a small basilar skull fracture, and a right temporal cephalohematoma. She was admitted for observation and released the following day. Two days after discharge she returned to the emergency room with complaints of pain, dizziness, and weakness. Repeat CT scan of the head showed no acute changes. Chest x-ray was normal. She was afebrile, but mildly hypotensive (98/50) and tachycardic. This resolved with a fluid bolus. She was discharged home with pain medications. She was found semi-responsive the following morning and arrested shortly after. She was pronounced dead at the scene. An autopsy was performed the following day.

The postmortem examination revealed a normally developed adolescent female with soft tissue swelling and resolving contusions and abrasions of the face. Reflection of the scalp showed purulence of the right temporal soft tissues. Pertinent intracranial findings included hairline skull fractures across the orbital and ethmoid plates and the anterolateral left petrous ridge up into the left temporal bone. Grossly, the lungs were heavy, mottled red/tan, and slightly firm and edematous. Microscopic examination showed acute pneumonia, edema, and frank blood within the alveolar spaces. Cultures of lung tissue, CSF, and right temporal soft tissue were

positive for β-hemolytic Group A Streptococcus. The final autopsy diagnosis was acute bacterial pneumonia due to blood aspiration from blunt force craniocerebral injuries. The facial sinuses were thought to be the source of infection.

Review of the literature reveals no data or case reports specifically addressing the issue of blood aspiration and pneumonia in the head-injured patient, though several studies address the increased risk of pneumonia, and one explores the increased risk of pneumonia in head-injured patients who were carriers of *Staphylococcus aureus*.^{4,5} The method of inoculation was felt to be aspiration at the time of injury and/or from intubation. The patients in this and other studies suffered from severe head injuries and had been intubated, some requiring prolonged ventilator support. This case differs, in that the head injury was not severe. The patient experienced no loss of consciousness, neurological symptoms, or airway compromise. No information was found regarding studies of the use of prophylactic antibiotics in this patient population. Prior to this case, the standard of care at the treating medical center for patients with clinically stable maxillofacial and skull fractures did not include prophylactic antibiotic therapy. This case suggests that further study in this area is warranted.

¹Marion, DW. Complications of head injury and their therapy. *Neurosurgery Clinics of North America* 2:April 1991, 411-24.

²Severyn FA, Fenn J. Overwhelming S. pneumonia meningitis after basilar skull fracture: A Case Report. *Air Medical Journal* 19:3, 2000, 102-4.

³Kingsland RC, Guss DA. *Actinobacillus urea* meningitis: Case report and review of the literature. *The Journal of Emergency Medicine* 13:5:1995, 623-627.

⁴Campbell W, Hendrix E, Schwalbe R, et.al. Head-injured patients who are nasal carriers of *Staphylococcus aureus* are at high risk for *Staphylococcus aureus* pneumonia. *Critical Care Medicine* 27:4:1999, 798-801.

⁵Bronchard R, Albaladejo P, Brezac G, et.al. Early onset pneumonia: Risk factors and consequences in head trauma patients. *Anesthesiology* 100:2004, 234-9.

Skull Fractures, Pneumonia, Head Injuries

G59 The Dangers of Dumpster Diving: Deaths Associated With Garbage Collection in the Tidewater Region of Virginia

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After attending this presentation, attendees will be able to recognize characteristics of crush and asphyxial injury inflicted by garbage collection machinery on persons within dumpsters. Pertinent considerations in such deaths of the contribution of toxicology, natural disease, and history, and the effect on diagnosis of antemortem from frequently seen decomposition artifact will be reviewed. Public policy consequences of such deaths will also be briefly reviewed.

This presentation will impact the forensic community and/or humanity by reviewing an unusual but recurring situation in which homeless persons or others are crushed to death in garbage dumpsters. The presentation reviews, autopsy findings, mechanism of death, and role of artifacts of decomposition in determining cause of death.

Four cases accumulated over an 11 year period illustrate an infrequent, but recurring, danger for poor or homeless persons, who die during garbage collection.

In 1993, the fully clothed body of a 51-year-old man was found by employees of a sewage and trash processing plant when a garbage truck dumped out the trash collected from a dumpster in Norfolk, Virginia. At initial examination on scene, a gaping laceration was evident in the lower

abdomen, with exposed bladder wall. At autopsy, diffuse changes of decomposition did not obscure extensive crush injury, including cervical spine, femur, and iliosacral fractures, fragmentation of the liver, diaphragmatic rent with traumatic herniation of the stomach into the chest, and a ruptured ileocecal junction. These injuries were consistent with death during trash compaction.

The decedent proved to be a homeless man with a history of heavy alcohol intake, last seen by his family two to three days before his body was found. Although investigation never proved what he was doing in the dumpster, it was possible that he was either looking for recyclable items, or may have fallen asleep there. Toxicology showed ethanol at 0.15 mg %.

In October of 1994, the body of a 48-year-old woman was found in the Hampton, Virginia landfill. At external examination, there were multiple abrasions and contusions, with areas of confluent contusion; the face was suffused, with dark purple contusions of the lips, and surrounding both orbits. At autopsy, there was severe crush injury, with fracture, dislocation, and transection of the cervical spine at both C1 and C7, and bilateral rib fractures with flail chest. There was also a healed myocardial infarct. She proved to be a vagrant from the neighboring city of Virginia Beach, with a history of diabetes and psychiatric problems, who was known to go through trash depots looking for salvageable materials. Toxicology showed a high but not lethal level of carbamazepine, with butalbital and oxazepam. It appeared that she might have climbed into a dumpster, collapsed from the toxic effects of her drugs or from a cardiac event, was later picked up by the trash-compacting truck, and was then crushed.

In November of 1994, the body of a 37-year-old man was found after a non-compacting trash truck dumped out its load at a sewage and trash processing plant. He did not have any crush injuries. Autopsy showed diffuse bilateral scleral and conjunctival hemorrhages, purple suffusion of the face, marked edema of the face and lips, epiglottal petechiae, contusions of the neck structure, and further contusions of the chest and back. Death was ascribed to traumatic asphyxia, which he would have sustained when tons of trash were placed over his body. Toxicology showed numerous toluene derivatives. Although investigation did not show how he entered the dumpster, he may have been seeking a place to inhale glue vapors, and could have been overcome by the drug.

In 2004, the crushed and decomposing body of a 60-year-old homeless man was found at a dump site near housing debris. Autopsy was able to show, despite extensive decomposition, that crush injuries had occurred antemortem. He had been known to sleep in an abandoned house that was demolished six days previously. Public reaction to the death caused re-evaluation of housing demolition policies.

This discussion will review the mechanism of death, immediate and underlying causes of death, contribution of natural disease and toxicology, and obstacles to determination of cause produced by decomposition, for persons dying in trash compactors. Review of these cases may heighten awareness of the dangers encountered by homeless persons foraging in dumpsters.

Garbage Dumpsters, Crush Injury, Traumatic Asphyxia

G60 The Differential Diagnosis Between Bioterrorism and Zoonosis and Spread to Humans: A Pathological Evaluation

Maurice Rogev, MD, Zamenhof 11, Tel Aviv 64373, Israel*

After attending this presentation, attendees will understand how recent episodes of international unrest have raised the danger of the use of "weaponized microbiological organisms" in terror attacks. At the same time, the ever present danger of the transmission of diseases from either domestic animals or from those who live in natural surroundings creates serious differential diagnostic issues. This presentation will outline an approach to the identification of the infecting microorganism and etiology that the forensic practitioner will be expected to make.

This presentation will impact the forensic community and/or humanity by assisting the medicolegal experts in learning how to identify terrorist attacks using micro-organisms that are naturally present in animals and can infect humans. These organisms having undergone weaponization.

Recent episodes of international unrest raised the danger of the use of "weaponized microbiological organisms" in terror attacks. At the same time, the ever-present danger of the transmission of diseases from either domestic animals or from those who live in natural surroundings creates serious differential diagnostic issues. This presentation will outline an approach to the identification of the infecting microorganism and etiology that the forensic practitioner will be expected to make.

Differential Diagnosis, Zoonoses Terror Exposure, Human Infection

G61 Suicides Among Youth in Geneva, Switzerland From 1993 to 2002

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After attending this presentation, attendees will understand the importance of knowing the circumstances of deaths in suicides among youth to help clinicians in their work in youth suicide prevention programs. The effort should be made to collect clinical data during medicolegal investigations.

This presentation will impact the forensic community and/or humanity by demonstrating how suicides among youth are such a tragic event, and that it is sometimes difficult to collect complete clinical information or do a full medicolegal investigation. Sparing the family from too many questions might be one of the reasons. In Geneva, Switzerland, lack of crucial information for clinicians who work to prevent suicides among youth is often observed. This study may help to create a close collaboration between suicides prevention programs and forensic medicine.

In Switzerland, suicides represent the leading cause of death in the age group 20 to 24 years, and the second most common cause of death in the 15 to 19 year age range. During the 1990s, the number of suicides in those age groups has remained stable, and has even decreased in Geneva between 1975 and 1996. The aim of this study was to look whether this tendency persisted during the years from 1993 to 2003. The authors analyzed all cases of suicide among youth less than 25 years of age in Geneva during this period. Suicide was defined through police and medicolegal investigations. Sixty-five suicides were found involving 50 male (77%) and 15 female (23%) victims. The minimum age was 12 years, and most of the victims were 18 years old or older (89%). No increase in the number of suicides throughout the years was found in the range being between 1 and 11 cases per year. For males, use of firearms was the most common method (38%), followed by fall from height (30%), hanging (16%), and drowning (10%). For females, fall from height was the most frequent (40%), followed by use of firearms and medication overdose (20% each), hanging (13%), and drowning (7%). Only 43% of the cases had toxicological testing, and the main drugs found were benzodiazepines, cannabis and cocaine. Blood alcohol concentration was analyzed in 53% of all deaths. Among them, 32% tested positive, half of them with a concentration below 52.5 mg/dL. Clinical data in medical charts were often incomplete, lacking in more than 70% of the cases. Although this study has brought very useful information about the circumstances of death, helping to better characterize suicide in youth, in Geneva, an effort should be made to collect more clinical data during medicolegal investigations. These data would be of help to clinicians who work in youth suicide prevention programs.

Suicides, Youth, Epidemiology

G62 Suffocation by Mistaken Use of a Biohazard Hood as a “Spit” Hood

K. Alan Stormo, MD*, Jeffrey M. Jentzen, MD, Mary K. Mainland, MD, John R. Teggatz, MD, and Victor V. Frolov, MD, Milwaukee County Medical Examiner, 933 West Highland Avenue, Milwaukee, WI 53233

The goal of this presentation is to document a case of mistaken use of a biohazard hood as a spit hood resulting in suffocation, and show resulting experimental re-enactment of such use including time and oxygen studies.

This presentation will impact the forensic community and/or humanity by demonstrating the danger of the improper use of the device, and by presenting data related to time necessary to become severely compromised by improper use.

A 20-year-old male was found to be in possession of drug paraphernalia and was arrested. While being transported to the police station he became belligerent, combative, and attempted to spit on the transporting officer. He was restrained with a car seatbelt with his hands cuffed behind him; a biohazard hood was placed over his head to contain the spitting. On arrival at the police department 8-10 minutes later he was found unresponsive; resuscitation was unsuccessful and he was pronounced dead in the local hospital ER.

The Quick 2000 is a widely available biohazard escape hood, which has a nose clip, a mouthpiece for breathing and a tight neck dam. Breathing into the mask without use of the mouthpiece rapidly depletes the oxygen and increases CO₂. Informal experiments demonstrate severe air hunger in two to two and one-half minutes if the mouthpiece is not used. Data from more formal experiments with oxygen and CO₂ studies will be presented.

Asphyxia, Suffocation, Biohazard Hood

G63 Unsuspected Pheochromocytoma Discovered During Autopsy After Sudden and Unexpected Death in an Expectant Mother

Sophie Gromb, PhD*, Nadia Khaldi, MD, Larbi Benali, MD, Mathurin Djodjo, MD, and Alain Miras, PhD, Department of Forensic Medicine - EA 3676 - IFR 99 of Public Health, CHU Pellegrin - Place Amélie Rabéon, Bordeaux, 33076, France

The goal of this presentation is to present a case report of sudden death due to pheochromocytoma (PC), and emphasize the necessity of complete autopsy and histological analysis in different tissues in which metastases can develop.

This presentation will impact the forensic community and/or humanity by showing the necessity to perform an autopsy in every case of sudden death in order to determine the cause of death for medical (responsibility), psychological (family), and epidemiological reasons (prevention of disease in the other members of the family); and demonstrating the importance of a complete autopsy and the necessity of histological analysis.

Case Report: An autopsy case of a PC in a 42-year-old asymptomatic and expectant mother is reported, without previously suspected PC. She was pregnant (her last period was 34 weeks ago), and had appointments with her obstetrician regularly. Her last visit to a doctor was 15 days before death, and all had been found normal. She didn't have abdominal pain or hypertension. Several days before death, she suffered asthenia, dyspnea, and chest pain. One morning, during a walk, she felt faint without other symptoms (nausea, vomiting, etc.), and this occurred again several minutes later. A loss of consciousness occurred and, in spite of the intervention of intensive care for more than one hour, she died in heart failure and cardiogenic shock.

Autopsy demonstrated rib fractures consistent with CPR, a normal thyroid gland, gastritis, polyvisceral edema, very intensive pulmonary edema, an enlarged heart, normal coronary arteries, no intravascular coagulation (pulmonary or other), brain edema, and a tumor in the left adrenal gland (60 g). The fetus and uterus were normal. Histological examination confirmed the adrenal tumor was a pheochromocytoma. Toxicology studies were negative.

Discussion : Adrenal PC is usually a benign catecholamine-producing tumor (90%) of the sympathetic nervous system. The incidence is 0.05% in all autopsies (McNeil *et al.*, 2000) and sudden death occurred in 8.9% of the cases (Casanova *et al.*, 1993). The PC is bilateral in 50.5% of cases and left in 63.5%. The diagnosis is difficult because, generally, PCs develop for a long time with non specific symptoms (or without classical constitutional symptoms), until explosive syndromes appear, related to catecholamine excess, with severe hypertension, acute pancreatitis, hyperacute myocardial ischemia, cerebral hemorrhage, cardiogenic shock, congestive heart failure, and sudden death. Sudden death is the only sign in 1.5% of cases. Several diagnostic methods are available to increase the detection and the diagnosis (meta- and normetanephrine in urine is one of the best sensitive screening tests; abdominal MRI - scintigraphy with meta-iodo-benzyl-guanidine for visualization). It is important to note that the heart weight is increased in 95% of the patients.

Conclusion: Diagnosis is often difficult, and many PCs are not recognized during life. Clinicians should be aware of the symptoms of PC, as early diagnosis is very important in order to perform a laparoscopic adrenalectomy. In addition, some symptoms are the same as acute drug intoxication. PCs are usually curable if diagnosed and treated properly, and, in certain cases, this diagnosis necessitates prompt surgical intervention.

During autopsy, certain tumors are observed with increased frequency in patients with PC, including thyroid carcinoma, liver tumor, prostate carcinoma, malignant melanoma, carcinoma of the uterine cervix, and breast carcinoma.

Pheochromocytoma, Sudden Death, Autopsy

G64 Modeling Languages in Forensic Pathology

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After attending this presentation, attendees will understand the importance and utility of modern modeling computer techniques in forensic pathology from Microsoft Word® (MS Word), to Microsoft Visio® (MS Visio), to Universal Modeling Language Two (UML2).

This presentation will impact the forensic community and/or humanity by demonstrating the importance and utility of modeling to solving forensic pathology problems.

In forensic informatics, modeling is an underemployed but important computer technique. Models illustrate concepts, analyze processes and relationships, and communicate with efficiency and clarity. Models show the first definitions of processes at their inception; they precede the formal formulation of the computer application. Current computer applications in MS Word®, MS Visio®, and UML2 may be used by forensic scientists to compose models; however, increasing specificity and precision require more study and attention as the applications mature and enlarge.

Models provide computer programmers with the initial structure of their applications; models also work to provide scientists their first formulations of the details of their work. Models act to provide actual representations of concepts and ideas. Referral by scientists to the available models allows the definition of objects and relationships valuable to extension of their thoughts. Such models teach, communicate, illustrate, standardize, lead thinking, require attention, precede other actions, require syntax, provide transmission and transfer, and act to standardize operations. The models by structural and behavioral analysis are classified as class

diagrams, package diagrams, object diagrams, use case diagrams, sequence diagrams, collaboration diagrams, state charts, activity diagrams, power diagrams, component diagrams, deployment diagrams, engineering diagrams, flow charts, and brainstorming diagrams.

Current applications providing computer modeling activities have been under formal development by computer scientists for over thirty years and are in their third generation of development. Forensic scientists find modeling possible with the word processing application MS Word®, and MS Visio® which is evolving into a more complex, capable and inexpensive modeling tool. The more advanced UML2 applications have the capacity to create and manage large models over the expanse of large organizations and corporations with the precision and accuracy needed in sophisticated scientific activities. Many commercial scientific modeling applications are available; however, to date no formal set of forensic symbols or diagrams are recognized or developed.

Little formal recognition has been given to modeling in the forensic or pathology literature so that the complexities, multiplicities, and composites inherent in the data often are either ignored or not represented.

Forensic models are limited in number and are without the standardization found in UML2. Note that the development of models is not easy work and requires analytic time and clear conceptualization of ideas. Modeling is blocked by poor definitions and is inefficient when topics are diffuse and poorly understood.

Demonstrations of functional models in forensic scene investigation and forensic pathology are presented.

Forensic Informatics, Modeling Languages, Forensic Death Investigation

G65 Polyarteritis Nodosa as a Rare Case of Sudden Death in Postmortem Diagnosis

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After attending this presentation, attendees will understand that, in the correct setting, among the common natural disease causes of sudden death of forensic importance, sometimes very rare diagnoses must be considered. In these cases, systemic vasculitis and systemic autoimmune diseases may play a role. To detect these rare diseases as causes of death, classic histology may need to be supplemented by immunohistochemical and serological examination of tissues and other samples.

This presentation will impact the forensic community by demonstrating the first reported case of polyarteritis nodosa playing a role within the context of a sudden unexpected death.

Worldwide, most unexpected sudden deaths of forensic interest by natural causes are due to cardiovascular diseases. In these cases, acute myocardial infarction and arteriosclerosis of the coronary arteries are the leading entities. In contrast to this, sudden deaths due to vasculitis are a rarity. Polyarteritis nodosa occurs three times more often in men than in women. The diagnosis of the disease is often incorrect.

A 21-year-old female student from Sweden came to Munich after vacationing in Greece with her parents. She was previously healthy, apart from a cold with fever a few weeks before her holidays which was treated with antibiotics. In Greece she complained of having back pain located near the right kidney and at a disco at Munich she got dizzy and collapsed. The day after, she became increasingly short of breath. In the afternoon she was found lifeless in the apartment of a friend with blood around her nose and mouth. She was brought into a hospital immediately.

She remained unconscious and was diagnosed with hypoxic edema of the brain. The initial presumption of drug intoxication was disproved by toxicological analysis.

She died with unclear symptoms three days after her collapse. As cause of death, the physicians of the hospital signed "Lung failure in pneumonia," as they suspected an atypical infection of the lungs.

The autopsy showed hemorrhagic lung edema. Weights of the lungs were: right 1085 g, left 1040 g. There was abundant bloody mucus in the respiratory passages, with some coagulated blood in the bronchi. Cultures of tracheal secretions were negative.

The histological examination revealed an intra- and extra capillary proliferative glomerulonephritis with crescents and focal segmental necrosis of the glomerular loops consistent with rapidly progressive glomerulonephritis. The lungs showed siderophages indicating older bleeding in addition to the fresh bleeding.

The clinical, laboratory and autopsy findings suggested either Wegener's disease or microscopic polyarteritis nodosa. The diagnosis was made by analysis of autoantibodies; the lack of cANCA indicated the diagnosis polyarteritis nodosa. The differential diagnosis will be critically discussed.

This may be the first reported case of polyarteritis nodosa playing a role within the context of a sudden unexpected death.

Polyarteritis nodosa, Sudden Unexpected Death, Immunohistochemistry

G66 Autopsy Findings in Hypothermia: A Five Year Retrospective Study

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After attending this presentation, attendees will understand the anatomic, toxicological, and investigatory findings associated with hypothermia deaths during the past five years in Maryland.

This presentation will impact the forensic community and/or humanity by providing information on the findings associated with hypothermia deaths with special emphasis on the gross autopsy findings.

To date, there are no recognized pathognomonic findings in hypothermia-associated deaths. Certain findings have been seen in greater frequency in hypothermia. These include paradoxical undressing, gastric mucosal ulcers, hemorrhagic pancreatitis, and pulmonary edema. It has been suggested that gastric ulcers and pancreatic changes are seen more frequently following resuscitation. Paradoxical undressing occurs when the body temperature is low, presumably causing mental confusion, possibly giving the sensation of extreme warmth, and leading to the removal of one's clothing. This confusion may also lead to a characteristic pattern of bruising on the extremities (elbows, wrists, hands, knees) as one wanders about in a confused state.

This poster will present the findings from a retrospective review of 145 cases investigated by the Office of the Chief Medical Examiner for the state of Maryland during the years 1999-2003, in which hypothermia was the cause of death or a contributory cause of death. The cases were assessed for association with drowning, natural disease, ethanol and drug intoxication, appearance of gastric ulcers, gross hemorrhagic changes of the pancreas, combined lung weights, evidence of paradoxical undressing, and contusions of the extremities.

Of the 145 cases, 19 were not included due to incomplete available data. Of the remaining 126 cases, 13 (9.7%) were associated with drowning. Only one of the drowning cases showed evidence of gastric ulcers. None had pancreatic changes. As expected, average combined lung weight was increased at 1067 grams (range 410-2310). Five of the 13 (38.5%) had ethanol levels over 0.08 g/dL. Drug intoxication was not noted in any of the drowning cases. Natural disease contributed in one case. Paradoxical undressing and contusion patterns on the extremities were not observed in the drowning cases.

Of the remaining 113 non-drowning cases in which full autopsy examinations had been performed, 83 (73.5%) were male with an average age of 56 years (range 19-91). Natural diseases such as cardiovascular disease, acetonemia, and dementia were associated with 59 (52.2%) of cases. Ethanol levels were over 0.08 g/dL in 33 (29.2%) cases. In 17 (15%) cases, drug intoxication contributed to death. Drugs involved included morphine, cocaine, methadone, meperidine, trazadone, oxycodone and acetaminophen.

Stomach ulcers were seen in 39 (34.5%) of the cases. Of these 39, 11 (28.2%) had been resuscitated. Sixteen (14%) of the 113 cases had gross visible changes in the pancreas. Of these 16, 5 (31.3%) had been resuscitated. Resuscitation occurred in 14 (12.4%) of the 113 cases in which no changes in the pancreas or stomach were noted. The average combined lung weight was 1050 grams, with a range of 400 to 2710 grams.

Paradoxical undressing occurred in 6 cases, with an additional 8 more potential cases (combined 12%). Pink-brown bruising was noted on the upper extremities in 24 (21%) cases and on the lower extremities in 25 (22%) cases. The contusions were often on the elbows, posterior wrists, the backs of the hands, and knees. Of the 14 total cases of potential paradoxical undressing, only 4 were associated with these contusions. Therefore, this pattern of bruising may represent a different type of confusional state possibly different than the thermoregulatory disturbances.

Hypothermia as a cause of death can only be determined through thorough investigation, as there are no autopsy findings which are noted in all cases. However, this study does provide further confidence in the diagnosis with the presence of other findings. The gastric ulcers were the most frequently associated finding. The contusions on the upper extremities and lower extremities, especially on the posterior surfaces of the arms, wrists and hands, are the next most common findings. Gross changes of the pancreas, visible as hemorrhage, were also noted, but less frequently. The pulmonary edema was difficult to assess as many of the hypothermia cases also had heart disease and drug and alcohol intoxication contributing to the cause of death. Paradoxical undressing, while uncommon, remains a real phenomenon that is potentially confused with criminal acts.

Hypothermia, Paradoxical Undressing, Gastric Ulcers

G67 Color Me Guilty: The Role of Paint Transfer in Weapon Linkage

Diane Scala-Barnett, MD, and Julie M. Saul, BA, Lucas County Coroner's Office, 2595 Arlington Avenue, Toledo, OH 43614-2674*

After attending this presentation, attendees will be alerted to examine for the presence of paint transfer onto bone as a means of weapon linkage, and be prepared to modify their specimen preparation techniques accordingly.

This presentation will impact the forensic community and/or humanity by demonstrating how paint transfer is commonly used for forensic linkage in vehicle related cases, although it may be overlooked in analyzing bone trauma.

Transfer evidence can be an important part of an investigation. Transfer evidence may relate to transfer of blood from one object to another, often leaving a distinctive contact transfer pattern that may be linked to a specific weapon.

Paint transfer also yields valuable information. Paint transfer usually relates to paint chips/fragments transferred from one vehicle to another (or onto a victim or structure) during a collision. This information aids in identifying a vehicle model and year based on analysis of the paint. It may even identify a specific vehicle.

Hair and fibers are transferred from one person or place to another – evidence of contact. DNA is transferred from a person to an object or another person. Fingerprints are transferred from one individual to another individual or an object.

Two cases will be presented involving paint transfer onto human bone through blunt force: in one case blue paint from a baseball bat and in the other the black surface (under flaking paint) of an old metal railing. Both cases involve severe blunt force trauma to the head. This is a phenomenon that had not been noted previously.

Case 1: In 1995 a 65-year-old male was found dead, the victim of a severe beating by an assailant who "came in like a raging bull with a baseball bat" (according to the Detective). At autopsy, Diane Scala-Barnett, MD, Deputy Coroner of Lucas County, Ohio, requested that Julie Saul, Director of the Forensic Anthropology Laboratory in that office, reconstruct the fragmented skull and determine what could be learned from the resulting fracture pattern. Blue paint chips and wood splinters were found in the soft tissue at wound edges of the mouth and scalp.

Traces of blue paint were noted on a few small fragments; therefore, initial cleaning was accomplished using only warm water in order to preserve pigment. Ultimately, five fragments were found to have blue paint embedded in the surface. Other bone fragments were cleaned and degreased using normal procedures.

Thirty-six fragments were reassembled. The fracture pattern indicated that the skull had been shattered with one blow, probably administered while the right side of the victim's head was against a hard surface – likely to be the floor. This was confirmed by bloodstain evidence at the scene.

The five bone fragments with embedded blue paint lined up together at one edge of the single impact area, located approximately on the left parietal eminence. The force of the blow at that point had driven blue paint from the baseball bat into the fracture edges.

Case 2: In 2004 a 40-year-old woman was found dead of severe blunt force injuries to the head. At autopsy, several distinctive patterned scalp lacerations were noted, along with bruises on the neck, face, chest and abdomen. A bitmark was present on the left breast. Retraction of the scalp revealed distinctive patterns on the skull beneath the scalp lacerations. These contact transfer patterns (not fractures) were formed by embedded black pigment, and corresponded well to the overlying scalp lacerations.

In this case, the instrument was not a broad, smooth object such as the baseball bat used in the earlier case, but a portion of an old iron fence railing with shapes that corresponded to both the lacerations and pigment contact transfer patterns.

In both cases, transfer of color (and/or pattern) onto cranial bone through blunt force yielded valuable information regarding the instrument used.

Although paint transfer is commonly used for forensic linkage in vehicle related cases, it may be overlooked in analyzing bone trauma.

Blunt Force, Paint Transfer, Trace Evidence

G68 The Role of Forensic Insects in Deposition of Pollen at a Death Scene

Rebecca J. Kirby, Anita L. Guedea, Phillip L. Watson, PhD, Roger E. Mitchell, PhD, and Scott M. Herron, PhD, Ferris State University, Department of Biology, Big Rapids, MI 49307*

The goal of this presentation is to investigate the importance of pollen transfer by insect visitors to a death scene.

This presentation will impact the forensic community and/or humanity by demonstrating the effect, if any, of forensically important insects on the deposition of both anemophilous and zoogamous pollen at a death scene. The importance of the findings could be critical in showing whether pollen evidence is subject to the uncertainty of insect visitors at a crime scene.

This poster will present the evidence of pollen deposition at mock crime death scenes with and without insect involvement. Pollen can be transferred to the death scene by wind (anemophilous) and by animals (zoogamous), particularly insects. It was the original purpose of the experiment to document the normal pollen assemblage in mock crime

scenes. This pollen assemblage at these mock crime studies was compared with the resident pollen on the pigs which were not local.

For over five years, one of the courses in the forensic biology program at Ferris State University has used pigs in a mock crime setting to teach students techniques associated with death scenes, including forensic entomology, botany, and anthropology. These mock crime settings are done under strict animal rights protocols. During these mock crime scenes, pollen collections have been done for baseline data on the pollen assemblages found during different times of the year.

In a series of insect inclusion and exclusion experiments, the pollen assemblages were collected at the mock crime scene. The original question attempting to be answered was the effect, if any, of the insects visiting the mock crime scene and deposition of both anemophilous and zoogamous pollen. The importance of the finding could be critical in showing whether pollen evidence is local or is subject to the uncertainty of insect visitors at a crime scene.

Insect, Pollen, Palynology

G69 Experimental Evaluation of Rigor Mortis - The Influence of the Central Nervous System on the Evolution of the Intensity of Rigor Mortis

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The goal of this presentation is to present the development of the intensity of rigor mortis after the disconnection of different parts of the central nervous system.

This presentation will impact the forensic community and/or humanity by providing a better understanding of the development of rigor mortis under different conditions.

In 1811, the French physician and chemist P. H. Nysten published the first scientific description of rigor mortis. The law named after him states that "Cadaveric rigidity affects successively the masticatory muscles, those of the face and the neck, those of the trunk and arms and finally those of the lower limbs." It is often added that resolution occurs in the same order. The development of rigor mortis is thus descending, a finding thought to be related to the varying distances between the different muscles and the central nervous system. However, Nysten himself noticed that the destruction of the CNS did not affect the order of the development of rigidity.

In 1904, Fuchs described the brain as the initial site of death, followed by the proximal part of the spinal cord, and suggested that the process then progressed towards the caudal spinal cord: the presumed impulsions influencing the development of rigor mortis arose from catabolic changes in the nerve cells.

In 1819, Busch observed that the removal of the brain and spinal cord resulted in an early onset of rigidity; moreover, rigidity was more pronounced and lasted longer.

In experiments conducted on animals, Eiselberg (1881) demonstrated that when the sciatic nerve was sectioned on one side, in over 70% of cases rigidity developed later than on the contralateral side.

Gendre (1885) and Aust (1886) confirmed this finding. Aust, in particular, obtained this result in 12 out of a total of 13 experiments. Having conducted *in vivo* sectioning of the left side of the spinal cord in rabbits (underneath the pyramidal crossing), Bierfreund (1888) made the following statement: "I was very surprised to find that after a few hours following death, the right half of the body became very rigid, while the left half remained almost normally mobilisable." Bierfreund thought that the "accelerating" effect of the central nervous system on the appearance of

cadaveric rigidity was the result of a weak excitation of the muscular system, and if this excitation really did exist, it was too weak to cause a visible contraction. To prove this hypothesis, Bierfreund conducted animal experiments that involved weak irritation by the sciatic nerve. The results were the very opposite of what he had hoped for.

The experimental results described above and some others are partially contradictory. Therefore, it remains unclear what role the nervous system may play in the development of cadaveric rigidity.

Some years ago, a method to increase understanding of rigor mortis through the objective measurement of the intensity of cadaveric rigidity in rats was developed. The principle of the method is to determine the force required to cause a movement of small amplitude (4 mm) in the limb under examination. Since the movement doesn't break rigor mortis, serial measurements can be conducted. The apparatus used measures the resistance caused by rigor mortis in the knee and hip joints of rats. This method has been used in the past to evaluate the influence of several pre-mortem and postmortem factors (i.e., body weight, muscular mass, age, physical exercise, ambient temperature, various causes of death, electrocution) on the development of rigor mortis.

In present investigations, experiments are performed that at least partially clarifies the influence of the central nervous system on the development of rigor mortis.

Experimentation: Animals: male albino rats, weighing approx. 300 g.

Measurement time points: 10 min, 1h, 2h, 3h, 4h, 5h, 6h, 8h, 12h, 16h, and 24h postmortem.

Measurements were made on the hind limbs of the animals.

Group N°1: control

Group N°2: medulla oblongata section

Group N°3: destruction of spinal chord with a needle introduced in the spinal canal

Group N°4: sciatic nerve section

Results: No significant difference was found in the development of the intensity of rigor mortis among the four groups.

Conclusion: In "normal" conditions, the central nervous system has no significant influence on the intensity or on the time course of the rigor mortis. These experiments do not exclude the possibility of the influence of the CNS on the development of cadaveric rigidity in some pathological conditions.

Rigor Mortis, Central Nervous System, Rats

G70 β -Phenylethylamine as a Biomarker in Mechanical Asphyxia-Related Fatalities

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The goal of this presentation is to establish β -Phenylethylamine (PEA) as a biomarker of asphyxia during medicolegal investigation by characterizing the rate-limited step of oxygen-dependent monoamine oxidase B (MAOB).

This presentation will impact the forensic community and/or humanity by showing how the elevation of PEA concentration in blood may play a crucial role in asphyxia-related fatalities. A PEA blood level higher than 2.7 μ g/ml can play a diagnostic role in the determination of asphyxia during the medicolegal investigation. An endogenous substance, PEA allows forensic scientists to develop a state-of-the-art biomarker using the rate-limiting step of MAOB to specify the cause of death in asphyxia.

Identification of asphyxia depends on various non-specific parameters in forensic medicine, such as signs of petechial hemorrhages, cyanosis, engorgement of right heart chambers, lung congestion, and a variety of signs in mechanical asphyxia. The cause of death in asphyxia depends on the history and the exclusion of other causes. It is imperative to develop a quantitative and specific biomarker to interpret the scientific evidence and to ensure a precise diagnosis of asphyxia during the medicolegal investigation. PEA, a specific substrate of MAOB, is a biogenic amine and acts as a sympathomimetic amine through its release of dopamine. The rate-limiting step of the MAOB activity of monoamine deamination is a highly oxygen-dependent phenomenon. The hypothesis is that reduction of the activity of MAOB during the hypoxic status could cause an accumulation of PEA in human body fluids.

A retrospective study consisted of forty-one cases of mechanical asphyxia and thirty-seven cases unrelated to asphyxia that were collected from the Institute of Forensic Medicine, Ministry of Justice, during medicolegal investigation in Taiwan. There were sixteen strangulation fatalities where the causes of death were by manual strangulation (hand or ligature) or hanging. In twenty-five cases of suffocation with mostly choking on food, fixing a pad or gag over the face, and drowning were concluded to be the causes of death. The control group of fatalities unrelated to asphyxia included sudden death by cardiac failure, gunshot injury, violence, and traffic and falling accidents. *In vitro* study in human platelets and *in vivo* animal models in rats were used to monitor the PEA alteration during the hypoxic status. Gas chromatography/mass spectrometry was performed to determine the PEA concentrations of each forensic fatality's body fluids and of each animal specimen.

The PEA blood concentrations of strangulation, suffocation and control cases were $34.2 \pm 7.7 \mu\text{g/ml}$ (mean \pm SEM, n=16), $33.0 \pm 6.7 \mu\text{g/ml}$ (n=25) and $0.16 \pm 0.03 \mu\text{g/ml}$ (n=37), respectively. The PEA blood levels of asphyxia-related fatalities were significantly higher than those of control cases ($p<0.005$). There was no difference in PEA blood levels between suffocation and strangulation cases. The PEA urine concentrations of strangulation, suffocation and control cases were $1.5 \pm 1.1 \mu\text{g/ml}$ (n=8), $0.3 \pm 0.2 \mu\text{g/ml}$ (n=9) and $0.2 \pm 0.1 \mu\text{g/ml}$ (n=12), respectively. The PEA gastric content concentrations in strangulation, suffocation and control cases ranged from 0.03 to $124.1 \mu\text{g/ml}$ with no statistical difference between asphyxia and control group. The postmortem interval for the asphyxia and control groups was 4.3 ± 0.8 days and 5.0 ± 1.0 days, respectively. The PEA profile was not affected by postmortem alteration up to 13 days. Decreasing oxidative activity of MAOB and accumulation of PEA are observed during a hypoxic status in human platelets. An animal model to induce a hypoxic status in rats resulted in elevation of PEA blood levels up to two to four times the control value.

In conclusion, elevation of PEA concentration in blood may play a crucial role in asphyxia-related fatalities. The PEA blood level higher than $2.7 \mu\text{g/ml}$ can play a diagnostic role in determining asphyxia during the medicolegal investigation. An endogenous substance, PEA allows forensic scientists to develop a state-of-the-art biomarker using the rate-limiting step of MAOB to specify the cause of death in asphyxia.

β -Phenylethylamine, Asphyxia, Strangulation

G71 Forensic Pathologists and the NICHD Brain and Tissue Bank for Developmental Disorders

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After attending this presentation, attendees will be able to recognize the significant contribution of forensic pathologists to medical research by

support of the activities of the NICHD Brain and Tissue Bank for Developmental Disorders.

This presentation will impact the forensic community and/or humanity by showing the significant contribution of forensic pathologists to medical research involving the use of postmortem human tissues.

Medical developments have increased the use of human tissues, especially for research purposes. The National Institute of Child Health and Human Development (NICHD), in 1991, established a Brain and Tissue Bank at the University of Maryland with a collaborating retrieval site at the University of Miami. Establishment of the Bank was in response to requests by family support groups for increased research on developmental disorders affecting children and young adults.

The Bank obtains donors through efforts by support groups and forensic pathologists. Through a coordinated outreach effort to support groups the Bank has registered over 2400 potential donors. The efforts have resulted in donation of autopsy tissue from nearly 1000 donors with over 100 different developmental disorders.

The legal and ethical issues regarding the use of human tissues donated for medical research have received great public attention. To protect the deceased's body from being used for postmortem research that is incompatible with the deceased or their families' wishes and values, informed consent is obtained for all tissue donations. The Bank provides the means for tissue donors to leave a legacy that will benefit future generations. A partial list of disorders includes adrenoleukodystrophy, autism, chromosomal disorders, metabolic disorders, Prader-Willi syndrome, sudden infant death syndrome, and tuberous sclerosis. Tissue from an additional 2000 donors has been obtained from local hospitals and the Office of the Chief Medical Examiner in Maryland. Tissue is stored formalin fixed and frozen at -80°C . The Bank has collected over 55,000 tissue samples.

The availability of normal control tissue is critical to studying developmental disorders. The ONLY source of control tissue is from accident victims who come under the jurisdiction of medical examiners. Support by the Office of the Chief Medical Examiner of Maryland has enabled donation of tissue from normal individuals as well as individuals with autism, chromosomal disorders, Prader-Willi syndrome, etc. In fact, disorders that are not inherently life threatening, such as autism, rarely come to autopsy unless death is accidental. The participation of medical examiners throughout the United States has enhanced the collection of tissues from normal donors (especially under 17 years of age) and donors with rare disorders.

The Bank serves an additional role: making the tissue available to qualified researchers. To date the Bank has distributed 12,000 tissue samples to 360 researchers in 11 countries. These researchers have published 150 full-length publications and an equal number of abstracts based on studies utilizing tissue from the Bank.

This report focuses on the role of forensic pathologists in medical research by support of activities of the Brain and Tissue Bank for developmental disorders. The mechanisms of how to obtain informed consent from the families of the newly dead is also addressed.

Forensic Pathologists, Tissue Donation, Medical Research

G72 Causes of Death Among People in the Prison of Loos (Northern France), 1997-2003

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People in prison are more likely to die prematurely, especially of violent causes, than people who are not in custody. Some of these deaths could be avoided. The goal of this presentation is to study the causes of death (violent and natural) among people in the prison of Loos.

This presentation will impact the forensic community and/or humanity by explaining what problems are present in French jails.

Methods: The authors examined the causes of death in both prisons of Loos for detainees in custody and sentenced detainees, from 1997 to 2003. The collected data included age, sex, work, cause of the death, location of the death, and history of addiction. The causes of death were categorized as violent (accidental intoxication, suicide, or homicide) or natural (cancer, cardiovascular disease).

Results: Forty-nine persons died in prison during the studied period: 47 male and 2 females ranging in age from 17 to 54 years. The average age was 30 years. There were 34 suicides, 4 natural deaths, and 11 deaths involving the presence of drugs or alcohol. In France, all deaths in prison (natural, homicide, accident, suicide, toxic) are autopsied and findings are described.

In this study the cases of suicides are described more precisely. Among the people who committed suicide, 30% were jailed after conviction for a sexual assault (34 of the 49 cases). Among them, 17 had already been sentenced and the others were waiting for a judgment. The position of the body and the presence of another detainee in the cell was studied. The method of suicide was mainly hanging with a large tie (29/34).

Discussion: The high number of deaths in custody resulting from self-harmful behavior has important implications for the criminal justice system and the penitentiary administration. The authorities have a high responsibility to prevent deaths in jail. It is important to develop a preventive health systems inside the jails to prevent suicides. Psychiatric treatments and therapy must be introduced to reduce the risks. An awareness of these causes might be of assistance in developing mechanisms to further reduce fatalities in this setting.

Prison, Death, Suicide

G73 Rathke's Cleft Cyst: Alleged "Brain Tumor" in a Middle-Aged Cocaine Abuser

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This presentation, will show the histology of a congenital anomaly that may present in a forensic case as a history of "brain tumor."

A 47-year-old female complained of chest pains at home, but failed to seek medical treatment. She collapsed at home later that day in the presence of a family member. She had a history of chronic cocaine use, and relatives were concerned that she might have used the drug on the day of her death. Her only other condition was an unclear history, according to the family, of a "brain tumor." The tumor had reportedly been present for some time, but she had received no recent medical care or treatment for it.

At autopsy, gross inspection of the uncal region revealed an enlarged tan-brown mass beneath the pituitary stalk. The stalk itself was fluctuant to pressure, but did not appear to be enlarged. Sectioning of the brain revealed a focal 0.4 cm diameter mass, with an apparent necrotic or caseous center, abutting the optic chiasm on one side, and the mammillary bodies on the other. Microscopic evaluation revealed the mass to be cystic, with a true wall of squamous epithelium, surrounding a center of amorphous fluid and squames. This is believed to be a Rathke's cleft cyst.

Rathke's cleft cysts are found in all age groups, but mean occurrence is 40-50 years. They are typically asymptomatic and found incidentally at autopsy. During embryologic development, Rathke's pouch is formed from an evagination of oral ectoderm that grows toward the midbrain. When the anterior lobe of the pituitary gland is formed from this ectoderm, the pouch is reduced to a residual cleft. Cysts are formed when the cleft persists, becomes enlarged, and its secretions accumulate. The cyst fluid

can be yellow and thin, or green or brown thick mucus. It is lined with columnar or cuboidal epithelium in most cases, but mixed cell epithelium or pseudostratified squamous epithelium has been found. Ciliated columnar cells and goblet cells are also present in a majority of the cases. Most Rathke's cleft cysts are asymptomatic, but they can produce a mass effect causing headaches, visual changes, and pituitary dysfunction. Pituitary histology in this case appeared normal. Rathke's cleft cysts are usually located within the sella turcica. Rarely, they are found in a suprasellar location, as in this case.

Death was due to the complications of chronic cocaine abuse, with hypertensive and atherosclerotic cardiovascular disease. The family could be assured that the "brain tumor" had been located at autopsy, but had nothing to do with her death.

Rathke's Cleft Cyst, Rathke's Pouch, Forensic Pathology

G74 Microscopic Soft Tissue Decomposition and Time Since Death

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After attending this presentation, attendees will understand the histological soft tissue demise associated with long-term understanding of rigor mortis.

This presentation will impact the forensic community and/or humanity by qualifying the changes that occur at a histological level as a body decomposes; specifically, the temperatures at which each of the layers of tissue lyse during this process.

Introduction: The stages of human soft tissue decomposition are universally accepted as autolysis and putrefaction with subsequent macroscopic disfigurement. While the visual signals have been long recognized and appreciated by pathology, the schedule and precise histological deterioration of epidermal, dermal, fat, and muscle tissue have never been quantified let alone qualified. And, even though biochemistry characterizes these events, this study focuses only on structure. This study provides a longitudinal histological validation of the process in order to more accurately design future research regarding soft tissue decomposition.

Materials and Methods: At the outdoor decomposition research facility at The University of Tennessee, eight identical landmarks on six cadavers were biopsied for two weeks following death, and examined with light and electron microscopy for temporal patterning. These sites were the ventral chest (pectoral region), shoulder (deltoid region), ventral upper arm (biceps), ventral forearm (flexors), lateral hip (gluteal), ventral upper leg (rectus femoris), dorsal lower leg (gastrocnemius/soleus), and sole of foot (plantar aponeurosis/flexor digitorum brevis). Each site was biopsied once each day for the 14 day period. Biopsy sites were paraffin sealed, and adjacent puncture sites selected during the decomposition process. Biopsies were prepared by routine formalin-fixed histological methods at The University of Tennessee Medical Center and examined using a Leica ZX900 light microscope and an Olympus XNC environmental scanning electron microscope.

Results: The cell death associated with decomposition more closely resembles the characteristics of clinically documented cell necrosis as opposed to the apoptotic events of programmed cell death. That is, the cells of decomposing tissue go through an expansion and explosion process, which causes a breakdown of the cell membrane resulting in the expulsion of their cytoplasmic contents into the extracellular matrix rather than simply shriveling into a condensed mass and breaking apart as in apoptosis. Each of the layers (epidermis, dermis, lipid and muscle fibre) experience the same type of cell death, although they do not occur in the same temporal period. The loss of muscle fibre structure was observed at 270 degree days.

The epidermis structure was lost at 150 degree days. The dermis cell structure was maintained until 230 degree days. Fat cell structure was last to fail at 450 degree days.

As part of a recent endeavor to understand the cellular aspect of soft tissue decomposition, this study provides validation of the cellular death process that is the hallmark of initial decomposition. Thus, this research provides a baseline for future experimental design.

Time Since Death, Soft Tissue Decomposition, Histology

G75 An Atypical Gunshot Wound With Absence of a Weapon? The Value of a Thorough Scene Investigation

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The goal of this presentation is to increase awareness of zip guns when investigating scenes in which a weapon is not apparent, and to aid in the recognition of the atypical wounds they produce.

This presentation will impact the forensic community and/or humanity by alerting the forensic community to the possible use of a zip gun in likely cases of suicidal gunshot wounds where a weapon is not initially apparent at scene investigation, and an atypical gunshot wound of entrance is present at autopsy.

This presentation will describe the case of a 43-year-old male auto mechanic with depression found dead at work. The body was found on the floor of a washroom stall at the auto body shop where he worked. The deceased had sustained a contact gunshot wound of the forehead, and no weapon was found at the scene during initial investigation. A claw hammer was present in a pool of blood beneath the victim's right arm, and blood spatter was present on the hand and arm.

The deceased's social history strongly suggested that the wound was self-inflicted. Two possibilities were considered; firstly, that the gun had been removed from the scene prior to the investigator's arrival, and secondly, that the case actually represented a homicide.

Autopsy revealed an atypical lacerated contact gunshot wound of the forehead, with a retained medium caliber lead bullet within the posterior scalp. The case was pended for police investigation.

Subsequently, a simple zip-gun fashioned from a piece of pipe, a connector and an air-hose nozzle, along with a pin, was found on the floor at the scene by a co-worker who was cleaning the stall, and the police were notified. On closer examination, a .38 caliber cartridge case was found embedded in the pipe. The conclusion reached was that the deceased had committed suicide using a zip gun constructed from available auto shop parts, and fired the weapon using the hammer found adjacent to him. Due to the nature of the scene and the innocuous appearance of the weapon, the mechanism of the injury and the manner of death were not immediately obvious.

In the United States, zip guns were popular in poor, inner city areas during the 1950s, since they were easy to manufacture from cheap, commonly available materials. Frequently, they were constructed from a piece of wood, a metal barrel such as a car antenna, and a firing pin made from a nail. The simplest zip guns consisted of a piece of metal pipe with a cartridge inserted at one end. To fire the weapon, the protruding cartridge base was struck with a hammer. Because the diameter of the bullet was frequently smaller than that of the unrifled barrel, the bullet would be unstable and tumble upon leaving the barrel. The resulting low velocity and instability of the bullet made zip guns only suitable for short-range use. Today, conventional firearms are less costly and simple to acquire, making zip guns almost obsolete.

Because zip guns are rarely seen, investigators and pathologists may be unfamiliar with their construction and appearance, and the type of wounds they produce.

This case will serve to alert pathologists and investigators to the possible use of a zip gun in likely cases of suicidal gunshot wounds where a weapon is not apparent upon initial inspection of the scene, and an atypical gunshot wound of entrance is present at autopsy.

Zip Guns, Atypical Wounds, Scene Investigation

G76 Suicide or Homicide - The Importance of Forensic Evidence: A Case Study

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Participants will develop a better understanding of the role and the importance of correlating autopsy findings and evidence from scene examination defining the manner of death.

This presentation will impact the forensic community and/or humanity by demonstrating the difficulties in defining a suicide case that may be considered unusual with respect to evidence recovered from the death scene, the background of the deceased, and the connection of the suicide to an earlier murder.

Traditionally, the most common method of committing suicide by women is via drug overdose. Some statistical reports indicate that since the mid 1980s there has been a significant increase in the number of female suicides involving the use of a firearm. The most common wound site reported in such suicides is the head, and the handgun is the most common weapon utilized by women to commit suicide. Investigation of suicides in most instances tends to be straightforward, however there are some suicides which are very problematic. The determination of the cause and manner of death requires proper evaluation of the autopsy findings, in addition to various findings relating to the scene examination. In suicides, the type of weapon used and the existence of a motive or intent are crucial in the reconstruction of events leading to death. The following report describes a suicide case that may be considered unusual with respect to evidence recovered from the death scene, the background of the deceased, and the connection of the suicide to an earlier murder. In the early morning of January 17, 2004, the local police in Bari, Italy were alerted to the death of a 24-year-old female, by a young man who was fully clothed, with the exception of his pants. The young man informed police that he had witnessed a suicide of a woman whose body was located under a local bridge, a short distance from the police station. Inspection of the death scene by police revealed the young woman to be lying on the ground next to the open door of her automobile. The deceased, who was wearing a very broad rimmed hat, exhibited a single gunshot wound to the front of the head. A small handgun was recovered next to the deceased by the police. While being interviewed at the scene, the informant told police that young woman was his secret mistress, and that he had received numerous calls the previous evening from the woman. During the telephone conversations the male informant noted that the young woman was very distraught, and insisted that they meet beneath the bridge. Upon arriving beneath the bridge, the informant approached the woman as she was ranting about their past, at which point she placed a handgun against the top of her head and pulled the trigger. The informant at this point ran to the woman, then held her in a desperate attempt to revive her.

Examination of the car of the deceased by police led to the recovery of a short note which had been written by the woman, and which stated that she wished she could have prevented the murder of her mother. After a short examination of the scene, the police became very suspicious of the informant and arrested him in connection with the death of the woman. Further investigation of the suspect revealed that he had recently received several very expensive gifts from the father of the deceased, who was unaware that the suspect was married. Unknown to the Italian authorities at the time of the suspect's arrest, the German Police had an arrest warrant

out for the young woman and her boyfriend. Two years prior, the deceased and her boyfriend murdered her mother in Germany. The mother had been bludgeoned, then run over with a motor vehicle to make it appear as if the death was an automobile accident.

The crime scene investigation reported that the body of the deceased was located next to the open door of her BMW. She was in a seated position on the pavement, with legs flexed, and her head and shoulders positioned back in the space between the opened door and the driver's seat. Her clothes exhibited no evidence of tears or rearrangement, with the exception of her hat which exhibited a circular defect in the front with traces of blood. Located next to the right hand of the deceased was a Baby – Browning .25 caliber handgun, model 1932. An empty shell casing of the same caliber was recovered from beneath the body of the deceased. The postmortem condition of the deceased as reported by the medical examiner at the scene noted a core body temperature of approximately 28° Celsius, minimal lividity changes and relatively little evidence of rigor. Inspection of the car revealed many items of value including jewellery, cash, and an airline ticket for a flight to Paris that was scheduled the same day as the death. The autopsy confirmed that the muzzle of the handgun was against the brim of the hat worn by the deceased when it was discharged. Soot, primer residue, and spent gunpowder particles were observed in and around the circular defect site on the hat. Analysis for primer residues were found to be positive on each hand of the victim, in particular on the external metacarpal surface between the first and second digits. A metal jacketed .25 caliber bullet was recovered from within the skull. Considering the cerebral lesions, it was evident that the bullet had passed through the frontal bone and the right frontal lobe, before crossing the midbrain and ending up in the left cerebellar lobe. Toxicological analysis was negative; however, sperm was identified from the anus of the deceased. DNA analysis of the sperm found it not to match the DNA profile of the suspect. Ballistic examination of the recovered bullet and cartridge revealed them to have been fired by the .25 caliber Baby – Browning recovered next to the deceased. One point of debate in the investigation was the possibility of positioning of the handgun by the deceased to commit suicide. The Baby – Browning, model 1932, possesses a three-stage safety system to avoid accidental discharge: it cannot be discharged with the magazine removed, even if a cartridge has been loaded. A manual safety is located on the left side of the weapon, along with a secondary safety which is located on the grip which blocks the trigger except when the pistol is held firmly in the hand, ready for shooting. Latent fingerprints on the handgun were identified as belonging the deceased. The autopsy and ballistic findings strongly supported the notion that the deceased had fired the weapon. A reconstruction of the incident revealed that the woman held the handgun with both hands, with her finger wrapped around the back of the butt, and that she utilized her thumb to depress the trigger. The small amount of gunshot residue detected on the clothing of the suspect boyfriend was attributed to contamination while holding the deceased after the discharge of the weapon. The combined findings of the forensic investigation convinced prosecutors and police to reconsider the manner of death as a suicide. The complete details of this investigation will be presented.

Criminalistics, Handguns, Suicide

G77 Determination of Range of Fire in Skeletal Remains

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After attending this presentation, attendees will better understand a technique that can aid in the determination of range of fire in skeletal remains found with firearm injuries.

This presentation will impact the forensic community and/or humanity by providing a relatively quick and easy method for evaluation of firearm injuries in skeletal remains.

The goal of this presentation is to introduce forensic scientists to a technique that can aid in the determination of range of fire in skeletal remains found with firearm injuries.

Introduction: The scenario is not an uncommon one: a person goes off into a secluded area with the purpose of committing suicide by shooting themselves, and is later found in a decomposed or skeletal state. The presence of a weapon would certainly indicate a suicide; however, circumstances are not always as they appear. Remains can also be scattered and separated from the weapon, and weapons can be separated from the remains due to theft. When remains are decomposed or skeletal, the usual clues to range of fire, soot, and stippling are often lost or obscured. The authors present a technique that can aid in the determination of range of fire in the absence of visible soot.

The sodium rhodizonate staining technique is widely employed in crime laboratories to detect lead residue on clothing. The staining pattern obtained can then be compared to the implicated weapon and ammunition utilized to determine the possible range of fire. This technique employs spraying the garment with sodium rhodizonate, then sequentially overspraying with buffer and then hydrochloric acid. A pink color with buffer and then blue-purple color with acid is indicative of the presence of lead. This test has been employed on skin; however the authors demonstrate the technique on human and animal skulls.

Materials and Methods: Amputated heads from six previously slaughtered pigs were purchased for this experiment. Three different weapons and ammunition were utilized: a revolver with a non-jacketed bullet, a 9mm semi-automatic pistol with a copper-jacketed bullet, and a shotgun with 00 buckshot. Hard contact shots were fired with the weapon placed between the eyes on the upper portion of the snout. Distant shots were fired from 3 feet with the handguns and approximately 28 feet with the shotgun. The skin from the head was then removed and tested for traces of lead. The skulls were then boiled in water to aid in the removal of the remainder of the soft tissue. Once the soft tissues were removed, the skulls were re-assembled, if necessary, and tested for lead residue. All skulls were examined for visible lead prior to testing with sodium rhodizonate. Color changes were documented and photographed. A test was determined to be positive for lead if the color changed from pink with the buffer to purple-violet with the acid.

Results: The distant gunshot wound from the revolver with the unjacketed bullet showed faint positive staining of the bone around the outer surface of the defect, with no staining on the inside of the skull. Evaluation of the skin revealed a ¼ inch x ¼ inch area of positive staining with a few positive spots 6 inches from the wound. The distant gunshot wound from the semi-automatic weapon revealed no visible residue prior to testing. After testing, a small rim of lead partially encircled the skin wound and there were a few positive spots 4, 5, and 6 inches from the wound edges. There were no traces of lead on the skull. The shotgun inflicted multiple buck shot wounds which tested positive for traces of lead on the skin, but not the skull. All contact range wounds had visible residue on the skin prior to testing, and subsequently had brightly positive staining after testing with sodium rhodizonate. The outer surfaces of the skulls also showed positive staining, however the inner surfaces of the skulls also stained positively. Of note, the brains of the pigs were present at the time of the shooting. This finding was reproduced on two human skulls, one of known contact range and the other of presumed contact range.

Conclusion: Sodium rhodizonate may help determine range of fire in skeletal remains. Lead residue was detected inside the skulls with inflicted contact range firearm injuries, whereas it was only on the surface of the entrance wound, and in small amounts, of the distant wounds. More studies are currently underway to further explore these findings.

Sodium Rhodizonate, Skeletal Remains, Range of Fire

G78 A Modern “Martyr’s Crown”: A Fatal Case of Multiple Self-Inflicted Nail Gun Shots

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After attending this presentation, attendees will understand an atypical case of multiple nail gun shots in a 62-year-old man. The peculiarity of the case is represented from the surprising sequence of radiological images.

This presentation will impact the forensic community by underlying the role of a correct and complete radiological store in cases of foreign bodies injuries.

The case of a 62-year-old man, who was taken to the emergency room with multiple head wounds, is presented. He complained only of headache, and spontaneously declared that he had shot himself in the head with multiple nails from a nail gun, which he handed over to the physicians. He was conscious, oriented to place and time, and had no focal neurological or cognitive defects. Only the finding of a foreign metallic body on the surface of the scalp in the right temporal region alarmed the physicians, who immediately hospitalized the patient. Radiographs of the head demonstrated seven injuries with foreign metallic bodies inside. This reproduced the typical appearance of the “Martyr’s Crown.” A CT scan confirmed the presence of multiple nails penetrating the skull in the right (5) and left (2) temporal regions. A subarachnoid hemorrhage was also detected; the ventricular system was unremarkable. Four days after admission, a surgical approach was attempted to pull out nails, six of which were pulled out by cutting the scalp and temporal muscles; the last one, not on the surface, required a craniotomy. The patient awoke one hour after surgery, but his clinical condition rapidly worsened. He became comatose, and died after 10 days of hospitalization.

Few cases of unsuccessful attempted nail gun suicides are reported in literature, fewer cases of successful suicides are described most frequently the head and the left side of chest represent the preferred targets of the body.

Nail guns have been used since the 1950s, designed as a powerful industrial tool to drive nails into various hard surfaces with ease. Recent years have seen an increased diffusion in the domestic environment, too. The ease of use and speed of these tools enhance productivity at the cost of increased potential for traumatic injury. The nail gun fires a single nail or bolt, as projectiles, into wooden or metal surfaces. It could be compared to conventional firearms, being capable of firing projectiles of up to 10 cm into fully stressed concrete at a velocity up to 424 m/sec.

International literature records nail gun related injuries, sometimes lethal, with two categories of forensic interest: industrial accidents and suicide attempts

In conclusion, the case report represents an atypical case of nail gun suicide; highlights the rarity of the event in the literature, and points out the absence of any clinical sign until surgery.

Nail Gun, Successful Suicide, Cerebral Ischaemia

G79 .17 HMR – It’s Not Your Father’s .22

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The goal of this presentation is to present a case study of a suicide employing a .17 HMR to familiarize the forensics community with this round and potential resulting injuries resultant there from.

Familiarity of the various forensic disciplines with new rounds should impact the forensic community and/or humanity by allowing recognition of same when encountered in a case, a potential significant benefit in cases where a weapon is recovered at the scene.

This case study involves the death of a 27-year-old male who had been involved in a physical altercation with his wife on the morning of his death. The wife exited the residence and, on hearing a gunshot, re-entered to find the decedent with a fatal intra-oral gunshot wound. Recovered from the scene were a box of .17 HMR rounds.

At autopsy, the subject had a $\frac{3}{4}$ inch stellate contact midline intra-oral gunshot wound with a surrounding $1\frac{1}{2}$ inch area of soot on the roof of the mouth. The shot fractured the floor of the skull and continued to the left parietal brain where the projectile was recovered at the brain surface. Typical subarachnoid hemorrhages and cortical contusions were associated with the wound. Externally, the decedent had an impression on his chest corresponding to a spent .17 HMR casing.

The .17 HMR TNT cartridge is marketed by CCI as a small varmint round with a hollow point tip for “explosive performance.” A follow-up, the .17 HMR GamePoint round was introduced in 2004, marketed as a “dimple-tip bullet [which] mushrooms like a big game bullet instead of fragmenting like a varmint bullet. This greatly reduces damage to edible meat!” A comparison of the .17 HMRs with the various CCI .22 cartridges (<http://www.cci-ammunition.com/default.asp>) shows velocities for the .17 (2375 & 2525 ft/sec) exceeding the .22 magnum (1875 ft/sec) and energy (250 & 241 ft-lbs) approaching the .22 magnum (312 ft-lbs) – see below.

Round	Weight (grains)	Velocity (ft/sec)	Energy (ft-lbs)
.22 short	29	1080	75
.22 long rifle	40	1235	135
.22 magnum	40	1875	312
.17 HMR GamePoint	20	2375	250
.17 HMR TNT	17	2525	241

A potential concern is an attempt (presumably by a novice) to fire such a .17 caliber from a .22 weapon. The .22 magnum may be able to chamber the .17 HMR, however, the 0.05 inch step-down from the casing to the bullet would provide for release of much of the propulsive gases. In theory, this might create problems for the shooter.

In summary, the .17 HMR round has significant velocity and energy. While causing far more damage than a typical .22 caliber round, the tissue destruction is markedly less than that seen with larger calibers.

Conclusion: Familiarity of the various forensic disciplines with new rounds should allow recognition of same when encountered in a case—a potential significant benefit in cases where a weapon is recovered at the scene.

Gunshot Wounds, Suicide, Firearms

G80 A Shot In the Dark? Investigating Accidental Gunshot Wounds

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The goal of this presentation is to provide a general review, using a case study, of proper investigation of lethal gunshot wounds and, in particular, recognition of the importance of scene investigation and firearms function testing in gunshot wound deaths. In addition, attendees will learn that a particular weapon (Tokarev CZ52) has a tendency, when dropped, to accidentally discharge due to a defective hammer drop safety.

This presentation will impact the forensic community and/or humanity by reviewing the overall investigation of a gunshot wound fatality with special attention to scene investigation, firearms examination, and reconstruction to allow for better recognition of manner of death in fatal cases. Proper death classification’s societal benefits are obvious, allowing insurance payments to be made or withheld where appropriate, and criminal prosecutions to proceed if indicated.

Most lethal gunshot wounds are suicides or homicides. True accidental gunshot fatalities are rare, particularly when the misnomer of

“hunting accidents” with firearms is excluded. With such a paucity of actual deaths due to accidental gunshot wounds, an almost imperceptible bias against recognition of such cases may develop.

Using the case study of the death of a 39-year-old male National Guardsman, the steps of a thorough case investigation, including scene investigation and reconstruction, are reviewed. Through processing of the scene in the case study, a gouge was recognized on the floor, near the body. This represented the impact point of the hammer mechanism on the floor, indicating that an accidental discharge was a real possibility.

The weapon employed should be examined, if possible, in all firearms deaths, particularly for function testing. In the presented fatality, the weapon employed was a Czech 7.62 mm caliber Tokarev (CZ52) pistol. The manufacturer of the pistol, Century International Arms, has issued a recall warning due to a defective hammer drop safety. Inspected weapons, recognized by a “Z” mark on the left side of the trigger guard, indicate the weapon has been “inspected to ensure proper operation in order to avoid grave bodily injury and/or property damage.”

On function testing, the decedent’s weapon was found to be functional with a trigger pull of $7 +/ - \frac{1}{4}$ pounds in single action mode. The holster was soiled with scattered gunpowder particles. Comparison of the flooring from the scene and the gun showed the slide and hammer had indeed caused the gouge. Video recorded re-enactment showed the gun would regularly discharge when dropped in a similar manner.

Using the location of the decedent’s wounds in combination with the gouge in the floor at the scene, a reconstruction of the decedent’s death proved consistent with the history of the victim having accidentally dropped the gun, resulting in his death.

Forensic pathology is not limited to the physical examination of a body. Utilizing available resources, including firearms examination and scene investigation, the medical examiner’s analysis of a fatality is enhanced, hopefully ensuring proper classification of deaths.

Gunshot Wounds, Accident, Safety

G81 Utilization of Automated Fingerprint Identification System (AFIS) to Aid in the Identification of Unknown Perpetrators to Close Unsolved Cases

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The goal of this presentation is to describe the processes and outcomes involved with the implementation and utilization of a fingerprint comparison system between the central district medical examiner’s office and the local law enforcement offices.

This presentation will impact the forensic community and/or humanity by helping law enforcement to close out “cold” case files and find persons involved in identity theft. The law enforcement and forensic communities will benefit from matching latent and ten print files to the deceased individuals, knowing that the case files can be closed and the offenders are permanently off the streets.

Hypothesis: Matching the fingerprints of deceased individuals from a specific profile with those in the Automated Fingerprint Identification System (AFIS) database could identify perpetrators who are deceased that may have committed unsolved crimes or have been involved with identity theft.

Introduction: The highest incidence group of perpetrators of violent crime is males aged 15-45. These individuals are also the highest group to undergo medicolegal autopsy. By submission of routine fingerprints of deceased males aged 15-45 into AFIS, two questions may be answered (1) identification of perpetrators in ten print file should be identified as deceased, so that case files can be closed involving these individuals, and (2) some of these individuals have not been previously arrested and do not

have a ten print fingerprint file but may be identified in the latent fingerprint files as suspects or perpetrators of crimes. The identification may also potentially uncover perpetrators of identity theft.

Methods and Materials: As a preliminary study, 50 consecutive males aged 15-45 are being fingerprinted as part of the medicolegal autopsy at the Office of the Chief Medical Examiner (OCME) Central District, Richmond, Virginia. The fingerprinting method utilizes fingerprint strips and ink pads. The fingers are cleaned and dried prior to printing. Four fingerprint strips are labeled with the individual’s personal identification. Two sets of fingerprints are taken. The fingerprints are then entered into the AFIS database by the fingerprint examiners of the Division of Forensic Sciences (DFS) for a search of the ten print and latent files. The results of the search are reported back to the OCME, and if a match does occur these results will be issued to the submitting law enforcement agency. Fingerprints that are not a match will be archived.

The number of decedents that match with the ten print and latent print files are calculated and assessed for statistical significance with regards to the cost/benefit based on the number of cases closed or solved based on the results of this information. The positive predictive value will be calculated to further define the value of this study.

Fingerprints, Perpetrators, AFIS

G82 Dead Hits: Matching Decedents’ DNA to Unsolved Crime Scenes

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The goal of this presentation is to determine the value of comparing DNA samples from decedents to DNA evidence left at unsolved crime scenes.

This presentation will impact the forensic community and/or humanity by providing closure to cold cases, ultimately impacting the family and friends of those who were victims of unsolved crimes. The forensic and law enforcement community would benefit from determining DNA matches or hits from unsolved crime scenes and knowing that the perpetrators of these violent acts are now deceased.

Hypothesis: Submission of DNA samples from cases performed at Office of the Chief Medical Examiner (OCME) Central District, Richmond, Virginia, that meet the demographic profile of persons at risk for societal maladjustment for comparison with biological evidence left at scenes of unsolved crimes will result in the solving and closing of outstanding cases.

Introduction: A large percentage of medical examiner cases represent a high-risk group for societal maladjustment (crime) and for encounters with the legal system as felons. The felon data bank archives the DNA profiles of felons. The Division of Forensic Science (DFS) in Richmond, Virginia, also archives profiles of biologic evidence left at scenes of crimes by unknown perpetrators who are not in the data bank. Some perpetrators of crimes who have left biologic evidence profiled by DFS may die without ever being caught, convicted and entered into the felon data bank or compared with DNA evidence profiles.

A pilot study to establish identities among the three groups would assist law enforcement by: (1) solving and closing some outstanding cases upon identification of a decedent as the perpetrator of a crime where the decedent was not in the data bank but had left biological evidence, and (2) determining whether, in the future, continued comparison of the designated group of decedents would assist the law enforcement community by saving time, money, and record keeping in a futile search for presently unidentified, but now deceased, perpetrators of crime.

Materials and Methods: OCME Central pathologists collect and archive blood spots of all medicolegal cases. From these cases, a subset of 50 consecutive males aged 15 to 45 will be the focus of the pilot study. Prior to submitting samples to the data bank, a list of the individuals will be submitted to the data bank. Data bank staff will check the samples against the listed individuals that already exist in the data bank, and exclude from the study those who match by name. The remaining samples will then be submitted on a specially designed data bank Request for Examination (RFE) form, and will be assigned a unique sample number. The data bank profiles those samples utilizing standard DNA-STR profiling kits and enters the results in a specially created database (index), where they remain for an indefinite period of time for comparison purposes.

DNA profiles from these samples are compared against unidentified profiles obtained from crime scenes. If a match occurs, a certificate of analysis is issued to the submitting law enforcement agency, with a copy to the OCME Central. No certificate of analysis is issued for a search not resulting in a match. Matches or hits are presented to the police to correlate with the investigative information.

Results: The percentage of hits are calculated and assessed statistically for cost/benefit for law enforcement based on the number of cases actually closed/solved as the result of this information. Additionally, the predictive value positive will be calculated to further describe the efficacy of this study.

Conclusion: The major observation would be the establishment of identities or hits in cold cases.

DNA, Decedents, Cold Cases

G83 To Dye or Not to Dye: A Tale of the Blues

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After attending this presentation, attendees will be able to evaluate the reliability of toluidine blue dye application as part of the postmortem genital examination; be able to compare the results from photo-colposcopy at various magnifications vs. photo-colposcopy plus toluidine blue dye application; and be able to better understand the nature and appearance of postmortem anogenital anatomy at various intervals.

This presentation will impact the forensic community and/or humanity by helping to promote consistency and reliability among examiners; improving diagnostic acumen of examiners; and enhancing both antemortem and postmortem investigations and genital examinations.

Living with the Blues: **Richart** (1963) reported the use of 1% toluidine blue in more than 200 women as an *in vivo* staining method to delineate areas of neoplastic epithelium on the cervix. The intensity of the stain was closely related to the number of nuclei per unit area. **Collins et al.** (1966) studied 242 patients to determine the efficacy of the dye for outlining neoplastic areas on the vulva. **Lauber and Souma** (1982) utilized the dye as an adjunct in the evaluation of traumatic intercourse. Results were compared between a group of 22 rape victims and 22 controls that had engaged in consensual coitus. Both groups were examined ≤ 48 hours. Further investigation of toluidine blue by **McCauley et al.** (1987) evaluated the influence of race, parity, age, and other factors in 24 rape victims and 48 controls, all examined within 48 hours.

Dying with the Blues: In 1992, Bays and Lewman described 4 case studies of children, ages 3 months to 4 years, where toluidine blue was used at autopsy to aid in the detection of genital and anal injuries due to child sexual abuse. In 3 of the cases, the dye uptake revealed previously undetected lacerations and a patterned injury due to a foreign object. Use of colposcopy was documented in only one case; magnification was not specified. This autopsy was done 3 days after the disappearance of the child.

When DNA does the Blues: One study, by Hochmeister, Whelan, *et al.* (1997), studied vaginal swabs from women after consensual intercourse.

The postcoital swabs were directly exposed to toluidine blue and other destaining agents in order to determine if the dye had an adverse effect on recovery of DNA. Although there was no effect on either PCR or RFLP recovery, the sample size consisted of only 5 women and the collection time was only 6 hours post-coitus.

Rhythm of the Blues: As a general nuclear stain, toluidine blue, when used *in vivo*, depends on the presence or absence of a nucleated cell population at the exposed surface. Because many current protocols stem from the earlier studies, salient recommendations from those **methodologies** should be considered:

- Richart (1963), described proper decolorization as the most important part of the method. In very mild dysplasia with very small lesions, application of the acetic acid destaining agent in *too liberal* or *too vigorous* a manner might rapidly remove all the stain, even from areas of dysplasia.
- Lauber and Souma (1982) used lubricating jelly to decolorize. Like Richart, they stressed that it was essential to ensure that the tested area was wiped repeatedly with cotton balls until completely dry. They also described the use of finer stroking with a dry cotton tip applicator to differentiate lacerations from dye trapped in crevices.
- In addition to cervical mucous, columnar epithelium, and areas of inflammation, the concomitant presence of 23 categories of benign diseases will cause a **false positive** dye uptake in living subjects (Collins, 1966).
- **Application interval:** a great deal of variability exists in the application of this nuclear stain for documentation of traumatic intercourse in the living. Original studies were done on subjects who were examined within 48 hours. The effects of wound healing on dye application have not been studied. Programs that employ toluidine blue during extended intervals after reported sexual assault must consider the possibility of false positive dye uptake in areas of granulation tissue.
- Lauber and Souma recommended application of the dye **before** speculum insertion to avoid the possibility of findings due to iatrogenic trauma and to circumvent the known spermicidal effect of the dye *in vitro*. However, they also recommended procuring a *hanging drop vaginal specimen*, prior to application of the dye, in order to compare with a subsequent sample. Recent protocols do not recommend this step.
- Programs that use this nuclear stain vary significantly in their methodology, i.e., **timing** of dye application *before* or *after* speculum insertion. The Office of Criminal Justice Planning (OCJP) protocol in California recommends dye application at the *conclusion* of biological evidence collection.
- Early studies were done before colposcopy with magnified photographs was incorporated into sexual assault examinations. **Slaughter, Brown, Crowley, and Peck** (1997) saw no injuries with toluidine blue that were not already seen via colposcopy. However, 15X magnification was routinely used for inspection and photographs. Visualization at lesser magnifications may not allow the same level of scrutiny of the anogenital tissues. Photos taken *prior* to speculum insertion can establish the presence or absence of pre-existing injury. Likewise, when and if iatrogenic injury occurs, it can be documented as such.
- Subtle findings are an examiner issue. Follow-up exams are needed to understand those findings that may mimic trauma and to appreciate changes that occur with healing (Slaughter, personal communication).
- Antemortem use of the **victim as his/her own control**: when patients who present with acute genital injury are brought back for a follow-up examination, the resolution of injury and course of healing can be documented. For the rape-homicide victim, comparisons are best drawn from a baseline group of cases where the cause of death has a non-sexual etiology.

- **Postmortem artifact:** in addition to all of the conditions that affect dye uptake in the living, factors such as skin slip, mucosal autolysis, blood, and other secretions, may cause a false positive uptake during the postmortem interval.

Further study is needed to assess the efficacy and reliability of this nuclear stain as an adjunct to the postmortem genital examination. A prospective study of postmortem cases drawn from various causes of death will allow a comparison of toluidine blue and colposcopy. This subgroup will be part of a larger baseline study on the nature and appearance of the anogenital tissues at various postmortem intervals. When the understanding of what is normal and what is not in the postmortem interval is improved, the application of any staining adjuncts may then enhance, for pictorial purposes, what is already known to be present.

Colposcopy, Toluidine Blue Dye, Postmortem Genital Examinations

G84 Postmortem Monocular Indirect Ophthalmoscopy

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After attending this presentation, attendees will become aware of how to perform postmortem indirect ophthalmoscopy and how it differs from direct ophthalmoscopy.

This presentation will impact the forensic community and/or humanity by describing an efficient, low cost method to examine the posterior retina following death that permits a wide field of view compared with direct ophthalmoscopy.

Postmortem fundal examination can be conducted with a hand held direct ophthalmoscope, head mounted binocular indirect ophthalmoscope or by monocular indirect ophthalmoscopy. The direct ophthalmoscope provides a detailed monocular retinal inspection with high magnification (15x for an emmetrope, less in hyperopia and more in myopia), but a small field of view (6.5 - 10?). Unfortunately, postmortem corneal changes can make fundal examination less than optimal with the direct ophthalmoscope. Binocular indirect ophthalmoscopy, a technique for evaluating the entire ocular fundus, provides a stereoscopic, low magnification, wide-angle, moderate to high resolution view of the retina. However, the binocular indirect ophthalmoscope is moderately expensive and requires some training to properly use.

Monocular indirect ophthalmoscopy is performed using a bright focal light source (penlight, Finhoff transilluminator, headlamp, otorhinolaryngology headlight or light source from direct ophthalmoscope) and a high plus condensing lens. The decedent's eyelid is held open with an eyelid speculum while glycerin or an ophthalmic irrigating solution is used to keep the cornea moist during the examination. After dimming the room lights, the light source is positioned against the examiner's lateral canthus/cheek or between the examiner's eyes. The light source must be directed through the pupil to illuminate the fundus. The image of the retina is then projected out of the eye, and in an emmetropic eye with no refractive error the image of the fundus will be formed at infinity. An aspheric condensing lens is held between the thumb and index finger then placed in front of the eye, thus focusing the retinal image in front of the observer. Initially the condensing lens is held to one side of the decedent's eye until the pupillary red reflex is established and moved between the eye and the examiner (initially about 1-2 cm from the decedent's eye) and then slowly pulled towards the examiner and away from the decedent's eye until the image of the fundus fills the lens, usually about 3-5 cm or equivalent to the focal distance of the lens. Alignment of the condensing lens is critical. It must be held parallel with the plane of the iris; with the flat surface of the

lens facing the decedent's eye (position the surface rim of the lens with a silver ring towards the decedent's eye). The condensing lens must be centered in-line and perpendicular to the axis from the examiner's pupil to the decedent's pupil. Resting the examiner's little finger on the decedent's forehead is helpful as it helps stabilize the lens. The real inverted, laterally reversed image is less magnified than that of a direct ophthalmoscope, but the field of view is much larger.

Indirect ophthalmoscopy permits viewing of the posterior fundus and equator even if there is less than perfect anterior segment media; however, postmortem corneal clouding may cause the fundus to appear hazy. A disadvantage of the technique, as with conventional direct ophthalmoscopy, is the lack of a stereoscopic view; however, stereopsis can be achieved but this depends on the condensing lens, viewing distance, and interpupillary distance of the examiner. This technique is about as difficult as direct ophthalmoscopy to learn. Presently available aspheric lenses range from +14 to +40 diopters and come in different diameters. Lower power lenses provide higher magnification but offer a smaller field of view and must be held farther from the decedent's eye, making positioning of the lens less steady. Further investigation is needed to identify techniques that mitigate postmortem corneal clouding.

Postmortem Indirect Ophthalmoscopy, Direct Ophthalmoscopy, Ocular Fundus

G85 Multislice Computed Tomography In Forensic Pathology

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Imaging in forensic pathology has been known for more than one hundred years, but used very little and only in selected cases such as shootings and battered child syndrome, in which cases traditional x-ray technique has been applied. The goal of this presentation is to introduce routine multislice computed tomography (CT) in forensic pathology.

This presentation will impact the forensic community and/or humanity by demonstrating how computed tomography can be a useful tool as a standard examination before autopsies.

The material consists of more than 1,000 consecutive cases which, before traditional postmortem examinations, were scanned in a CT-scanner (Siemens Somatom Plus4Exp). The results were compared with the results of the autopsies. The examiner records the results of the scanning and provides the description and the pictures to the autopsy pathologist, who then records his results.

All data are stored in optical discs or CD-ROM, and relevant expositions are developed and generated in 3-D images. The scanning procedure is very short – a few minutes – but the generation of the pictures takes approximately 20-40 minutes per case.

The preliminary evaluation shows that the method is especially valuable to demonstrate foreign bodies such as bullets and artificial joints etc., fractures of the skeleton and larynx, and also intracranial hemorrhages and hemorrhages from rupture of large vessels such ruptured aneurysms of the aorta. In some cases, radiographic calcification of the coronaries is so marked that it suggests the cause of death to be coronary insufficiency.

In the authors' opinion, the new method has come to stay in forensic pathology – in the future combined with MR-scanning which covers the soft tissue examination better. Since the method is non-invasive it is more in accordance with the increasing resistance to classic postmortem examinations.

The new non-invasive technique may also appeal to the hospital pathologist, due to the fact that when it has become routine the technique can replace many postmortem examinations in hospitals.

Computed Tomography, Virtopsy, CT-Scanning

G86 Murder in the Ancient Castle: A XIV Century Warrior Virtual Autopsy

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The goal of this presentation is to present a unique case of the discovery of human skeleton remains of a XIV century “warrior” murdered by a crossbow arrow found in the cervical spine. A virtual autopsy (“virtopsy”) was conducted with multislice Computed Tomography (MSCT) and X ray. The results of radiocarbon dating are also presented.

“There was a time, in a Tuscan castle, a brave knight valiantly died fighting a battle to defend the fortress: This is his story.” Thus could begin this exceptional report concerning a discovery in a medieval castle. A medieval murder by a crossbow is presented. In February of 2004, during restructuring of a medieval castle in a Tuscan country, a burial was discovered. The burial was found at the base of an ancient keep in the highest side of the hill where the castle was built within a rectangular room. This room was more recently used for animal shelter.

The burial was placed in a pit dug in barren clay, and contained easily recognizable human skeletal remains in supine position with the arms bent on the chest and the head protected by two large stones.

These skeletal remains constituted a primary sepulture in full space. The skeleton appeared completely preserved in each part. Anthropological examination confirmed that the remains belonged to a 30-40-year-old male with a stature of about 170 cm. The anterior surface of the left maxilla had a round bone defect with clean-cut outline, 22.10 x 14.65 mm. The alveolar processes of the left maxilla had a round bone defect with an irregular outline involving the second incisor, canine and first premolar, 17.88 x 10.64 mm. A galley dart stile was thrust between the second and the third cervical vertebrae. A complete x-ray study of the skeleton and an image-guided virtual autopsy with multislice computed tomography (MSCT) were made to analyse the correlation between radiologic images, anthropological data and macroscopic findings.

The x-ray study has confirmed the presence of the dart, classified as a “verrettone,” a kind of XIV century dart.

The 3-D reconstruction analysis of the maxillary alveolar wound demonstrated the traumatic origin due to the dart entrance wound. The MSCT was able to analyze and reconstruct the internal dart trajectory. The dart penetrated the spinal cord causing an instantaneous death due to a complete section of medulla oblongata.

No other traumatic lesions were found.

The radiocarbon test (database used: INTC AL 98) was performed to date the remains. It confirmed them as being from the XIV century.

In conclusion, the case reported represents a unique case of human skeletal remains from a XIV century homicide, killed by a crossbow arrow in the cervical spine. A complete study with modern techniques has been performed, using CT scan and x-ray imaging, DNA analysis and Carbon 14 examination to date remains.

Crossbow Homicide, Radiocarbon Test, Multi-slice Computed Tomography (MSCT)

G87 19th Century Autopsy Techniques: Failing to Meet 21st Century Forensic Science Needs

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After attending this presentation, attendees will be familiar with diagnostic medical procedures applicable to death investigation in lieu of an autopsy.

This presentation will impact the forensic community and/or humanity by refining the autopsy selection criteria, which will allow greater opportunity for use of advanced clinical techniques and achieve a higher quality of report for use in adjudicated cases.

The autopsy hit its heyday in the 1880s due to the European masters like Rene Laennec, Rudolf Virchow, and Ambroise August Tardieu to name a few. Subsequent improvements to the autopsy include use of Roentgen's x-ray device, photography replacing artwork, and increased utilization of laboratory studies including microbiology and immunology. In contrast, some technologies, notably histology, have fallen into decline at many forensic facilities. Currently, Jurgen Ludwig's multiple editions on autopsy practices are the most modern compendium of pathology techniques derived purely for the purposes of demonstration and diagnosis. Yet the traditional autopsy still relies upon narrative styles little changed over the years, with the exception that comparing lesions to articles of food has been replaced by standard nomenclature and metrics. The pictorial style of autopsy reporting has been very difficult to incorporate, despite the truth of a picture being worth a thousand words. Pre-printed diagrams marked with short annotations are used by some and in this digital age, many photographs are still made using film technology, despite the instant feedback and proven advantages of digital imaging.

A wide variety of disciplines are incorporated at the autopsy table [anthropology, bloodstain pattern interpretation, trace evidence, and clinicians] to provide focal expertise ensuring no stone goes unturned. Expectations of the pathologists include being a physician with clinical skills. Pathologists should be adept at crime scenes, and clinical physical exams including the ability to read a 12-lead ECG, x-rays and other diagnostic images. They also need to be conversant with surgeons regarding resuscitation and surgical decision making. It is beneficial to remain current with the latest pharmaceuticals. The majority of continuing education, journals read and textbooks procured are of a clinical nature, from family practice to the surgical and medical specialties, pediatrics and OB/GYN. Significant additions to autopsy protocols include the following:

- Invasive angiographic studies
- Advanced x-ray protocols for child deaths following AAP guidelines
- Bronchoscopy and endoscopy
- Intra-peritoneal lavage
- Epiluminescence
- Supra-vital staining
- Cardiac conduction dissections
- Cytology of fluids, fine needle aspirates and touch preps
- Needle biopsy for tissue culture
- Needle biopsy for gross and/or histologic diagnosis
- *In situ* retinal evaluation
- Retinal recovery and histologic evaluation
- Histologic dating of wounds
- Histologic evaluation of wounds for foreign materials
- Evaluation/interpretation of bloodstain patterns on victims and clothing

- Excision and retention of bone fractures for fractural analysis and toolmarks
- Soft tissue and osseous burn pattern interpretation
- Digital narrative/pictorial public record autopsy protocol
- Privileged pictorial autopsy protocol
- Review by cultural anthropology

In the practice of pathology, the traditional autopsy is a quaint expression of the best technology the 1880s had to offer. As with today's medicine, the practice of forensics has far more tools in its toolbox now than in the 19th century, mainly borrowed from clinical brethren. By using those tools and refining examinations with diagnostic procedures adopted from clinical colleagues, the percentage of persons needing autopsy to attain diagnosis has paralleled hospital autopsy experience and fallen to 14%. Because the new procedures with fewer autopsies save time, those most in need of autopsy; primarily homicides, child deaths and those too young to die, receive an Engineering Investigation quality autopsy averaging 12 hours of physician time per case. Thus, those cases requiring the highest standards of proof receive the greatest effort with the latest technology and the best reporting format.

Autopsy, Forensics, Pathology

G88 Diesel Fumes Do Kill: A Case of Fatal Carbon Monoxide Poisoning Directly Attributed to Diesel Fuel Exhaust

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The goal of this presentation is to present a novel case of fatal carbon monoxide (CO) poisoning directly attributable to diesel fuel exhaust, a previously unreported and perhaps under-recognized source of CO.

This presentation will impact the forensic community and/or humanity by reporting to the forensic community an under-recognized and potentially fatal source of CO poisoning. Exhausts emitted from diesel fuel, although possessing lower levels of CO than exhaust from gasoline fuel, are nevertheless a conceivably dangerous source of CO. Through this three-part research project prompted by this single case, the authors aim to promote further awareness that CO intoxication can occur from inhalation of diesel exhausts, similar to open-air intoxication and, most importantly, to emphasize that it is preventable.

This presentation will fully examine a case of CO poisoning brought to autopsy as a possible work-related natural death in Louisville, Kentucky. The death was initially considered to be caused from complications of ischemic heart disease (IHD), pending toxicological analysis that included a CO level. The CO was ordered at the time of autopsy because the victim was found in the secure cab of a running diesel engine semi-trailer truck at a rest stop. When the toxicology results showed high levels of blood carboxyhemoglobin, the death was recertified as CO intoxication secondary to inhalation of [diesel] vehicular exhaust fumes. This case will illustrate how diesel fuel can potentially serve as a source of CO in fatal and nonfatal poisonings.

Often called the "silent killer," CO is the most common fatal poisoning in the United States, claiming 1,000 - 3,500 lives every year. Although suicides constitute the majority of fatalities in CO poisoning, accidents account for approximately 30% of annual deaths. CO is produced by the incomplete combustion of organic material, and high

concentrations can rapidly accumulate under many different scenarios. The most common sources of fatal CO intoxication are from inhaled fumes in fires or motor vehicle emissions. Typical accidental poisonings usually involve unsuspected increased CO levels in enclosed environments, which can include secured motor vehicles, closed residential or parking garages, car washes, homes, and even tents. Open air CO intoxication is a well-known potential hazard in boating-related activities. CO poisoning has been notoriously attributed to the inhalation of fumes emitted from the gasoline powered motor vehicular exhaust when personal-use automobiles were involved, even when the engine possessed a catalytic converter. In the U.S., a very small fraction of personal automobiles have a diesel engine. While it is known that diesel fuel combustion engines produce much lower levels of CO than gasoline engines, these CO emissions could certainly rise to lethal levels given a sufficient amount of time in an enclosed space and under suitable environmental conditions.

The case involves a moderately decomposed 52-year-old male truck driver found prone between the sleeper and driver compartments of a secure tractor trailer truck. The initial cause of death attributed to IHD was amended after the toxicology results from the Kentucky Office of Forensic Toxicology (OFT) showed a blood carboxyhemoglobin saturation of 67% by differential spectrophotometry. The amended cause of death was attributed to CO intoxication sustained from inhalation of motor vehicular exhaust. IHD was considered a significant factor contributing to his death.

Because of the unique source of fatal CO intoxication in this case, the contributory IHD, and the possible contaminants in the putrefied blood, a 10 year retrospective review was conducted of all non-fire related CO deaths autopsied at the Office of the Chief Medical Examiner in Louisville, KY from 1994-2003. The review compared this case to gross autopsy and toxicological findings and scene investigation of 116 postmortem cases. Specifically examined were severity of heart disease, degree of postmortem decomposition, and evidence of cherry red skin discoloration present at autopsy and scene description. In addition, for confirmation of the validity of the carboxyhemoglobin detection method used by the Kentucky OFT, blood samples from cases representing varying degrees of decomposition along with controls were submitted to two different commercial laboratories and one federal laboratory. The carboxyhemoglobin concentrations were measured using three different laboratory methods. The results from the commercial and federal laboratories were compared to the Kentucky OFT results and were found to show no statistically significant differences in measured carboxyhemoglobin concentration. Lastly, an extensive literature search and personal communication yielded no reported cases of fatal CO poisoning, accidental or suicidal, attributed to diesel fuel exhaust.

Carbon Monoxide, Diesel Fuel, Poisoning

G89 Sublingual Tablet Thwarts Opioid Addiction

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The goal of this presentation is to offer information regarding a new tablet, buprenorphine, which when dissolved under the tongue (sublingual) prevents opiate/opioid withdrawal, craving and continued addiction, and reduces co-morbid diseases, crime, and healthcare costs.

This presentation will impact the medical, legal, and forensic community, and/or humanity by demonstrating a high degree of positive outcome results of maintained sobriety in its first year of use by motivated patients and private physicians utilizing buprenorphine.

The Center for Substance Abuse Treatment (CSAT) and The Substance Abuse and Mental Health Services Administration (SAMHSA), divisions of the U.S. Department of Health and Human Services (USHHS), have recognized that approximately 980,000 people in the U.S. are addicted to opioids while only 205%, 180,000, are treated. This innovative treatment allows the physician to prescribe this drug in the private office setting and is called Office Based Opioid Treatment (OBOT).

Opiates (morphine and codeine) and semi-synthetic and synthetic opioids (heroin, oxycodone, hydromorphone, hydrocodone, methadone, fentanyl) are abused by oral ingestion, nasal insufflation, transmucosal absorption (oral, nasal, rectal and vaginal) and injection. The amount of transmitted diseases from substance abuse, i.e., hepatitis, HIV and sexually transmitted diseases significantly elevate the cost of medical treatment and crime. The chemo-therapeutic drug for the past 32 years to detoxify from opioids and maintain sobriety has been methadone. Methadone itself is addicting, but enables the addict to live in society, maintain employment, and remain healthy and productive. However, the addicted patients with the primary, chronic, recurrent, neurobiological disorder of the brain (definition of addiction by the National Institute of Drug Abuse) must be treated daily by reporting to federal and state licensed narcotic treatment programs (NTP) each morning for their dose of methadone. This is time consuming and frequently reduces employability and disrupts the family homeostasis.

Buprenorphine is an agonist-antagonist opioid that is used as an analgesic in small doses by injection but stops opioid craving when given in high strengths as a sublingual tablet. The Drug Abuse Treatment Act of 2000 opened pathways for qualified physicians to prescribe a 30 day supply to patients from their offices and filled at pharmacies. This enables the addicted patient to receive treatment while making them more employable, able to leave welfare subsidies, provides social acceptability, enhances mentally and physical health, family acceptability and responsibility.

Two forms of the drug, manufactured under the names of Subutex® and Suboxone®, have been available since January 2003. The former, pure buprenorphine, induces the drug to a stable maintenance dose. The patient is then switched to the latter drug that is combined with a pure opioid antagonist, naloxone. If a patient tries to pulverize, solubilize, and inject it, the patient will experience rapid withdrawal symptoms.

The overall purpose is to educate and train physicians to treat addiction on the front line of medical practice by the family physician, internist or psychiatrist and thereby treat larger numbers of addicts not currently in treatment and involved in criminal events to support their addiction.

The physician must have a minimum of eight hours of training by government (CSAT) approved addiction specialty organizations.

To date, the reports of buprenorphine's use indicate it is well tolerated and well accepted. Patients can find certified physicians on a physician locator web-site. The benefits of these new drugs are to invite untreated addicts into a less formidable type healing program that eliminates the necessity of reporting to a NTP each morning and raises self-esteem. Since approximately 70% - 80% of inmates in the penal institutions are charged with committing a crime directly or indirectly related to drug abuse or the disease of addiction, it becomes more cost effective to build better lives rather than bigger prisons.

Subutex®, Suboxone®, OBOT

G90 An Analysis of 35 Ethylene Glycol Fatalities in Cook County, Illinois From 1993 Through 2003

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After attending this presentation the participant will understand that suicide is the most common manner of death from ethylene glycol intoxication in Cook County, Illinois, followed by accident, and rarely undetermined; understand the common death investigation circumstances surrounding death from ethylene glycol intoxication; and understand that toxicology values, although important in determining the cause of death, cannot replace a thorough death investigation when determining manner of death.

This presentation will impact the forensic community and/or humanity by providing realization that homicidal ethylene glycol intoxication is very rare, with suicidal ingestion by far the most common manner of death. Although homicidal poisoning is possible, the determination of the manner of death by the medical examiner or forensic pathologist should rely on the circumstances of the death after a thorough investigation, and not based on toxicology values alone, which overlap with accidental and intentional ingestions.

Introduction: A cluster of alleged and convicted homicidal ethylene glycol poisoning deaths has recently been reported in the media. In light of these reports, the authors sought to retrospectively review the experience of the Cook County Medical Examiner's Office investigating deaths occurring from ethylene glycol intoxication in an 11 year period from 1993 through 2003.

Background: Ethylene glycol is a relatively inexpensive and easily obtainable liquid used predominately as an antifreeze-antiboil additive in motor vehicles, but is also found in detergents, paints, cosmetics, and de-icing products. It has a sweet taste, and is odorless and colorless, but commonly has fluorescent green or yellow dye added. It is an intoxicant with properties similar to ethanol when ingested, and is occasionally used as a substitute for ethanol when ethanol is not available. Several hours after ingestion, toxic effects of nausea, vomiting, convulsions, stupor, and coma can develop. Death usually occurs 24 to 48 hours later depending on the amount ingested, but can be delayed with medical intervention, as ethylene glycol causes metabolic acidosis, hyperosmolality, and tissue injury through its toxic metabolites.

Results and Analysis: During this 11 year period, 35 cases of fatal ethylene glycol intoxication were found in the Medical Examiner's Office computerized database. Retrospective analysis included review of the investigation and circumstances of the death; reports of follow-up investigations, including family interviews, autopsy reports, toxicology results; and any ancillary testing results. Temporally, one case occurred in 1993, no cases in 1994 or 1995, seven cases in 1996, eight cases in 1997, two in 1998, four in 1999, one in 2000, two in 2001, four in 2002, and six in 2003. Deaths were highest in October, April, and August, with only December having none. The average age was 43 years for both sexes, with a range of 25 to 73 years. There were 27 males and 8 females (ratio of 3.4 to 1). Twenty-eight were white and seven were black.

Manner of death was determined for the 35 deaths: 29 were suicides, 4 accidental, and 1 undetermined. There were no homicides. Of the suicidal determinations, ten left suicide notes or phone messages of intent. The four accidental determinations were related to chronic alcoholism and use of ethylene glycol as a substitute intoxicant. The one undetermined case could not be resolved between suicide and accident in a setting of chronic alcoholism and depression. Of the 29 suicide determinations, 14 had history of clinical depression, three had psychiatric diagnoses, and ten were going through a breakup in a long-standing relationship. Twenty-one had either commercial containers or cups of antifreeze at the scene. In examining where death or collapse from intoxication occurred, 28 were at their own home or apartment, 1 at work, 2 at their neighbor's home, 3 in motels, and one in a large department store. Of these 28 found at home, 11 were found in their bedroom, 4 in the basement, 1 in the kitchen, 1 inside a cabinet, 2 in the bathroom, and 7 had no specific location within the home noted.

Autopsy findings were nonspecific and consistent with drug ingestion with pulmonary and cerebral edema. Calcium oxalate crystals were found in renal tubules if death was not significantly delayed by treatment.

Ethylene glycol toxicology analysis was divided into three study groups: (1) those pronounced dead at the scene with postmortem analysis; (2) those found still alive and admitted to the hospital for a short period of time with postmortem toxicology; (3) those found still alive and admitted to the hospital, but subsequently died with antemortem hospital toxicology analysis only. There were 15 victims in the first group dead at the scene. The average blood ethylene glycol concentration on postmortem toxicology testing was 264 mg/dl (range 0 to 849 mg/dl). Average urine concentration was 1028 mg/dl (range 151 to 2193 mg/dl). The average ratio of blood to urine compared in individual cases was 0.31 (range 0.12

to 0.50). The manner of death for all members of this first group dead at the scene was suicide.

The second group was found alive and admitted to the hospital, but died after a short period of time, usually in the emergency room, and underwent autopsy with postmortem toxicology testing. All had metabolic acidosis and hyperosmolality while alive. Examples include two victims who both lived nine hours in the ER after a prior ingestion at unknown time. One had ethylene glycol in the blood of 626 mg/dl, bile 529 mg/dl, and vitreous 716 mg/dl. The second victim had ethylene glycol in the blood of 1141 mg/dl, bile 1134 mg/dl, and urine 561 mg/dl. In these two cases, bile seemed to parallel blood levels.

The third group was found alive and admitted to the hospital, but subsequently died, some after a long hospital course. This group tended to have large variable antemortem blood levels depending when testing was performed during the hospital course. The range of initial ethylene glycol in the blood was 143 to 864 mg/dl. All had documented metabolic acidosis and hyperosmolality, and all progressed to coma and death. Serial determinations of ethylene glycol blood levels were performed in many of the patients in this group and showed variable ethylene glycol metabolism rates. The half-life of ethylene glycol appeared to be less than 12 hours in this group where serial hospital blood measurements were taken.

Conclusion: In spite of the recent cluster of alleged and convicted ethylene glycol homicides reported in the media, none have been found in Cook County, Illinois, within the past 11 years. The majority of the Cook County deaths were from suicidal ingestion, with a few accidents in people using it as a substitute for alcohol. The results are similar to a prior reported cluster of non-fatal intentional ethylene glycol intoxications in Northeastern Illinois in 1996.¹ Toxicology values of ethylene glycol should not be used as a substitute for a thorough death investigation in determining manner of death.
¹ Leikin JB, Toerne T, Burda A, et al. Summertime cluster of intentional ethylene glycol ingestions. *JAMA*, Nov 5, 1997;vol 278, No. 17, p 1406.

Ethylene Glycol, Manner of Death, Toxicology

G91 Patterns of Illicit Drug Use of Prisoners in Police Custody in London, United Kingdom

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After attending this presentation, attendees will gain an understanding of the types of illicit drug use seen in prisoners in police custody in the U.K., and the characteristics of such drugs users.

This presentation will impact the forensic community and/or humanity by allowing understanding of the needs of the drug users and the need for forensic physicians to have a broad general medical background, and thus assisting in determining the type of training needed by forensic physicians to manage such patients in the police setting.

Various national and local strategies have been formulated and implemented directed at reducing illicit drug use, and crime associated with such drug use, in England & Wales. A number of these strategies directly involve police (including drug arrest referral workers in all police stations, drug testing for trigger offenses, needle exchange schemes), and thus directly or indirectly, forensic physicians.

Aims and Methods: Studies undertaken in 1992 identified the proportion of drugs users seen as part of the forensic physician workload and explored the characteristics of such drug users seen in police custody. The aim of the current study was to identify changes that have taken place in the last decade comparing the number and characteristics of drug users seen in police custody. A prospective, anonymised, structured questionnaire survey was undertaken of consecutive, self-admitted illicit drug users seen by forensic physicians in police custody within the Metropolitan Police Service in London, U.K.

Results: In a separate study 30% of detainees seen had dependence on heroin or crack cocaine (1992 – 11%). 113 drug users were studied in 2003.

95.4% gave their consent to participate in the study and complete the questionnaire. Of those consenting, 82% were male, 18% female. Mean age was 28.5y (range 18-49). 80% were unemployed; 29% had no fixed address (1992 – 10%); 65% were Caucasian (1992 – 85%); 18% were Bangladeshi (1992 – 4%). Significant mental health issues (e.g., schizophrenia) were present in 18%; 15% had significant alcohol use; 23% were married or had long term partners; 56% of partners/spouses used drugs. Heroin remains the most frequently used drug – in 93% of cases (1992 – 77%); crack cocaine was used by 87% (1992 – 30%); mean daily cost – heroin GBP 76 (range 20-240), crack GBP 81 (range 20-300). More than 50% of users inject crack and heroin simultaneously. 56% used the intravenous route (1992 – 72%); 25% had shared needles at least once (1992- 41.6%); 100% had accessible sources of clean needles; 6.4% were hepatitis B positive (1992 – 25.7%); 42% were aware of hepatitis prophylaxis (1992 – 9.7%); hepatitis C positive – 20.2% (not recorded in 1992); 3.6% were HIV positive. The mean total length of time of drug use was 7.5y (range 1 month – 20 years); 82% had served a previous prison sentence; 73% of prison sentences were drug-related (drug-defined – 21%, drug-inspired – 74%); 54% had used drugs in prison (1992- 82%); 11% had used needles in prison (1992- 30%); 3% of users stated they had started using in prison. 38% had been on some form of rehabilitation programs previously; 11% had been on Drug Treatment & Testing Orders (DTTO); 5.5% were currently on DTTOs at assessment; 32% had used the services of Drug Arrest Referral Teams in police stations; 10% were in contact with Drug Teams at the time of assessment.

Summary and Conclusions: National drug reduction strategies appear to have had little beneficial influence on patterns of drug use of the population seen in police custody. In the last decade there appears to be a substantial increase in the prevalence of drug use – particularly of crack cocaine. Treatment interventions are either not available, not followed through or not needed. In very general terms, the illicit drug use problem appears to have significantly worsened in the population seen in police custody, although there is evidence that suggests that within this population health education and harm reduction messages appear to have had some positive effects.

Drugs, Police Custody, Forensic Physicians

G92 Child Homicides in Hong Kong: A Retrospective Review of a Ten-Year Period From 1989-1998

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After attending this presentation, attendees will understand the characteristics of child homicide in a predominantly Chinese population and thus be able to compare and contrast with characteristics in their own population.

This presentation will impact the forensic community and/or humanity by providing rare data on child homicide in a predominantly Chinese culture. It also represents a systematic review of all child homicides for all of Hong Kong in a ten year period. It shows similarities with other published material but will also highlight differences which may be cultural in nature.

This paper presents the findings of a retrospective review of all child homicide cases seen in Hong Kong in a ten-year period between 1989 and 1998. In this period there were a total of 799 homicide incidents, with 948 victims and 1666 offenders. Children younger than 4 accounted for 7.3% of victims (n = 69) and between ages 10-15, 8.8% of victims (n = 83). However, there was a much lower homicide rate between ages 5 and 10, accounting for only 2% (n = 19) of all homicide victims. These results are consistent with previous statistics that child homicide had a bimodal pattern, peaking in ‘very early childhood’ and ‘late adolescence’ (Christoffel)¹

Victim-offender relationships, causes of death and manner of death will also be discussed.

i Christoffel, K.K. (1984). Homicide in childhood: A public health problem in need of attention. *American Journal of Public Health*, 74(1), 68-70.

Child Homicide, Hong Kong, Retrospective Review

G93 Evolution of the Intentional Injury Infant Syndrome in Northern France

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In northern France, child abuse represents a daily preoccupation in forensic medicine. The goal of this presentation is to retrospectively study infants hospitalized for subdural hematoma and examined in the forensic department for suspicion of child abuse.

This presentation will impact the forensic community and/or humanity by showing the importance of child abuse and Intentional Injury Infant Syndrome (IIIS) in northern France.

Patients and Methods: During a 36 month period (January, 1999, to December, 2001), 39 infants aged 1 month to 2 years, hospitalized for subdural hematoma, were examined or autopsied (eight cases). Clinical and paraclinical information was collected.

Results: Intracranial hematoma: 22 subdural hematomas were bilateral, 5 were interhemispheric and 12 were unilateral. Five infants had evidence of different ages of intracranial hematomas and 7 had chronic subdural hematomas. Some infants had associated skull fractures. Severe cerebral edema was present in 8 cases.

Ophthalmoscopic findings: 33/39 cases had abnormal ophthalmoscopic findings. Eighteen cases had retinal hemorrhages. Some cases were associated with retinoschisis (3), with other ocular haemorrhages (2), and/or with papilledema (3). Retinal haemorrhages were absent in six cases.

General examination: 25/39 had evidence of child abuse including bruises (12 cases), soft-tissues injuries (5 cases), rib fractures (6 cases), long bone fractures (2 cases), burns (1 case), bilateral testis injury (1 case), severe denutrition with growth and psychomotor retardation (6 cases).

Risk factors: 19 cases had antecedent evidence of child abuse or neglect in their family. Eighteen were first born and the only child. Thirteen infants had previously been abused; in 1 case, the mother was young (less than 18) and in another one she was psychotic.

Facts: In 11 cases, related facts were a history of shaken baby syndrome; in 8 other cases, the history was not correlated with the observed injuries. In 18 cases, injury mechanism was not explained by the caregivers. In two cases, the caregivers have affirmed that they played with their children.

Neuroimaging: In 27 cases, MRI was performed and was abnormal in all cases. They were compared with results obtained in CT imaging, and standard radiography.

Discussion and Conclusion: Only 33/39 subdural hematomas were associated with retinal hemorrhages and determined the classical description of "the shaken baby syndrome." The absence of a traumatic history or a history not correlated with the clinical signs is a major element for the diagnosis and is highly suggestive of child abuse. Associated injuries observed in 50% cases are also pertinent arguments. The use and the utility of neuroimaging to determine the time of the lesions and their origin is very important and discussed. A specific prevention of the IIIS should be developed in France.

IIIS, Child Abuse, Clinical Forensics

G94 Breath Holding Spells Associated With Unexpected Sudden Childhood Death

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After attending this presentation, attendees will be able to recognize a medical condition that may account for sudden death in childhood (greater than 12 months old).

Breath holding spells (BHS) have traditionally been thought to be benign—"something that the patient will outgrow." However, clinical monitoring during some of these "spells" has resulted in the documentation of both severe bradycardia and dispersed QT intervals. A recent study reported ten patients with significant bradycardia that required permanent pacemaker placement.

The authors report the case of a 20-month-old Caucasian male, born by induction via membrane rupture and the use of pitocin at the gestational age of 38 weeks with APGAR scores of 7/8. He was noted to be a "slow starter," requiring vigorous sternal rubs to facilitate normal vital signs. In addition to this he had temperature instability that required his transfer to the Special Care Nursery for monitoring and isolette placement to maintain his temperature. He remained in the hospital for six days after his birth. After discharge he had what his parents described, and his doctor related, as "breath holding spells," occurring two to three times a week. These did not alarm his parents because his older sister also suffered from them. His spells were provoked by crying or coughing, and after those activities he occasionally had a quiet period with apparent apnea. These spells were associated with both pallor or cyanosis that could last for five to ten seconds. Multiple 911 calls were made when the apneic spells progressed into seizure activity lasting more than 30 seconds. At the age of seven weeks, following a coughing episode with an emergency room evaluation, he was found to have oxygen saturation of 88 to 89 percent. While the phlebotomist was drawing his blood he became apneic. He was given supplemental oxygen and became more alert. A follow up chest x-ray revealed a slightly enlarged cardiac silhouette. A subsequent echocardiogram was normal. He was worked up for gastroesophageal reflux disease and placed on omeprazole. In the last four months of his life he had a marked decrease in these episodes.

On the day of his death, while under the care of his aunt, he was placed in his crib after his lunch meal. No articles of potential respiratory compromise were in the crib. He awoke with a cry after his nap, and when his caregiver checked on him 20 minutes later, he was found unresponsive and a 911 was called. Attempts at resuscitation were unsuccessful.

Postmortem exam revealed no anatomic cause of death. Toxicology, blood cultures, histology, postmortem radiographs, and vitreous electrolytes were unremarkable. Detailed cardiac pathology was normal.

Breath holding spells are a frequently observed event in infancy and early childhood. Their association with sudden and unexpected death is rare. Typical cases begin between six and twelve months of age, and rarely last past age four. Breath holding spells have been associated with pallor and/or cyanosis, and severe cases involving convulsions have been described. Several causes and explanations have been proposed, but proof of etiology is not found in most cases. Autonomic dysfunction and paroxysmal vagal overactivity have been felt to play a significant role.

The death of this child represents a case of paroxysmal vagal overactivity with a fatal outcome. While rare, when the history is consistent with this premorbid diagnosis, and no alternative explanation is found, this cause of death should be a consideration.

Breath Holding Spells, Paroxysmal Vagal Overactivity, Sudden Unexpected Death in Childhood

G95 An Interdisciplinary Approach for Diagnosis and Age Estimation of Infants' Fractures in the Course of the Autopsy

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After attending this presentation, attendees will understand a scheme for diagnosis and age estimation of infants' fractures during autopsy.

This presentation will impact the forensic community and/or humanity by diagnosing and estimating the age of infants' fracture as an important contribution to the diagnosis of the battered child syndrome. Fractures of different ages are suspicious, and dating the fractures allows some scrutiny in assessing whether the ages are in accordance with the details given by the accused. Moreover, the implementation of an interdisciplinary approach involving forensic pathologists, osteopathologists, and radiologists allows use all resources and enhances cooperation with other disciplines.

Age assessment of infants' fractures plays an important role in the diagnosis of the battered child syndrome. In postmortem cases an interdisciplinary scheme involving careful external investigation, skeletal survey, autopsy, radiography, and osteo-histology has proven useful for dating infants' fractures. Four postmortem cases of infants with multiple fractures of different ages due to child abuse (a total of 48 osseous lesions) were evaluated. Early stages of fracture healing processes were dated histologically by the extent of periosteal thickening, osteoid production and calcification of soft callus. In advanced healing processes the osseous apposition rate defined by the width of the newly formed trabeculae was measured for age estimation of the fractures. Multiple influencing variables must be considered. Hence, dating the osseous lesions leads not to one single day, but to a time-interval when the fracture has occurred. The results of the cases presented indicate the forensic relevance of defining a time interval of the injury, which often allows some scrutiny in assessing whether the ages are in accordance with the details given by the accused. Also, fractures of different ages are a strong indicator of child abuse. Further work in this field will lead to more precise dating of infants' fractures.

Battered Child Syndrom, Infants' Fractures, Osteo-Histology

G96 Are Retinal Hemorrhages Diagnostic of Shaken Baby Syndrome? What Really Killed Baby Cooper

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The goal of this presentation is to discuss the inherent limitations of the current state of medical knowledge regarding the specificity and causal connection of retinal hemorrhages and Shaken Baby Syndrome.

Bilateral extensive retinal hemorrhages accompanying evidence of childhood head trauma (subdural or subarachnoid hemorrhage) are considered virtually diagnostic (pathognomonic) of Shaken Baby Syndrome by most pediatricians and ophthalmologists. The association of retinal hemorrhages and Shaken Baby Syndrome, with or without impact, is a subject of increasing debate in the forensic medicolegal community. The purpose of this presentation is to describe the diagnostic dilemma presented by the suspected child abuse death case of 3 month 24 day old Baby Cooper, who was alleged to be the victim of Shaken Baby Syndrome (SBS) while in the care of his state licensed daycare provider.

On December 18th, 2002, Baby Cooper's daycare provider reported that he didn't look right as he lay sleeping 45 minutes after being placed down for his afternoon nap. Baby Cooper's "little cheeks were purple." He was picked up and it was described that "his little arms went limp." 911 was immediately called. Pending emergency personnel arrival, rescue breathing was started as the daycare provider talked to the 911 operator. The paramedics arrived within five minutes. By that time Baby Cooper was breathing again but had an irregular heart rhythm (bradycardia). Paramedic assessment in the field revealed no evidence of trauma. The daycare provider denied any intentional or accidental traumatic injury. Baby Cooper was quickly transported to San Diego Children's Hospital. Upon arrival, Emergency Department medical staff noted that Baby Cooper's pupils were fixed and dilated, he had no pulse, and could not breathe on his own. He was intubated and after 45 minutes of resuscitation, including CPR, Baby Cooper's heart began to beat on its own but his respirations had to be maintained on a ventilator. A CT scan two hours after hospital admission revealed brain swelling consistent with global hypoxic-ischemic injury, including complete obliteration of the sulci and basilar cisterns. The admitting pediatrician believed he saw a frontal lobe contusion on the CT scan. Abdominal and pelvic CT scans were negative. Possible blood was noted in the posterior chamber of baby Cooper's eyes. A neurological examination concluded that Baby Cooper was probably brain dead. A trauma surgeon examination concluded there was no external evidence of trauma except for a bruise on Baby Cooper's chest caused by the CPR done in the Emergency Department of the hospital. Baby Cooper's initial blood studies, done within one hour of hospital arrival, revealed that his blood sugar was 372, his blood gas had a pH of 7.02, his sodium level was elevated to 160 and his potassium was elevated to 11.5. Baby Cooper's initial coagulation studies revealed a severe coagulopathy (a PT of 17, a PPT of greater than >130, and a low fibrinogen level of 44). Three hours post hospital admission an ophthalmology examination revealed bilateral retinal hemorrhages extending out to the periphery. Chest x-ray noted the child's lungs to be hyperinflated. A complete skeletal survey the following day was negative. One hour before a blood culture draw, Baby Cooper received several IV injections of an antibiotic. Brain death was declared 48 hours after admission. Organ donation took place 64 hours after admission, preceded by anticoagulant therapy.

Baby Cooper's prior medical history included normal birth weight, a prolonged vaginal delivery, mild jaundice and significant head molding. At two weeks Baby Cooper underwent an unremarkable circumcision. At six weeks Baby Cooper was diagnosed with microcephaly (head circumference below the 5th percentile). Baby Cooper's diet consisted of maternal breast milk either via nursing or via bottle. In the month before hospital admission Baby Cooper had sporadic episodes of constipation (up to four days) and days when he would not eat well.

At autopsy, anoxic cerebral changes ("respirator brain") with some lymphocytic infiltration, questionable "Traumatic Axonal Injury" ("focal retraction balls") and superficial hemorrhagic injury of the upper spinal cord and cerebrum were noted. No frontal lobe contusion, subdural hematoma, subarachnoid hemorrhage, or other traumatic brain injury was present. Baby Cooper had extensive bilateral retinal hemorrhages, and unexplained subdural bleeding in the lower thoracic spinal column. Toxicology was negative. After two months, the medical examiner signed an amended death certificate and concluded that Baby Cooper was the victim of Shaken Baby Syndrome and ruled the manner of death as homicide.

The trial of the day care provider was a battle of conflicting medical experts. The prosecution contended that Baby Cooper died of Shaken Baby Syndrome because of the rapid onset of brain swelling, the superficial spinal cord and cerebral hemorrhagic injury and the bilateral retinal hemorrhages. Defense medical experts concluded that Baby Cooper stopped breathing because of a Sudden Infant Death Syndrome event (SIDS) that was resuscitated (known as "a near-miss SIDS" or a "resuscitated SIDS" case). All the findings at autopsy were the result of Baby Cooper being kept alive on a ventilator for more than two days before he was formally declared dead. The retinal hemorrhages were caused by

the child being given vigorous CPR while the lungs were hyperinflated. The severe anoxic changes with swelling caused the superficial hemorrhagic and cerebral injury due to crushing against the skull, together with a patient having a severe clotting disorder upon admission to the hospital.

At trial, based solely upon the medical findings, the prosecution claimed that the daycare provider became increasingly irritated with Baby Cooper's crying, and in a moment of frustration shook him to death. In her defense the daycare provider testified she did nothing to injure the child and called numerous character witnesses who testified that, over a fifteen year period, they had children in her daycare or were frequent visitors to the daycare. They testified to her love, understanding, and abilities to care for the needs of children. Character witnesses also testified that children were always well cared for, and that the daycare provider never lost her temper or became frustrated with a child. After two six-week jury trials (the first jury trial ended in a deadlock), the daycare provider was acquitted of all charges. The controversial medical evidence along with the character evidence convinced the jury that the daycare provider was not the type of person who would be capable of harming an infant child.

In reviewing a case of suspected Shaken Baby Syndrome death, all aspects of the case must be integrated before drawing any conclusion regarding cause and manner of death. Attention should be paid to post hospital admission medical treatment and diagnostic tests, along with a careful evaluation of secondary effects of medical care. Extensive peripheral retinal hemorrhages are part of a constellation of findings helpful to diagnose some cases of Shaken Baby Syndrome. Retinal hemorrhages in the absence of specific brain injury (subdural hemorrhage, subarachnoid hemorrhage, or contusions) present a diagnostic dilemma.

Shaken Baby Syndrome, Retinal Hemorrhages, SIDS

G97 Fatal Craniocerebral Trauma With Hemorrhagic Retinopathy in an Infant: Abuse or Accident?

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After attending this presentation, attendees will be aware of the limitations of certain ocular findings that are considered diagnostic for inflicted childhood neurotrauma and remember the importance of a thorough investigation before determining if a fatal pediatric head injury is intentional or unintentional.

This presentation will impact the forensic community and/or humanity by demonstrating the importance of a thorough investigation for all cases of fatal pediatric head injury.

Severe hemorrhagic retinopathy, retinoschisis and perimacular folds have been considered characteristic of inflicted childhood neurotrauma (Shaken Baby Syndrome), rarely occurring in children with intracranial hemorrhage from other causes. Observational reports and evidence-based inquiries have begun to question those assumptions. This is a report of a case of a 7-month-old infant who was left in the care of his 11-year-old brother and 10-year-old cousin for about two hours. When his mother returned from the store she found the infant unresponsive. He was transported to the local hospital where a cranial CT scan showed a non-displaced skull fracture adjacent to the coronal suture with widening of the sagittal suture, an extensive scalp hematoma, and a mixed density left subdural hematoma. Cerebral edema was noted, with diffuse effacement of the sulci over the left cerebral hemisphere and a suggestion of transtentorial herniation. After the infant was transferred to a tertiary medical center, a pediatric ophthalmology consult reported extensive bilateral retinal hemorrhages with premacular subhyaloid hemorrhage in the right eye and macular edema of the left eye consistent with a non-accidental head injury. A skeletal survey revealed no fractures other than the parietal skull fracture described on the initial cranial CT examination. A repeat cranial CT scan

showed poor gray-white differentiation consistent with severe anoxic brain injury. Clinical brain death was determined about 20 hours after admission.

Major findings at the autopsy included multiple (6) contemporaneous acute skull fractures (consistent with a crush injury from quasi-static loading), subscalpular extravasated blood, subgaleal and epidural hemorrhage, subdural hematoma, diffuse subarachnoid hemorrhage, severe anoxic brain injury and a right cortical cerebral contusion. Postmortem ophthalmologic findings consisted of extensive bilateral retinal hemorrhages; intrascleral hemorrhages; retinoschisis and a perimacular retinal fold in the right eye; macular edema of the left eye; and intradural, subdural, and subarachnoid hemorrhage of the optic nerves.

Subsequent investigation revealed that the 10-year-old cousin had placed the infant in a baby carriage and taken him and his sister outside while the 11-year-old brother played basketball with friends. Investigators doubted her story that when she came back inside she lifted the infant out of the stroller with one hand and put the stroller away with her other hand. Subsequent investigation and examination of the stroller showed that if the frame latch was not secure, releasing the latch on the handle would permit the stroller to collapse and lurch forward into the legs of the young babysitter, causing her to fall onto the stroller. Recent evidence-based reports have questioned the diagnostic specificity of certain ocular findings in infants/young children with brain injuries. Statements in the medical literature that retinoschisis and perimacular circular folds are diagnostic of shaken baby syndrome are not supported by objective scientific evidence. It is imperative that ocular findings are not viewed out of context and a thorough investigation is conducted before determining whether a fatal pediatric head injury is intentional or unintentional.

Shaken Baby Syndrome, Inflicted Childhood Neurotrauma, Retinal Hemorrhages

G98 The Evidence-Based Medicine Paradigm Shift and Forensic Pathology

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Attendees will learn that the concepts of Evidence-Based Medicine are not being used in forensic pathology writings, although some of the terminology is being applied in polemics about the Shaken Baby Syndrome.

This presentation will impact the forensic community and/or humanity by assisting forensic pathologists in being better able to judge the validity of assertions about Abusive Head Injury and/or Shaken Baby Syndrome couched in terms of Evidence Based Medicine.

Hypothesis: The term Evidence-Based Medicine (EBM) has, so far, been utilized in the Forensic Pathology context to gain entry to the current literature for an editorial, an opinion paper, and a single case report, all attempting to discredit the concept of Shaken Baby Syndrome. Such papers might not be given as much consideration without the appearance of fluency with the issues raised by EBM.

Synopsis: Evidence-Based Medicine (EBM) is an approach to scientific decision-making in selecting treatments for well-defined diseases. Prospective, double-blinded, randomized controlled trials (RCTs) of therapies are given the highest weight, while other forms of comparing health interventions are ranked lower in the EBM hierarchy. The term Evidence-Based as used in the forensic pathology literature to date asserts that no evidence exists, or only weak evidence exists, for what is called Shaken Baby Syndrome. EBM nomenclature has not been used in other contexts to establish or refute other diagnoses in health-related papers, whether in medicine, respiratory care, or dentistry.

Evidence-Based Medicine (EBM) concepts were introduced to a broad readership in a publication in the Journal of the American Medical Association in 1992. The then editor of the JAMA, George Lundberg, referred to the JAMA itself as "The Journal of Physician Behavior

Change.” He was describing his vision for the impact of the articles presented in the Journal. EBM has rapidly achieved widespread acceptance and is achieving “Physician Behavior Change.” Print and electronic journals have sprung up to publish articles using the term, and at times even applying the concepts.

Use of the term “Evidence-Based Medicine” has not been uniformly associated with appropriate appreciation of EBM’s goals nor application of its techniques. Reviewing the actual EBM literature reveals multiple articles complaining that others use their terminology but not their concepts. Still other articles discuss the phenomenon of EBM and urge further study of the validity of its assumptions. Much of the literature dealing with the results from applying EBM describe large studies (called mega-studies) and substitutes for mega-studies by literature analyses (called meta-analyses), both seeking to achieve more “Statistical Power” (statistical significance) by comparisons of treatment in similar, large groups. Additionally, other articles call for Evidence-Based comparisons of various forms of intervention from toilet-training to cancer treatments.

A review of the literature accessed through PubMed (<http://www.ncbi.nlm.nih.gov/PubMed>) searching for the terms “Evidence-Based Medicine” and “Shaken Baby” reveals only three papers: one is a literature review, the second is a single case report with a brief literature review, and the third is a comment published in the same issue as the case report. Both of the literature reviews fail to provide a citation to describe the classifications used to assert the weakness(es) of existing “Evidence.”

Determining whether the terminology from EBM is used accurately or not requires the reader to review the goals and techniques of EBM. Such a review leads one to realize that the terms and techniques of EBM are misapplied in these three publications. Abusive Head Injury is not a “treatment” applied prospectively and randomly with case-controls (RCTs) in a mega-study.

The published reports of cases, case series, or studies involving Abusive Head Injuries or Shaken Babies are not legitimate subjects for meta-analyses: Those studies which support statistical inference (have sufficient “Statistical Power” on their own) gain no benefit from having their populations and selection criteria diluted. Those studies which do not support statistical inference are too dissimilar both in their populations and selection criteria to be legitimately combined. When such heterogeneous populations are combined for analysis, the result is at best an admixture, not the blend meta-analysis seeks. It is a priori apparent that every attempted meta-analyses of such disparate groupings must lack all true “Statistical Power,” whether for or against any given hypothesis.

Evidence-Based Medicine, Abusive Head Injury, Shaken Baby Syndrome

G99 Sequential SIDS or Double Homicide? Challenges of Delayed Investigation of Potential “Subtle” Child Homicides

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After attending this presentation, attendees will understand the challenges of delayed investigation in sequential infant deaths.

This presentation will impact the forensic community and/or humanity by demonstrating successful coordination of investigation of sequential childhood deaths. Experience illustrates a truism that needs to be remembered in all death investigation; namely, that all autopsy, biochemical and toxicologic data must be considered in the context of a coordinated investigation.

A stepfather placed his five-month old white female child on a living room love seat for a nap at 9:00 a.m.. According to police records, the step-father went to sleep across the room on a couch. He awoke a few hours later to find the infant unresponsive. The infant was transported to the regional hospital where she was pulseless and apneic with a rectal temperature of 93.0° F. The initial police investigative report made no mention of syringes or insulin at the scene of death. Little information regarding the stepfather’s medical history or background was obtained at that time.

At autopsy, the infant was normally developed and well nourished, with a length and weight appropriate for age. No contusions, abrasions, scars, or other signs of old or recent trauma were noted. Evidence of medical intervention included an intraosseous catheter in the right tibia, a single needle puncture wound in the left antecubital fossa, three needle puncture wounds in the right antecubital fossa, and a single needle puncture wound on the anterior right lower leg. No additional puncture wounds were seen. Postmortem x-rays revealed no acute or old skeletal lesions. There were no petechial hemorrhages in any of the internal thoracic organs, and no congenital organ anomalies were identified. Abundant hemosiderin-laden pulmonary macrophages were detected. Additional postmortem microscopic, microbiologic, and toxicologic studies were unrevealing. Vitreous glucose levels were not obtained due to insufficient sample quantity. The cause of death was classified as sudden infant death syndrome (SIDS).

Two years after the first child’s death, the couple had moved to a different location, in a different police jurisdiction. A two-month-old male sibling was discovered by the father not breathing. Emergency medical personnel arrived to find the child unresponsive and pulseless on the sofa, with the father, again the sole caregiver, pointing toward the child without attempting resuscitation. The local hospital documented a rectal temperature of 92.6° F approximately one-hour and ten minutes after the father claimed the child was last known to be alive. Autopsy revealed a developmentally normal child, with no injuries. Gross and microscopic examination did not reveal evidence of natural disease, although abundant hemosiderin-laden macrophages were detected in the lungs. Resuscitative attempts had been aggressive and puncture marks were in the bilateral femoral areas; however, no other sites suspicious for injection were noted at autopsy. Postmortem microbiology and metabolic screening were non-contributory. Toxicology for standard drugs of abuse, salicylate and acetaminophen was negative. Vitreous fluid was not obtained. Because of additional investigative information, a postmortem blood test for insulin and C-peptide was done. Although the ratio of insulin to C-peptide was suspicious for exogenous insulin injection, the relative postmortem stability of these compounds is not known.

After the second case was reported to the medical examiner office, a coordinated investigation into both of these cases was initiated, with re-evaluation of the first death. Following a comprehensive investigation, utilizing both correlative interpretations and essential interagency cooperation, the cause and manner of death in the initial case was changed to undetermined, while the second case was similarly left as undetermined. These cases illustrate several points to be considered in sequential child death investigations. First, multijurisdictional and multiagency coordination was crucial because the family moved into another police jurisdiction before the second death. Secondly, no suspicious circumstances came to light during initial investigation of the first child death. In retrospect, some red flags were evident and should have been detected with current investigative protocols. Third, interpretation and differential diagnostic implications of hemosiderin-laden pulmonary macrophages in infants will be briefly described. Finally, the difficulty of interpretation of postmortem insulin and C-peptide levels will be described. Limited experimental data obtained during attempted validation of this postmortem biochemical test will be presented.

SIDS, Insulin, Sequential Deaths

G100 Case Presentation: Infant Death Due to Epidermolysis Bullosa

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The goal of this presentation is to acquaint the forensic community with the manifestations of epidermolysis bullosa, so that they might include this disease process in their differential when confronted with similar infant deaths.

When confronted with an infant death, this presentation will impact the forensic community and/or humanity by demonstrating the importance for the forensic staff to consider the possibility of a natural disease process with manifestations that could mimic traumatic injuries. The skin lesions of epidermolysis could be mistaken for thermal injuries if a thorough history is not available, and if the possibility of a disease is not considered.

This presentation reviews a case of death caused by complications of epidermolysis bullosa in a 17-month-old Asian infant. This child began to form skin bullae in the diaper area days after birth; these soon spread to include the extremities and face. A biopsy-proven diagnosis of epidermolysis bullosa simplex (Dowling-Meara subtype) was given at age 2 months. Mucosal involvement became apparent when white plaques were noticed in the oral cavity. Recurrent reflux hindered feeding, and resulted in a lack of adequate weight gain. Persistent respiratory difficulties necessitated tracheostomy tube placement at the age of 4 months. The tracheostomy site soon became infected; although treated, a mucoid discharge, on occasion culture-positive for *Staphylococcus aureus* and *Pseudomonas aeruginosa*, continued to drain from the tracheostomy site. A gastrostomy tube was placed at the age of 5 months, due to the child's difficulty swallowing. By his seventeenth month of life, the child's condition had seemed to stabilize and even slightly improve, when, one afternoon, he was found gasping for air; when the father attempted to suction the tracheostomy site, the child stopped breathing. An ambulance transported the child to a nearby hospital, where he was pronounced dead.

An autopsy was performed by the medical examiner's office. The small-for-age body had numerous scattered skin lesions, ranging from unruptured, thin-roofed bullae containing clear fluid, to superficial, red, weeping erosions, to red-brown, dried erosions with a crusted base. The teeth were dysplastic. The fingernails and toenails were absent; the nailbeds had erosions. The oropharyngeal and laryngeal mucosae were markedly edematous, with multifocal ulceration, scarring, and stenosis. The trachea and mainstem bronchi had superficial mucosal erosions as well. Hematoxylin-eosin stained sections of these mucosal erosions had extensive chronic inflammation and submucosal fibrosis. Sections of lung parenchyma had mucus plugs in scattered bronchioles. There was no evidence of trauma. The cause of death was listed as: "Complications of epidermolysis bullosa."

Epidermolysis bullosa is a group of rare genetic disorders that result in fragile epithelium that splits and blisters when subjected to minor trauma. Subtypes are classified by the level of the disrupted epithelium or by genetic basis in newer classifications. Epidermolysis bullosa simplex, due to mutations in genes forming keratins, results in splitting within the superficial layers of the epidermis. Junctional epidermolysis bullosa is due to mutations in genes forming hemidesmosomes or anchoring filaments, and results in separation of the basal cell layer from the basement membrane. Dystrophic epidermolysis bullosa is a result of mutation of the gene forming type VII collagen, and causes separation of the epidermis from the underlying dermis. These disorders range from mild to lethal, and can present at birth or later in life.

When presented with an infant death, it is important for the forensic staff to consider the possibility of a natural disease process with manifestations that could mimic traumatic injuries. The skin lesions of epidermolysis bullosa could be mistaken for thermal injuries if a thorough history is not available, and if the possibility of a disease process is not considered.

Epidermolysis Bullosa, EB, Epidermolysis Bullosa Simplex

G101 Child Abuse by Another Child: Can it Happen?

Darinka Mileusnic-Polchan, MD, PhD, University of Tennessee Medical Center; Knox County Medical Examiner's Office, 1924 Alcoa Highway, Knoxville, TN 37920; and Sharon O'Connor, Cook County Office of the Medical Examiner, 2121 West Harrison Street, Chicago, IL 60612*

The goal of this presentation is to recognize and appreciate child abuse by another child as a special entity with far reaching professional, ethical, and social consequences.

This presentation will impact the forensic community and/or humanity by demonstrating how child abuse by another child is an extremely rare occurrence; however, when it happens it should be promptly recognized. To assure proper handling of these distressing cases in an efficient and sensible manner, team work of all involved investigators, pathologists, clinicians, and social workers appears to be of paramount importance.

In this presentation the authors describe a rare and unusual variant of child abuse in which the investigation focused on ruling out a preschool child as the perpetrator. The first part of the presentation outlines the investigative process, highlighting the importance of the alternative approach to examination and specific methods during the inquiry of the suspects. Following that the authors discuss autopsy findings such as the complex nature of the injuries and particularly the peculiar ocular involvement. Correlation between the pathology and proposed mechanism(s) of injury is emphasized.

Secondly, ethical, social, and professional issues concerning all involved parties in this daunting and disturbing case are analyzed. Differing opinions and crucial disagreements among child abuse experts regarding workup and findings in this case are disconcerting. These fundamental differences might reflect to a certain extent doubts and emerging crises that are becoming increasingly apparent in the child abuse field. In the end the authors analyze these issues in terms of outcome and follow-up of this tragic event.

Blunt Force Injuries, Retinal Hemorrhage, Social Services

G102 Acute Pancreatitis in a 2½-Year-Old Child: A Fatal Therapeutic Complication of Polyethylene Glycol (PEG)-L-Asparaginase

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The goal of this presentation is to present to the forensic community a case report and review of an unusual cause of acute pancreatitis. The authors discuss therapeutic effects and complications of the administration of PEG-asparaginase as a chemotherapeutic agent.

This presentation will impact the forensic community and/or humanity by heightening awareness in the forensic community of an unusual cause of acute pancreatitis, stressing the importance of gathering health history in a patient diagnosed with acute pancreatitis, and informing the medical community of this possible complication of the use of PEG-asparaginase and to raise the index of suspicion so that preventative measures may be applied.

This presentation consists of a case study of a female toddler who died suddenly from acute pancreatitis, a complication of chemotherapeutic intervention for Acute Lymphoblastic Leukemia (ALL). The authors review the pathogenesis, incidence, and diagnostic workup of PEG-L-asparaginase-induced acute pancreatitis.

A 2 ½-year-old white female was diagnosed with ALL after the onset of easy bruising, nosebleeds, and lower leg (shin) pain. Induction therapy consisted of an antineoplastic and palliative regimen of vincristine, dexamethasone, pegaspargase (PEG), cytarabine, and methotrexate. Remission was induced as the blast counts, which initially ranged from 10 to 14% on peripheral smear, became essentially absent. The therapy was complicated by hypertension and sinus bradycardia, which prompted treatment with enalapril, an angiotensin-converting enzyme inhibitor. The symptoms resolved by discharge. For approximately one week thereafter, the patient's blood count remained free of leukemic cells. Approximately two weeks post induction chemotherapy, the patient developed abdominal pain without fever. The patient's mother attributed two episodes of vomiting to dexamethasone prescribed to the patient. On the morning of death her mother administered an over-the-counter oral stomach remedy and reported that the toddler had difficulty breathing. The emergency medical service was notified and transported the patient to the hospital where, despite aggressive resuscitation attempts she was pronounced dead in the emergency department.

Due to the sudden and clinically unexpected nature of the patient's death while in apparent remission, an autopsy was requested by the local coroner. At autopsy the body was that of a normal but pale female child with no congenital anomalies. Internal examination exhibited hemorrhagic ascites with petechiae of the small bowel mesentery and omentum. The pancreatic tail was enlarged and violaceous. Microscopical examination revealed multifocal necrosis, hemorrhage, and acute inflammatory cellular infiltrates in the pancreatic parenchyma. Inflammation extended to the peripancreatic fat, small intestine and appendiceal wall. Other findings included hepatic steatosis and a focal intraluminal thrombus in a pulmonary artery of the right lower lobe. Histopathological examination of the post-mortem bone marrow confirmed the presence of all three hematopoietic cell lines, but severe autolytic change precluded unequivocal recognition of blasts. No gallstones, structural anomalies of the gastrointestinal tract, or other risk factors for pancreatitis were noted. The cause of death was ascribed to acute hemorrhagic pancreatitis with the contributing factor of ALL, status post chemotherapeutic intervention (PEG-asparaginase).

Asparaginase is an enzyme manufactured by certain bacteria, plants and animals. *Escherichia coli* bacteria supply asparaginase used for medical purposes. Asparaginase catalyzes the hydrolysis of the amino acid, asparagine, to aspartic acid. Neoplastic cells, especially those of ALL, have low levels of asparagine synthetase. For this reason they fail to produce sufficient asparagine to survive and require an exogenous source of the amino acid. Asparaginase, a chemotherapeutic agent for ALL, eliminates exogenous asparagine by hydrolyzing serum asparagine into nonfunctional aspartic acid and ammonia. Asparagine is needed by ALL cells to build proteins for cellular structure and enzymes. Documented complications of asparaginase include allergic reactions, chemical hepatotoxicity, thromboembolic coagulopathies, hyperglycemia, and acute pancreatitis. Clinical acute pancreatitis is noted in about 1% of patients receiving asparaginase, and rarely results in death.

Asparaginase is used in several forms in conjunction with other chemotherapeutic agents to combat ALL. The L-asparaginase form produced by *E. coli* has been reported to have a lower rate of acute pancreatitis than that of asparaginase alone. In an effort to reduce the incidence of immunogenicity, polyethylene glycol (PEG) is added to L-asparaginase.

PEG-asparaginase therapy is a known cause of acute pancreatitis in the absence of other risk factors. The implications for the patient can be serious: in rare instances significant morbidity and, as this case study demonstrates, even mortality may occur. Acute pancreatitis must be considered in the differential diagnosis of gastrointestinal symptoms in the leukemic patient treated with PEG-asparaginase.

Fatal Acute Pancreatitis, PEG-asparaginase, Acute Lymphoblastic Leukemia

G103 Increased Risk of Sudden Infant Death Syndrome (SIDS) Among Infants Harboring the Apolipoprotein E-4 Allele: Genetic and Pathologic Similarities to Alzheimer's Disease (AD)

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After attending this presentation, attendees will learn that there is increased apoptotic neurodegeneration in SIDS, which may constitute the proximate cause of death, and that similar to AD, the risk of SIDS may be enhanced among those individuals harboring the Apolipoprotein E-4 allele.

Because of the 96% incidence of increased numbers of Alz-50 immunoreactive neurons in SIDS, this microscopic feature may be useful in establishing the criteria for an objective diagnosis, if convincingly confirmed. This presentation will impact the forensic community and/or humanity by providing direction for future investigation, along the lines of altered cholesterol metabolism in SIDS, and the relationship between the severity of Alz-50 pathology and dose of the ApoE-4 allele.

Introduction: A number of studies suggest a neuropathologic overlap between Sudden Infant Death Syndrome (SIDS) and the dementing disorder Alzheimer's disease (AD). AD is a neurodegenerative disease characterized by the pathologic presence of neurofibrillary tangles and accumulation of the peptide β -amyloid, predominantly in the temporal cortex and hippocampus. Pre-tangles (early form of the neurofibrillary tangle) and degenerating neurons in AD and increased numbers of neurons in SIDS medulla and temporal cortex are reactive with Alz-50 antibody compared to respective control populations. Likewise, increased levels of the neurotoxin β -amyloid are uniformly present in AD brain and have been observed in the temporal lobe of many SIDS infants. Studies of non-demented individuals with coronary artery disease (CAD) suggest that Alz-50 immunoreactive neurons occur in advance of AD-like β -amyloid accumulation. An increased risk of developing AD is associated with increased frequency of the Apolipoprotein E-4 (ApoE-4) genotype. Three ApoE alleles taken two at a time are possible (2/2, 2/3, 3/3, 2/4, 3/4 and 4/4). Likewise, there is an increased risk of CAD if an individual retains the ApoE-4 genotype, reportedly because of associated elevations in circulating cholesterol levels. Elevated circulating cholesterol is prevalent in AD and cholesterol is emerging as a factor promoting production of β -amyloid in the disorder. Furthermore, CAD in early life increases the risk of developing AD.

Scientific Objectives: (1) Determine if there is increased prevalence of the ApoE-4 genotype among infants dying of SIDS compared to age-matched infants dying of known causes; (2) Provide previously published data indicating that Alz-50 antibody highlights neurons undergoing apoptosis; (3) Demonstrate that there are significantly increased numbers of Alz-50 immunoreactive neurons throughout the length of the respiratory nuclei in the medulla of SIDS infants, thus suggesting that neurodegeneration may underlie the cause of SIDS.

Methods: The authors investigated 115 infants > 4 weeks of age and < 12 months of age (81 SIDS and 34 non-SIDS) for ApoE genotype. The cause of death was diagnosed using 1991 NICHD criteria for SIDS and standard protocols for known causes (non-SIDS). ApoE-4 genotype was evaluated in brain tissue using real-time PCR methods. Temporal cortex and medulla from a subset of these infants were evaluated for Alz-50 immunoreactive neurons in 50 μ m vibratome sections. Some sections were

counterstained for condensed DNA (apoptotic bodies) with propidium iodide subsequent to Alz-50 immunohistochemistry and RNAase treatment (to degrade all RNA).

Results: The mean age at death was 94.5 ± 7.8 days among infants with the E-4 allele and 93.2 ± 12.4 days among infants without the E-4 allele. The ApoE-4 allele occurred in 29.95% of the infant population and was absent in 70.15% of the infants. The ApoE-4 allele frequency was increased in SIDS (16.75%) compared to infants dying of known causes (7.6%); this difference was significant using the Armitage's trend test ($P < 0.05$) and marginally significant ($P = 0.086$) using a linear-by-linear chi square assessment. There was a 2.2-fold increased risk of SIDS (OR, 0.76 – 6.46) if an infant harbored the ApoE-4 allele.

Ninety-six percent of SIDS infants exhibit significantly greater numbers of Alz-50 immunoreactive neurons in temporal lobe and throughout the extent of, and exclusively in the dorsal and ventral respiratory nuclei and the reticular activating nuclei of, the dorsal medulla. Essentially all Alz-50 immunoreactive neurons in SIDS brain exhibit condensed bodies of DNA stained by propidium iodide (apoptotic bodies). Such apoptotic bodies were confined to the nuclear envelope and did not occur in the absence of an Alz-50 immunoreactive neuron.

Discussion: There is a greater than 2-fold increase in the ApoE-4 allele frequency among infants dying of SIDS compared to age-matched infants dying of known causes. This is similar to the just over 2-fold increase in the ApoE-4 genotype among individuals with AD compared to age-matched non-demented non-heart disease controls. This genetic difference in SIDS is concomitant with a marked increase in features suggestive of early AD neuropathology. Because of the anatomic link between the location of enhanced apoptosis in the medulla and control of involuntary respiration and arousal from sleep, SIDS may be a neurodegenerative disorder of infancy. Future multi-site studies will be required to confirm this possibility. Due to the link between ApoE genotype and cholesterol metabolism, investigation of cholesterol levels in SIDS brains and circulation may be fruitful.

Conclusions: SIDS may be the AD of infancy, and as in AD, the influence of ApoE genotype may contribute to the severity of neuropathology in SIDS.

SIDS, Alzheimers-Like Neuropathology, Apolipoprotein E Genotype

G104 Ano-Genital Findings in Sexually Abused Children in Cases With a Conviction

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After attending this presentation, attendees will understand that ano-genital findings at colposcopic examination are not major determinants for conviction at court.

This presentation will impact the forensic community and/or humanity by assisting professionals in understanding that specific physical findings of the ano-genital area are seldom found in sexually abused children; the history told by the child remains paramount in cases of sexual abuse.

The department of Forensic Medicine, Aarhus, Jutland, Denmark, performs, at the request of the police, colposcopic examinations of children suspected to be sexually abused. Included in the research during the period from January 1, 1996 to September 1, 2002, were 482 children, giving an incidence of 1,48/ 10,000 children from birth to 16 years of age in Jutland, Denmark. This study includes those cases in which the perpetrators were convicted at court because of substantial evidence of sexual abuse of the child.

Results: One Hundred sixty-five perpetrators were convicted at court, involving 149 girls and 11 boys, with a median victim age of 13.5 years for boys and 10.6 years for girls (range 0-15 years of age). Forty-one children reported touching of genitals; 22 attempts of vaginal, anal, or oral penetration, 21 vaginal penetration; 5 anal penetration; 10 fellatio; and 33 a combination of the above (the rest were other or unknown). Twelve children were examined within 24 hours after the last sexual assault, 36 within a week and the rest more than a week later.

Colposcopic findings: Sixty-one girls had normal internal genital findings (vagina, hymen, vestibulum, labia minor). Ninety-one had abnormal findings, all non-specific findings except for 10 who had lesions. One hundred thirty-three had normal external genital findings (labia majora, perineum, perianal area). Fifteen girls had abnormal external genitals, of which six were lesions of the labia majora or/and perineum. Two boys had abnormal but non-specific findings of the penis and four of the anus. Abnormal findings of the anus were found in 22 girls; of the abnormal anal findings, seven were lesions. Thirty girls had an incomplete cleft of the hymen, but only eight were complete posterior clefts.

Abnormal ano-genital findings were not significantly correlated to conviction at court; however, the age of the child was.

Conclusion: The history from the child, not physical findings, remains the single most important feature in cases of sexual abuse.
References:

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Child Sexual Abuse, Colposcopic Examination, Conviction at Court

G105 The Contribution of Computerized Image Analysis to the Diagnosis of Munchausen Syndrome by Proxy

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After attending this presentation, attendees will understand the difficulty in diagnosing child abuse, in particular Munchausen syndrome by proxy, and understand the advantages of computerized image analysis for child abuse diagnosis.

This presentation will impact the forensic community and/or humanity by demonstrating the use of new technologies, such as computerized image analysis, when child abuse is suspected

Munchausen syndrome by proxy cannot be diagnosed by objective means unless the perpetrator is caught in flagrante delicto (such as when using video surveillance). A psychiatric report on its own does not constitute sufficient proof for such a diagnosis. The authors present a case that shows how new diagnostic means may be useful in the practice of clinical forensic medicine in general, and in the case of the Munchausen syndrome by proxy in particular.

The case concerns a female infant with a past history of hematomas described as "spontaneous" by the pediatricians. The investigation started when the infant, aged three months, was admitted to the hospital for a fracture of the skull, thought to be accidental on the basis of the initial findings. A clinical forensic examination and forensic diaphanscopy casted serious doubt on the accidental version of the fracture of the skull. Multiple hematomas, invisible to the naked eye, were also revealed, leading to complementary medical imaging analyses. As investigations proceeded, evidence supporting the hypothesis of infant abuse was mounting. In spite of the authors' negative recommendation, the hospital physicians allowed the mother to take the child home for the weekend. On Sunday night, the mother brought the child back for emergency hospitalization. The infant

presented with numerous petechiae on her head, with the exception of two areas: a digitiform zone on the scalp and a triangular zone in the nasobuccal region. Petechiae were also present on the upper part of the thorax and at the basis of the upper limbs. A number of hematomas, invisible to the naked eye, were revealed by forensic diaphanoscopy on the anterior side of the thorax. The lesional picture was consistent with a thoracic compression leading to the obstruction of the respiratory tract, in the context of an attempted asphyxia.

A key issue remained: who was the perpetrator of this child abuse?

The answer was provided using computerized analysis of the images obtained from the digitiform lesion on the infant's scalp and the mother's and father's fingers. The mother was identified as the perpetrator of the acts using objective criteria, in the particular context of Munchausen syndrome by proxy.

Child Abuse, Computerized Image Analysis, Munchausen Syndrome by Proxy

Pathology/Biology

G1 Penetrating Wound of Head by Slingshot: Medicolegal Aspects

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After attending this presentation, attendees will understand the occurrence of medicolegal problems when medical doctor conducts incomplete/improper examination of head wound; and understand the consequences of negligent conduct of doctor during trial.

This case of slingshot intracranial head injury is very unusual. Attention of medical officers is once again drawn to the medicolegal problems that can be caused by the improper/incomplete examination of wound.

The author autopsied an unusual case of penetrating wound of head by slingshot (piece of stone).

The case was initially discharged from casualty after stitching the head wound. The patient died at home of intracranial infection. Autopsy revealed a skull fracture and intracranial stone piece.

This case highlights that no head injury should be ignored as trivial injury. Careful examination of the wound could have prevented a fatality and possible medico-legal problems.

Head Injury, Slingshot, Homicide

G2 Suicide by Hanging in Children

Ziadi Arbia and Chadly Ali, MD, Department of Forensic Medicine, University Hospital Fattouma Bourguiba, Monastir, 5000, Tunisia*

After attending this presentation, attendees will consider cases of hanging in children and the consequences of suicide in children.

Death from hanging is common in suicide youth. There's no large series dealing with such a death but numbers communicated even though small are significant.

Aim: we aimed to examine the epidemiology and pathology findings of 16 cases of suicide from hanging in children and suggest prevention.

Material and Methods: we considered cases of suicidal death from hanging in children referred to the department of forensic medicine of the university hospital Fattouma Bourguiba of Monastir from 1991 to 2002.

Sixteen cases of children committed suicide by hanging were reported. These cases were preceded by age, gender, manner of death, past history, surrounding circumstances and pathology findings.

Results: the 16 children were found dead. The age range was 11 to 17. The greatest share of suicide was found in the age of 17. The majority was males (15/16). Rope for ligature was more common, string was used in 2 cases. A previous suicide attempt was reported in 1 case. Two cases were with a borderline personality and one case was with a medical history of juvenile diabetes. In 14 cases, hanging occurred within the decedent's home. We couldn't provide a statistic valid seasonal risk. However afternoon seems to be the most chosen time for hanging (10/16). Complete suspension was seen in all cases. Most of children were from rural areas.

The autopsy showed usual external injuries of asphyxial death. No injuries of the larynx or trachea were reported. Contusion hemorrhage of neck muscles was found. Petechial hemorrhage was not seen.

Conclusion: death from hanging in children is rare. Our report is a contribution to several series dealing with such a death. Prevention is possible in some cases by parental supervision and by providing education and mental health care to adolescent. It's important to carry out prospective studies in order to determine the specific character of such occurrence, so we can provide a specific prevention measures.

Suicide, Death From Hanging, Children

G3 The Effects of Liquid Bleach on Pig Decomposition in Southeastern Pennsylvania

Lauren E. Way and John R. Wallace, PhD, Department of Biology, Millersville University, PO Box 1002, Millersville, PA 17551*

After attending this presentation, the participant will understand the effect of liquid bleach on carrion decomposition. This poster has two objectives to compare the rate of decomposition in pigs treated with and without bleach; and demonstrate the importance of understanding the impact chemicals have on corpses for criminal investigative purposes.

This study demonstrates that an easily accessible and common household chemical such as bleach can significantly influence decomposition rates and postmortem interval (PMI), leading to the possible incorrect estimate in the time of death of a victim.

Suspected use of bleach on the victim in a recent homicide trial in San Diego, CA, led the prosecutor to question if bleach on a body would affect a flies reproductive cycle. This case not only exemplified how forensic entomologists were unable to corroborate estimations of a post-mortem interval (PMI), but also how the effect of such chemicals may influence arthropod colonization and utilization (if any) of a corpse, thus affecting PMI estimations.

To date, empirical studies published on the effect of controlled substances and other chemicals such as pesticides, have examined the effect on particular insects and provided logical implications of the potential impact on a PMI estimate. However, few field studies exist on how decomposition is influenced by any chemical substance. We hypothesized that the topical application via dousing of common household bleach would negatively impact insect colonization of pig carcasses directly, and indirectly slow decomposition.

The objective for our first experiment was to determine the effect of bleach on pig decomposition. In two later experiments we are comparing decomposition rates between habitats, each with and without bleach treatments, and determining the rate of degradation of bleach between habitats. Stillborn pig carcasses were used in this study. Control pigs (n=3/habitat), i.e., not treated with bleach and experimental pigs (n=3/habitat), i.e., treated topically with a dousing (≈ 4 liters) of Ultra Clorox® liquid bleach, were placed onto individual plastic trays inside separate animal Have-a-Hart® cages. In experiment 1, all cages were placed in an open field exposed to full sunlight. For experiment 2 and 3, cages will be placed in an open field (full sun light) and a wooded area (complete shade). Temperature probes (Tidbits®) were inserted into two pigs, 1 control and 1 doused, to monitor internal temperatures. Daily temperatures were recorded from a local weather station and a max/min thermometer located in the open field. Temperature data was used to determine degree-day totals for each habitat. The pigs were observed daily to record physical changes in decomposition. The pigs were weighed to the nearest gram to monitor percent weight loss. Dead/live insects were sampled from the pigs on days 2, 7, 14, 21, and 28 and preserved for identification.

Five stages of decomposition were easily distinguishable for the control and doused or bleach treated pig: fresh, bloat, decay, post-decay, and dry. The use of bleach appeared to affect the physical aspects of decomposition. Decomposition in the control pig progressed from the fresh to dry stage in 11 days. Preliminary results showed that bleach dousing slowed decomposition of pigs by 7 days. Insect colonization on experimental pigs was similar to control pigs, however insect feeding was negatively impacted through observations of dead maggots and a recolonization period on day 10.

The rate of decomposition as a function of weight loss was most rapid for the control pig. Decomposition rates for pigs treated with bleach tended to be similar initially but slowed overtime possibly due to decreased insect activity. Accumulated degree-days estimates were less for control pigs and significantly greater for pigs treated with bleach in full sunlight.

Results from the first experiment focused on the first objective of our study, the effect of bleach on pig decomposition. These results show that decomposition was slowed by the presence of bleach on the pigs. Our preliminary evidence suggests that decomposition and lack of insect activity may influence PMI estimations when bleach is topically applied to a corpse. We are currently conducting two additional experiments to examine the effects of habitat on the rate of decomposition, as well as extraction and detection techniques of bleach from carrion flesh.

Forensic Entomology, Bleach, Postmortem Interval

G4 The Use of Whole Body Donors in Forensic Research

Charlotte A. Wacker, MS and Brandi J. Schmitt, MS, University of California, One Shields Avenue, 3301 Tupper Hall, Davis, CA 95616*

After attending this presentation, the attendees will learn how whole body donors can facilitate research in forensic science.

Whole body donors are used everyday for the advancement of medical research and education. These studies include, but are not limited to, surgical trials, biomechanical research, and emergency procedures, as well as the academics of anatomy as it is taught through dissection. On the contrary, research in forensic science is generally prompted by current casework and is performed as a byproduct of an investigation. It is important to note that the use of whole body donors for studies could help answer questions before cases even occur. Many fields within the realm of forensic science can benefit from these altruists in our society. Included are the disciplines of forensic entomology, odontology, pathology, biology, anthropology, and toxicology and can extend into aspects of the physical sciences as well.

One location has facilitated human donor studies important to the associated fields. However, they are conducted in a manner that is specific for the climate, flora and fauna of that area. In other areas, decomposition studies and the like have been performed with the use of porcine materials as a substitute for human materials. These studies are not reported here as invalid, but in order to apply the most appropriate and applicable science to matters of evidence, it is imperative that the most realistic methods and materials are used. Recognizably, the diversity of these United States requires the application of continuous studies to varied geographical areas and academic disciplines to achieve the best and most accurate results.

Thousands of people each year become donors to the 112 university sanctioned whole body donation programs throughout the U.S. The lack of research is not due to the unavailability of human specimens, but is a result of low numbers of requests by appropriate researchers. This may be attributed to the idea that many researchers are just not aware of the possibilities that exist for their projects. Questions regarding the ethical uses of whole bodies for science may further reduce the use of human remains by forensic researchers. It is the intention of the writers to provide a comprehensive presentation of the utilization of whole body donors to facilitate forensic research in the most appropriate manner possible.

Whole Body Donor, Forensic Research, Forensic Science

G5 Pediatric Homicides Related to Burn Injury

William F. Zaloga, DO, Wake Forest University Baptist Medical Center, Department of Pathology, Medical Center Drive, Winston-Salem, NC 27157; Kimberly A. Collins, MD, Medical University of South Carolina, 171 Ashley Avenue, Charleston, SC 29425*

After attending this presentation, attendees will be able to assign manner of death with more confidence in pediatric homicides related to burn injury.

This presentation will impact the forensic community and/or humanity by adding to and supporting the current literature of pediatric burn related homicides.

Burn related injuries and fatalities are usually thermal but may be placed into six categories: fire (including smoke inhalation injuries), scald, contact with a hot object, electrical, chemical, and ultraviolet radiation (sun). Many injuries are mistakenly referred to as "accidents" because they occur suddenly and are seen as unpredictable and uncontrollable; however, injuries often occur in predictable patterns.

We reviewed all forensic cases referred to the Medical University of South Carolina Forensic Pathology Section over the 28-year period from January 1975 through December 2002. All cases with victims 17 years of age and younger were analyzed and included in the study. We examined the age, sex, and race of the victims; type of burn injury; reported location; time of year; cause and manner of death; scene history; any perpetrator; injury-death time interval; and the autopsy and toxicology findings.

In our study there were 124 cases of pediatric burn related fatalities. The ages ranged from 6 months to 17 years. Categorized, the cases were 121 fire related fatalities (97%, 1 fire due to high voltage electrocution), and 3 scald fatalities. There were no burn related fatalities from contact with hot objects, chemicals, or ultraviolet radiation. Ninety of the burn related fatalities were in the 0-5 year age group (73%), with a peak (29 cases) in the 2 year age group.

The manner of the burn related deaths was also analyzed with 108 accidents, 12 homicides, and 4 undetermined. No cases were classified as suicide. Eleven of 12 burn-related homicides also occurred at the home (9 of 12 fire related and 3 of 12 scalds) with all of the victims in the 1-8 year age group. The perpetrator of the arsons was the mother in 5 cases, the sister in 1 case, and undetermined in 2 cases. Homicide involved a car fire in 1 case in which the father caused an explosion with an accelerant. The scald death perpetrators were the father, mother's boyfriend, and an aunt.

This retrospective study and review of the literature may reveal patterns useful for evaluation of manner of death. By recognizing scene characteristics, potential perpetrators, and children at risk we can better classify pediatric burn related fatalities.

Pediatric, Burns, Homicide

G6 Insect Succession Studies on Pig Carrion in Southwest Virginia and the Effects of Antemortem Ethanol Ingestion on Insect Succession and Development

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The goal of this presentation is to present the results of the effects of antemortem ethanol ingestion on insect development patterns on pig

carrion; and to present the results of insect succession studies performed on pig carcasses during different seasons over a two year period.

This presentation will impact the forensic community and/or humanity by presenting research which describes an interdisciplinary animal model, incorporating the expertise of forensic entomology and forensic toxicology, in characterizing factors that may or may not influence the succession and development of insect taxa on postmortem remains. As a collateral forthcoming project, the model will provide the means to investigate the feasibility of using biochemical markers of ethanol consumption (fatty acid ethyl esters) in discerning antemortem ingestion of ethanol from postmortem neo-formation during decomposition.

Learning Objective: one method of estimating the postmortem interval (PMI) uses results from studies on the faunal progression or succession patterns of carrion arthropods. The pattern of insect succession is specific to the location and environmental conditions in which a carcass occurs. Because taxa can vary greatly with locale, particularly at the species level, it is important to identify the forensically important insects that are specific to an area. To date, no such data have been published for the southwest Virginia region. It is possible that factors such as antemortem ingestion of ethanol or drugs can affect succession patterns and insect development rates, thereby rendering a PMI estimation based on insect evidence inaccurate.

Succession studies were performed over three seasons for two years using untreated pig carrion. Over 57 insect taxa were collected and identified. An occurrence matrix showing dominant species on a seasonal basis is presented.

In an additional study, two pigs (weighing 57 and 66 kg) were intravenously dosed with a mixture of 95% ethanol and saline using an intravenous catheter inserted into an ear vein and by oral gavage. Two untreated pigs of similar weight (53 and 49 kg) were used as controls. Antemortem blood samples were collected from both groups 15 minutes following delivery of ethanol to the treated animals. Euthanasia immediately followed the collection of blood samples. Loin meat was removed from each carcass to be used as a rearing medium for field development studies of the black blow fly, *Phormia regina*. The carcasses were placed under cages in a partially wooded field within one hour of death. Insects were collected and an occurrence matrix was developed. Results of the succession studies indicate no differences in the insect taxa collected from ethanol-treated versus control pigs. Decomposition rates were similar for all animals.

All four carcasses were necropsied in the field two days post-mortem. Blood, tissue and maggot homogenate specimens were analyzed for ethanol by headspace gas chromatography (HSGC) utilizing a HP 7694 HS Sampler configured to an AgilentGC-6890 PlusTM with a flame ionization detector (FID). The column was a Restek Rtx-BAC1TM and the internal standard utilized was n-propanol. Total run time was four minutes. The limit of quantitation (LOQ) is 0.01%.

For the development studies, *P. regina* egg clusters were collected from carcasses and placed in rearing cups containing pieces of loin meat from either treated or control pigs (n=6 each). The rearing cups were kept outdoors to monitor development under natural conditions. Temperature and relative humidity were recorded at the site using HOBO[®] data loggers. Following egg hatch, six maggots were removed from each rearing cup every eight hours until pupation. Size and larval stage were recorded for each sample interval. The time from pupation until adult emergence was also determined. Preliminary data indicate no difference in development on meat from ethanol-treated versus control animals. However, the concentration of ethanol in the loin meat of treated animals (0.07%) was only slightly higher than that of controls (ND). Additional *in vitro* studies using meat fortified with higher concentrations of ethanol are being conducted to determine if alcohol can affect maggot development.

An ethanol vitreous humor concentration of 0.14% was obtained for one animal (No. 2) and the loin ethanol concentrations (No. 1 and 2)

of 0.07% suggest distribution within the pig model similar to that encountered in the vitreous and skeletal muscle of humans. The experimental paradigm seems to provide a reasonably comparable model to human postmortem tissues and fluids for elucidating the influence or effect of antemortem ingestion of ethanol on insect succession and development. The postmortem blood ethanol determinations in animals 3 and 4 are consistent with postmortem neo-formation encountered in decomposition. Maggot specimens analyzed as homogenates obtained from animals 1 and 2 had higher ethanol concentrations when compared to the control, untreated animals (No. 3 and No. 4). The low ethanol concentrations observed in the control animal maggot specimens are possibly the result of postmortem neo-formation during decomposition or being a metabolic by-product attributed to maggot and bacterial interaction. Additional data from a second experiment, derived from serial collection of maggot masses over a period of five days, from ethanol-treated and control animals is provided in the poster.

ETHANOL RESULTS-% (WEIGHT BY VOLUME)

Animal No.	Antemortem	Postmortem	Loin	Maggots
	Blood	Blood		
1	0.14	0.11	0.07	0.06
2	0.16	0.10	0.07	0.04
3	ND	0.02	ND	0.02
4	ND	0.01	ND	0.02

Animals 1&2 ethanol-treated

Animals 3&4 non-treated controls

ND indicates not detected

The research describes an interdisciplinary animal model, incorporating the expertise of forensic entomology and forensic toxicology, in characterizing factors that may or may not influence the succession and development of insect taxa on postmortem remains. As a collateral forthcoming project, the model will provide the means to investigate the feasibility of using biochemical markers of ethanol consumption (fatty acid ethyl esters) in discerning antemortem ingestion of ethanol from postmortem neo-formation during decomposition. (The Virginia Tech Animal Care Committee approved this study).

Forensic Entomology, Ethanol, Maggots

G7 The Detection of Saliva: Factors Affecting the Phadebas® Press and Tube Tests

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The goal of this paper is to present to the forensic community, the findings from a study conducted to assess a test employed to detect saliva in forensic casework samples.

Forensic biologists will learn of the relative merits of the Phadebas test for the detection of amylase applied quantitatively as a Tube Test and semi-quantitatively as a Press Test.

It is often necessary for a forensic biologist to locate and identify saliva stains in casework. Not only is saliva important as a source of DNA, its presence in various circumstances can corroborate aspects of an account of a crime. Unlike blood, which is usually evident by visible, red-brown staining, often saliva does not contain any visible components, making the "stains" difficult to observe. Therefore, chemical methods are used to locate saliva stains.

At the Centre of Forensic Sciences, the localization and identification of saliva is determined using the Phadebas[®] Amylase Test (Pharmacia and Upjohn Diagnostics AB, Uppsala, Sweden). This assay

is used to detect the digestive enzyme α -amylase, which is found in high quantities in saliva. The test can be performed in two ways: the press test (Willott and Griffiths, 1980) and the tube test (Willott, 1974). In this study, three variables were assessed to determine their effects on both the press and tube tests: 1) the quantity of amylase in a person's saliva, 2) the type of substrate on which saliva is deposited, and 3) the mixing of saliva with a second body fluid, either blood or semen. A second aim of the study was to evaluate the effectiveness of both tests to determine if the tube test is always necessary to perform in addition to the press test, and to determine the required duration of the press test.

Neat and diluted saliva from thirty individuals was used to stain cotton. Ninety percent of the neat saliva stains were detected in less than 10 minutes using the press test, and all neat saliva stains had amylase activities greater than 0.03 International Units (IU) (Willott, 1974) using the tube test. Overall, the tube test showed higher sensitivity. Press and tube tests were then performed on stains made from saliva from individuals covering a range of amylase levels on the following substrates: cotton, polyester, a blend of 95% acrylic 5% spandex, silk, satin, corduroy, denim, and white S & S #903 filter paper (Schleicher & Schuell Bioscience). The press test could detect saliva more readily on thinner, less absorbent fabrics, while higher amylase activities were obtained with thicker fabrics using the tube test. Experimentation was also done to determine how the deposition of saliva in the presence of semen and blood affects the press and tube tests. Stains were made of saliva and either blood or semen in three different ways: 1) mixing prior to deposition, 2) depositing saliva, letting it dry then depositing the other body fluid on top, and 3) depositing the other body fluid first, letting it dry then depositing saliva on top. Semen did not interfere with the detection of saliva using the press or tube tests, regardless of the method of deposition. Blood did not interfere with the detection of saliva using the tube test, but when the press test was performed there were some instances where the result took longer to appear or did not appear within the 20-minute test period.

Overall, the press test is sufficient for detecting saliva stains in most cases if administered for 40 minutes. The limitations discussed must be considered when blood is present on the sample to be tested, or if the substrate fabric is heavy / thick (e.g., denim).

Saliva, Phadebas, Amylase

G8 Places to Commit Suicide

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NO ABSTRACT PROVIDED.

Suicide, Place of Death, Methods of Suicides

G9 Dramatic Rise in Methadone-Related Deaths in Oklahoma 1990-2002

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After attending this presentation, attendees will have awareness of dramatic increase in methadone-related deaths and potential explanation of why they occur. This trend is evolving nationwide and there is every expectation that it will continue.

This presentation will impact the forensic community and/or humanity by making the forensic community aware of the emerging epidemic of deaths related to this drug and the reasons for it. Unique aspects of its pharmacology interacting with ignorance of this by physicians, patients, and substance abusers have resulted in an emerging

tragedy. The forensic community needs to enlighten the broader community as part of its public health and public safety missions.

Deaths attributed to the toxic effects of methadone, alone or in combination with other drugs, have dramatically increased in the State of Oklahoma during the study period. Tabulation of these deaths on an annual basis from records of the Office of the Chief Medical Examiner of the State of Oklahoma demonstrates this trend. A comparison of deaths in the three-year period 1990–1992 versus 2000–2002 shows 7 versus 140 respectively. This parallels a dramatic rise in the prescribing of methadone in the state, particularly for the treatment of chronic pain. Possible rationales for this increase including unique aspects of the pharmacology of methadone are discussed.

Methadone, Deaths, Chronic Pain

G10 Fatal Botox®-Induced Anaphylaxis? A Case Report

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After attending this presentation, attendees will learn about autopsy findings and laboratory diagnosis of anaphylactic reactions and the history and uses of Botox®.

This presentation will impact the forensic community and/or humanity by reporting on the first case of Botox® associated death; describing what kind of conditions Botox® is currently used for, and that it can possibly be a cause for anaphylaxis; and describing how to support the diagnosis of anaphylaxis.

Introduction: adverse drug reactions can occur with any therapeutic drug, with anaphylaxis being the most serious event. Botox (botulinum type A, Allergan Inc, Irvine, CA) is a relatively new drug that is FDA-approved for blepharospasm, strabismus, cervical dystonia and glabellar wrinkles. It is also used 'off label' for a variety of disorders such as chronic pain syndromes, hyperhidrosis, cosmesis, and achalasia. It has been touted as extremely safe and effective. To date, no deaths associated with Botox have been reported. We report the first case of anaphylaxis and death in a woman who received a mixture of Botox and lidocaine injections.

Case History: a 43-year-old woman who had chronic upper back pain presented at a rehabilitation clinic for a repeat set of Botox and lidocaine injections. Fourteen months previously, she had received her first set of Botox injections and obtained relief from her pain for several months. However, over the last few months, her back pain returned. A 5 cc solution of 1% Lidocaine and 100 units of Botox was made and 1 cc was injected into each of the 5 trigger points located in her upper back. Immediately following the last injection, she experienced a vasovagal reaction, lost consciousness and exhibited seizure activity. She was transported to the local hospital emergency room, where despite all efforts, she died.

Autopsy and Toxicologic Findings: the most significant autopsy finding was pulmonary edema and hemorrhage. The hypopharynx, larynx and trachea showed no evidence of edema or hemorrhage. Postmortem blood toxicology demonstrated a lidocaine level of 1.1 ug/mL and a methadone level of 0.12 mg/L. Premortem serum demonstrated a tryptase level of 37.6 ug/ml (reference range 0.4-10.9 ug/ml) and an IgE level of 6.7 IU/mL (reference range 0.0-100.0 IU/mL).

Discussion: anaphylaxis can occur quite suddenly, and is often a clinical diagnosis or a diagnosis of exclusion. It commonly occurs with food allergies and insect stings. An elevated serum tryptase level can support the diagnosis of anaphylaxis. Tryptase is a mast cell specific enzyme that is released in allergic reactions. This patient demonstrated a greatly elevated tryptase level. Although IgE was not significantly ele-

vated, it does not exclude anaphylaxis, since some drugs may trigger mast cell degranulation directly. Because the mixture included lidocaine, the cause of the anaphylaxis cannot be definitively solely attributed to Botox, since rare anaphylactic reactions and death have been associated with lidocaine. The patient's previous injections of Botox may have been the time of sensitization.

Conclusion: both Botox and lidocaine have few reported adverse side effects. This is the first Botox associated anaphylactic reaction and death. Despite reports of safety and few complications, precautions should always be taken for an adverse reaction.

Botox®, Lidocaine, Anaphylaxis

G11 Significant Trends in Work-Related Deaths — United States

Gordon K. Murphy, MD, 814 Hathaway Road, Dayton, OH 45419-3555*

After attending this presentation, attendees will become familiar with work-related deaths and how to investigate them properly.

Both the general public and forensic scientists will realize that there are hazards inherent in every form of work, whether sedentary, or involving physical labor. Prevention of work-related deaths involves recognition of hazards; personal protective equipment; instilling proper work practices; and monitoring the workplace. It will be recognized that most important of all is a persistent commitment to safety by both management and labor. While there has been a significant decrease in work-related deaths over time, many still occur, and many of these are preventable.

In recent years, work-related deaths have ranked second only to motor vehicle accidents as a category of accidental deaths in the USA. It is vital that the forensic scientist be familiar with all aspects of work-related deaths because of their frequency; the often time-consuming and complex nature of a proper investigation; and because these deaths often have implications for the living as well, in the context of prevention. A significant number of these deaths result in litigation - civil, criminal, or both.

Investigation of work-related deaths involves thorough examination and documentation of the scene of death, with expert consultation when indicated; a complete autopsy, including toxicology; and clear statement of conclusions of the investigation as warranted by the evidence.

Four significant trends in work-related deaths in the USA are apparent from experience and review of the literature. 1 - A significant decrease in the number and incidence of work-related deaths particularly since the turn of the 20th century, as well as in the past 20 years 2 - Mining and quarrying; construction; and agriculture in that order were formerly the three industries in which the largest numbers of work-related deaths occurred. Due to significant improvements in safety in mining and quarrying, and in agriculture, the three leading industries are now construction, transportation, and manufacturing. 3 - Work-related deaths due to gunshot were formerly infrequent. Since 1990, however, homicide has been the second-leading cause of work-related deaths in the USA. Homicide is the leading cause for females. 4 - Deaths due to collapses of open-trench excavations in construction, although preventable, continue to rise.

Illustrative cases: Construction - a motor-vehicle accident, the leading cause of work-related death. Deaths at two construction sites, one presenting the coroner with an unusual responsibility Open-trench excavation - a death resulting in both a large fine stemming from OSHA citations, and a civil lawsuit. Homicide - While the great majority of work-related homicides are committed by fellow workers, each of these two cases is a law enforcement officer shot and killed by another because of mistaken identity during a crisis. Manufacturing - death in a chocolate candy factory Death from immersion in a vat at a paper mill Accidental death of a lawyer at work

Conclusions: The investigation of work-related deaths is challenging. It requires broad knowledge of various fields of work, and of the dangers inherent in each. Investigation must be both wide-ranging, yet focused. All findings must be rigorously documented.

Both the general public and forensic scientists will realize that there are hazards inherent in every form of work, whether sedentary, or involving physical labor. Prevention of work-related deaths involves recognition of hazards; personal protective equipment; instilling proper work practices; and monitoring the workplace. It will be recognized that most important of all is a persistent commitment to safety by both management and labor.

While there has been a significant decrease in work-related deaths over time, many still occur, and many of these are preventable.

Work-Related Death, Homicide, Investigation

G12 Over Diagnosis of Low Voltage Electrocution

Ronald K. Wright, BS, MD, JD, 2101 SW 29th Avenue, Fort Lauderdale, FL 33312*

After attending this presentation, attendees will understand the mechanisms of death in electrocution; be provided easily conducted analyses to prevent over diagnosis of electrocution; recognize that over diagnosis of electrocution is relatively common.

This presentation will impact the forensic community and/or humanity by understanding the pitfalls which can occur in investigation of low voltage electrocutions and techniques to employ to reduce over diagnosis.

The fact that electrical burns are the only significant finding in low voltage electrocutions is well known in the forensic pathology community. The fact that electrical burns are seen in only approximately 50% of low voltage electrocutions is also well known. Further, it is generally understood that a high index of suspicion is required if there is a possibility that an electrical circuit may have killed someone, as the autopsy will not identify the cause of death in approximately 50% of cases.

Unfortunately, the above works to create over diagnosis in some cases. The author has encountered eight cases of over diagnosis of low voltage electrocution in the past eight years in his consultative practice of forensic pathology. Of these cases, the author was a consultant to the defense in seven and to the plaintiff in one. The possibility of bias could thus be argued, but then again, the government-hired death investigator also has a bias to determine a cause of death, and in the majority of these cases, if electrocution was not diagnosed, the cause of death was certainly obscure. Invocation of electrocution made a tidy diagnosis in an otherwise puzzling case in the majority of cases.

The eight cases presented show variable circumstances, with varying degrees of certainty that the death could not have been electrocution.

In each case there was a possibility of electrocution because some source of electricity was available to the deceased prior to his or her demise.

In each case, the approach will be to show that for there to be an electrocution, there must be a circuit of more than 16 mamps through the person immediately prior to the death. 16 mamps is used a minimal figure as that is the average "no let go" value for alternating current passing from hand to hand. Further, it is necessary to show that the circuit of more than 16 mamps traversed the body through the chest or the head or both. With low voltage electrocution the mechanism of death is either asphyxia (rarely) or ventricular fibrillation (commonly.) Asphyxia is produced by prolonged exposure (minutes) of the chest causing tetanic contractions of the chest musculature during a through-the-chest circuit or by seizures induced by a through-the-head circuit. Ventricular fibrillation requires a through the chest circuit, of probably

more than 100 mamps of current flow, but of very brief duration, as little as 0.2 seconds.

For there to be a circuit of more than 16 mamps through a person there must be exposure to voltage sufficient to overcome the resistance to current flow which the human body presents. For contact through the skin, requiring the skin to be minimally keratinized, moist and flushed, the resistance is greater than 1000 ohms. Thus to achieve 16 mamps of current flow requires 16 volts as a minimal voltage to achieve "no let-go." As will be shown, one of the cases involved batteries have a voltage below 16 volts, thus making it a case of over diagnosis.

Further, low voltage direct current probably requires much higher current flows than seen with alternating current making the DC current case even more unlikely.

In one of the cases, the conduit through which wires passed caused the insulation to be cut, causing a short circuit which blew the fuse to the transformer. Upon replacement of the fuse, the cut wire arced periodically. As the conduit was grounded, it was never ever to have a voltage, and thus insufficient voltage provided a way to determine over diagnosis.

In another case, the possibility of ground leakage, producing a force field of varying voltages over distance was proposed as the mechanism of electrocution. Demonstration of shoes with high dielectric (resistance to the flow of electricity) made the over diagnosis unlikely.

In four of the eight cases the autopsy demonstrated causes of death from other causes than electricity. These included traumatic asphyxia, ruptured AV malformation of the lung, aortic stenosis with cardiomegaly and buried left anterior-descending coronary artery with ischemic changes new and old in the distribution of the LAD.

In two of the cases the deaths were witnessed. In both of these cases there was no involuntary movement produced by the flow of electricity. A circuit through a person sufficient to cause death causes involuntary contraction of the muscles in the circuit 0.2 seconds after the initiation of the circuit. This results in a scream or shouts if the current passes through the chest. In addition, if the circuit passes through the upper extremity there is involuntary flexion. If the circuit passes through the trunk and lower extremities there is involuntary extension. Both of these phenomena should be described by witnesses who could see and hear the soon to be deceased. In two the presented cases no such movements were heard or seen.

However, the most striking and uniform absence in all of the presented cases is the pathway to ground. In none of the presented cases was there a demonstrable pathway to ground. To have an electrical circuit there must be a source of electrons and something conductive to allow them to flow to a place with fewer electrons. In a low voltage electrocution there must be a circuit of more than 16 mamps from an energized source and the person must be grounded to complete the circuit. In all eight cases there is complete absence of pathway to ground, thus an analysis of pathway to ground which is simple and easy to do, is the most important criteria to employ in the investigation of a possible electrocution.

Autopsy, Electrocution, Cause of Death

G13 Accidental Parachuting Death Due to Equipment Failure

Martha J. Burt, MD and Matthew J. Bowes, MD, Miami-Dade County Medical Examiner Department, Number One on Bob Hope Road, Miami, FL 33136*

After attending this presentation, attendees will understand the importance of an integrated approach to determining cause and manner of death in skydiving related fatalities.

This presentation will impact the forensic community and/or humanity by emphasizing the importance of a multidisciplinary approach to death investigation.

The goals of this research project are to recognize the importance of a multidisciplinary approach to the investigation of parachute deaths, with an emphasis on the importance of scene investigation and equipment analysis.

Skydiving carries a low but significant risk of harm for participants. Between 1992 and 2002, there have been between 27 and 44 skydiving deaths per year in the United States, with an average of approximately 35 deaths per year. As compared with other high risk sports, skydiving has a relatively low mortality rate (25 deaths per 100,000 participants, versus SCUBA diving, 25 per 100,000 and boxing, 50 per 100,000 participants). Human error is the most important cause of mortality in skydiving. Equipment failure is considered rare.

Case Report: A 47-year-old male with no significant medical history began his dive at 13,000 feet. He deployed his main parachute at 5000 feet. The position of his body at the time of deployment of the parachute was head down. Witnesses observed the parachute deploy properly, but the subject did not steer. The subject began to spin, thus tangling his lines. The subject was not observed to make an attempt at cutting the lines and deploying the reserve parachute, which would have been the correct course of action. The subject fell to Earth in a grassy field some distance from his designated drop zone. At the time of his impact, his body was traveling at somewhat less than terminal velocity, since his parachute was deployed, but deployed imperfectly. Fire-rescue was called, but resuscitation was unsuccessful and he was pronounced at the scene.

External examination showed a mildly obese male with several abrasions, lacerations and contusions. In particular, the left neck had a transverse, linear, patterned mixed abrasion and contusion. Internal examination demonstrated scant subarachnoid hemorrhage without skull fractures or cerebral contusions. The organs of the neck underlying the transverse abrasion/contusion had extensive acute hemorrhage. The atlanto-occipital joint was severely dislocated, without transection of the brainstem or proximal spinal cord, but with significant impingement on the brainstem and spinal cord structures. Several ribs were fractured. The heart had a full thickness laceration of the right ventricle with hemopericardium. The coronary arteries did not have any atherosclerosis. The lungs were contused but not lacerated. The liver and spleen were extensively lacerated.

Examination of the parachute harness demonstrated a torn vertical nylon strap on the left side, which connected the horizontal chest strap to the leg straps. The vertical strap doubles over through a metal ring to allow for adjustment to the harness length between the chest strap and the leg strap. The edges of the nylon strap were frayed in close proximity to the metal ring. The company owned several other similar harnesses of the same type, which showed significant wear pattern in the same location.

Integration of data collected from the scene, autopsy and analysis of the harness allowed us to surmise that the nylon strap had snapped when the parachute deployed, thus causing the freely mobile chest strap on the left to be violently pulled caudally by the deploying parachute, forcefully abrading and contusing the left side of the neck while snapping the head backward. This caused the atlanto-occipital dislocation, disabling the subject and making self-rescue impossible. The disturbed flight characteristics of the limp and unbalanced human form caused the parachute to spin and tangle, hastening the subject's descent. The death was ruled an accident.

Equipment failure as a cause of parachute death is rare, but potentially preventable. This case underscores the critical importance of equipment evaluation by a competent analyst.

Skydiving Death, Parachute Equipment, Scene Investigation

G14 The Richard Cory Phenomenon: Suicide and Socioeconomic Status in Kansas City, Missouri

Thomas W. Young, MD*, Jackson County Medical Examiner, 660 East 24th Street, Kansas City, MO 64108; Suzanna Wooden, University of Missouri, Kansas City School of Medicine, 2411 Holmes, Kansas City, MO 64108; Jinwen Cai, MD and Gerald L. Hoff, PhD, Kansas City Missouri Health Department, 2400 Troost, Kansas City, MO 64108; Paul C. Dew, MD, MPH, University of Health Sciences, 1750 Independence Avenue, Kansas City, MO 64106

The goal of this presentation is to present findings from a retrospective study demonstrating a positive association between suicide and socioeconomic status.

This presentation will impact the forensic community and/or humanity by enabling the design of more effective public health interventions for people at risk for suicide. The study also illustrates how data obtained from a coroner or medical examiner agency may be useful for the epidemiologic research of violent death.

Edwin Arlington Robinson's famous poem, "Richard Cory," tells how a man of refinement and wealth goes home "one calm summer night" and inexplicably puts "a bullet through his head." The poem leaves the reader surprised that a wealthy man with all one could seemingly desire in life kills himself. Is a suicide like his unexpected? Results of a retrospective study performed in Kansas City, Missouri, indicate that suicide actually occurs more frequently among those with more of life's finer things.

The Jackson County Medical Examiner receives reports of and investigates all deaths from injury and many natural deaths in Jackson County, Missouri, and maintains a database of information from these investigations. The information includes the home address of each victim. Jackson County Government performs house and personal property appraisals for taxation purposes. Appraisal values for real estate and personal property can be viewed from the Jackson County Government website (www.jacksongov.org) by the parcel address and by the name of each individual owning personal property subject to taxation. These government home and personal property appraisals tend to be lower than actual real market value.

The authors studied all suicides reported to the Medical Examiner from 1998 to 2002. They compared appraisals of houses where suicide victims used to live to appraisals of houses lived in by victims from a control group of non-suicidal deaths. Each non-suicide control victim was randomly selected from the Jackson County Medical Examiner database and matched by age, race, sex, and year of death with each suicide victim. Where available, appraisals for personal property owned by each victim, the victim's spouse, or the victim's parents were also obtained and compared for each group. Additionally, stressors for suicidal intent, such as financial strain, recent loss of a loved one, relationship difficulties, and health, mental or drug problems, were identified for each suicide from investigative reports.

The suicide and control groups each had 426 victims. Significantly more victims in the suicide group lived in houses than victims in the control group (suicide: 70% vs. control: 56.8%, $p < 0.001$ by chi square analysis). Appraisal values for the houses obtained for 277 members of the suicide group had a significantly higher mean and median compared to those of 227 members of the control group (mean: \$70,143 for suicide vs. \$61,513 for control, median: \$62,316 for suicide vs. \$50,580 for control, $p = 0.04$ for two means by two-tailed t-test). Personal property appraisals were available for only 93 members of the suicide group and 90 members of the control group. Although the mean and median appraisals were higher for the suicide group (mean: \$3,666 for suicide vs. \$3,054 for control, median: \$2,750 for suicide vs. \$2,045 for control), the differences were not statistically significant. Analysis of stressors within the suicide group identified mental health and rela-

tionship issues as the predominant stressors, but financial strain, identified in only 8% of victims, was the least frequent stressor. Those suicide victims identified with financial strain had even higher mean and median house values than the suicide or control groups (mean of financial strain group, \$77,126; median, \$74,050).

The data indicate that suicide victims are: 1) more likely to live in houses than other victims rather than in apartments or trailers, 2) more likely to live in more expensive houses than other victims, 3) more likely to kill themselves because of factors other than financial strain, and 4) if financial strain is a factor, more likely to kill themselves after becoming accustomed to a more affluent lifestyle.

Suicide, Socioeconomic Status, Retrospective Study

G15 Suicide: A Ten-Year Retrospective Review of Kentucky Medical Examiner Cases

Lisa B. Shields, MD*, Donna M. Hunsaker, MD, and John M. Hunsaker III, MD, JD, Office of the Associate Chief Medical Examiner, 100 Sower Boulevard, Frankfort, KY 40601

The goal of this presentation is to present a retrospective analysis of information gleaned from postmortem examinations of all suicides from the medical examiners' records in Kentucky between 1993 and 2002; and to correlate this data with national trends regarding suicides.

This comprehensive report aims to dispel the conventional image of the suicide victim as an elderly Caucasian male afflicted by physical disease and demonstrate how suicidal trends have been drastically altered over the years; and to delineate distinguishing characteristics present at the scene and revealed in the medical history that may aid investigators in ascribing the manner of death as suicide.

According to the Center for Disease Control's Monthly Vital Statistics Report in 2000, suicide ranks eleventh in the United States and accounts for approximately 30,000 deaths annually. A host of biological and psychosocial components interplay in the investigation of a suicide. Precipitating factors may include domestic quarrels, loss of employment, financial difficulties, substance abuse, chronic disease, or mental illness. The commonly held belief of the typical suicide victim includes either an elderly Caucasian male with a debilitating disease or a female dying from acute drug intoxication commonly referred to as an overdose. Men are more likely to commit suicide than women. Researchers attribute the lower number of female suicides to a larger number of women who may attempt, but fail to commit, suicide by drug overdose. Furthermore, women may be prone to ventilate emotional problems with others in an attempt to avert suicide whereas men are less likely to admit hardships and are more impulsive in their actions. Although a suicide note may illustrate suicidal intent, it is present in less than one third of cases reported by some authors.

This study presents all 2,866 medical examiner cases of suicide between 1993-2002 in Kentucky. The majority of victims were males (81.8%) and Caucasian (94.8%). Black females comprised the smallest group of decedents, consisting of only 0.59% of suicides. Individuals ranged between 11 and 96 years of age with an average age of 42.0 years. The greatest number of suicides occurred in the fourth decade of life followed by the fifth decade and then the third decade. The preferred mode of death was by gunshot (67.6%), followed by hanging (13.7%), overdose (10.0%), and carbon monoxide poisoning (4.6%). Of the 1,934 gunshot wound fatalities, 79.5% of the wounds involved the head, 18.3% the chest, and 2.6% the abdomen. Both males and females chose a firearm as their primary means of committing suicide, 71.4% and 50.5%, respectively. The head was the most likely target of the gunshot wound in all shooting victims, specifically, 80.4% of the men and 72.7% of the women. 65.5% of black victims utilized a firearm to commit suicide, and 83.8% of these were head wounds. In men, the second and third most common causes of death respectively were hanging (14.5%) and overdose (5.9%). Conversely, this pattern was reversed in women:

the second leading cause of death was overdose (28.1%) and the third, hanging (10.3%).

The review analyzes a myriad of factors that may have prompted an individual to commit suicide: medical and psychiatric history, domestic relationship problems, substance abuse, financial and legal difficulties, and seasonality. The presence of a suicide note, previous suicide attempts, family history of suicide, dyadic murder-suicide, and suicide by cop have also been documented. A discussion of “playing” with a gun known in Russian Roulette and issues related to schizophrenic patients who commit suicide will also be presented. Furthermore, this study inventories and discusses the variety of disease processes and toxicological findings uncovered at autopsy.

Forensic Science, Forensic Pathology, Suicide

G16 Homicidal Cerebral Artery Aneurysm Rupture

Joseph A. Prahlow, MD, c/o South Bend Medical Foundation and Indiana University School of Medicine, 530 North Lafayette Boulevard, South Bend, IN 46601*

After attending this presentation, attendees will understand that, in the correct setting, a natural disease cause/mechanism of death may be considered a homicide, and to learn a set of proposed criteria for such deaths involving ruptured cerebral artery aneurysms.

This presentation will impact the forensic community and/or humanity by addressing the difficult question of whether or not minor head trauma, or even the threat of trauma, can be implicated in a death due to ruptured cerebral artery aneurysm. If trauma (or threats of trauma) can be considered a contributory cause in such deaths, “homicide” may be a reasonable manner of death, given the proper circumstances. The paper proposes a set of criteria to help forensic pathologists determine whether or not a given case represents a “homicide by ruptured berry aneurysm.”

In 1978, Davis published his classic work, “Can sudden cardiac death be murder?”¹ In Davis’ paper, a logical, well-reasoned argument is made for certifying certain cardiac deaths as homicides, so long as a set of specific criteria are met. Using Davis’ criteria, a mugging victim who suddenly collapses and dies from underlying severe coronary artery disease can be appropriately ruled a homicide. While some forensic pathologists may not agree with such a ruling, the phrase “homicide by heart attack” remains well-known to many within the forensic community.

Cardiac disease is not the only natural disease process that can be considered the underlying mechanism of death in homicide. Subarachnoid hemorrhage related to traumatic ruptured cerebral artery berry aneurysm or arteriovenous malformation has received some attention in the medical and forensic literature. In this paper, we present a case of “minor” head trauma causing the rupture of a cerebral artery aneurysm. The MOD was considered “homicide.” The ensuing discussion will address this controversial topic and present a proposed set of criteria useful in making such a determination.

An intoxicated, 46-year-old man, his wife, and their female friend returned to the friend’s home late one night, after having been out for dinner and drinks. The man was reportedly loud and boisterous. Upon hearing the commotion, the friend’s adult daughter, who had been sleeping, got-up, came-out of the bedroom, and asked them to be quiet, since her live-in boyfriend needed to get-up early for work. She then stated that she was going back to bed. The 46-year-old man then proposed to the daughter that he might join her in bed. The daughter’s live-in boyfriend then emerged from the bedroom and confronted the intoxicated man. A short verbal altercation ensued, followed by a single punch, thrown by the boyfriend, that landed on the other man’s face. The man immediately collapsed to the floor, totally unresponsive.

Emergency resuscitation was initiated by the owner of the home. Emergency medical services responded to a 911 call and transported the victim to the hospital, where work-up and imaging studies revealed diffuse basilar subarachnoid hemorrhage and a ruptured berry aneurysm in the basilar artery. He died approximately 36 hours after the initial collapse.

Autopsy confirmed the presence of diffuse, basilar subarachnoid hemorrhage, as well as a ruptured, 9 mm basilar artery aneurysm. Brain examination was consistent with global ischemia. The remainder of the autopsy was significant for cardiomegaly (500 gm), with concentric left ventricular hypertrophy, as well as mild to moderate atherosclerotic cardiovascular disease involving the aorta and coronary arteries. There were no facial injuries identified at autopsy. A blood ethanol level from the time of hospital admission was 153 mg/dL.

Police investigation confirmed the story as presented above. The victim’s wife, the homeowner, her daughter, and the boyfriend all related similar scenarios as they recalled the events. The cause of death was ruled “subarachnoid hemorrhage due to ruptured basilar artery aneurysm following blunt head trauma.” The manner of death was ruled “homicide.”

Whether or not “minor” head trauma may cause the rupture of a cerebral artery aneurysm (or arteriovenous malformation) remains a controversial topic. Some claim that “significant” or “severe” head trauma is necessary, with concomitant skull fractures or brain contusions/lacerations. Others feel that minor head injury is sufficient, in certain instances, to cause aneurysm rupture. A careful review of the literature suggests that minor head trauma may, in fact, contribute to or cause the rupture of an intracerebral aneurysm or arteriovenous malformation. This appears to be true particularly when the traumatic event (or threatened traumatic event) is associated with intense emotion, with a rise in blood pressure. Another factor that increases a person’s risk for cerebral aneurysm rupture (traumatic or spontaneous) is ethanol intoxication, due most probably to the considerable intracranial blood vessel dilatation known to occur in association with ethanol intoxication.

The following represent a proposed set of criteria for ruling a ruptured cerebral artery aneurysm (or arteriovenous malformation) as a homicide: 1) Head trauma (and/or extreme emotional stress) must immediately precede the onset of symptoms related to ruptured aneurysm (or arteriovenous malformation). 2) Autopsy findings must confirm the presence of a ruptured aneurysm (or arteriovenous malformation), with no findings indicating that the rupture occurred prior to the trauma/emotional stress. 3) When head trauma is implicated, autopsy evidence of physical injury of the face/head may or may not be present. 4) Head trauma (and/or extreme emotional stress) must have occurred during or as a result of an event that would normally be considered a form of criminal activity. 5) In order to implicate the emotional stress of an event as a cause or contributing cause of the intracranial hemorrhage, the victim should have realized that the threat to personal safety was implicit, and the circumstances should be of such a nature as to be commonly accepted as highly emotional.

It is important to remember that each case must be evaluated on its own. Death scene investigation and witness statements are often of paramount importance, particularly when attempting to address criteria #1, #4, and #5. If the criteria are not met, it is prudent *not* to rule such a death as a homicide. In such an instance, an “undetermined” ruling is acceptable, with or without a statement suggesting that the case may represent a homicide. As a corollary, a modified form of the criteria may be utilized in an attempt to determine whether accidental trauma can be implicated in deaths related to ruptured cerebral aneurysms or arteriovenous malformations; criteria #4 would not apply in such accidental trauma cases.

Reference: 1. J.H. Davis. Can sudden cardiac death be murder? *Journal of Forensic Sciences* 23(2):384-7,1978.

Homicide, Natural Disease, Cerebral Aneurysm

G17 Death by Defibrillator: A Unique Homicide by Electrocution

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This presentation will review a case in which an external defibrillator was used as a weapon, discuss the general features of defibrillators, and review the role of defibrillators in accidents and suicides.

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A 49-year-old mentally challenged black male worked as part of a cleaning crew in a suburban dialysis clinic. According to co-workers while he was mopping the floor he had a seizure and collapsed to the floor. Upon their arrival paramedics found the subject in ventricular fibrillation and despite full advanced cardiac life support measures including external defibrillation he was pronounced dead at a local emergency room.

The autopsy examination showed a well developed, well nourished black male weighing 189 pounds and measuring five feet nine inches in height. Externally there were two irregular burn marks: one on the upper left chest measuring 0.9 x 0.6 inches and the other on the upper right chest measuring 0.5 x 0.4 inches. Internal examination was remarkable for a 415 gram heart and 90% atherosclerotic occlusion of the right coronary artery. The remaining coronary arteries were free of atherosclerotic disease. The lungs and brain were remarkable only for the presence of edema. A scene investigation was performed which disclosed no irregularities or the presence of electrical equipment in the room in which the decedent had worked. The cause of death was attributed to coronary atherosclerosis and the manner of death was natural.

One week later a member of the cleaning crew came forward stating that the initial story had been a fabrication. The crew member revealed that an 18-year-old co-worker, who had tormented the mentally challenged decedent on multiple occasions, had turned on one of the clinics external defibrillators which had a preset energy level of 200 joules. The 18-year-old then coaxed the decedent over and discharged the defibrillator into his chest. Following this statement and police investigation, the cause of death was amended to electrocution and the manner of death was changed to homicide.

The first experiments using electricity to stop the heart were conducted in 1775 using chickens. It was not until 1956, however, that the first successful external defibrillation was performed on humans.

A defibrillator delivers 60,000 watts of electricity in four to five millisecond intervals with a resultant energy level of 300 joules. This level of energy is analogous to a bolt of lightning. A properly used defibrillator delivers a current through the chest wall and heart. This causes the heart to stop and allows the pacemaker cells of the heart to repolarize and re-establish a sinus rhythm.

There are two general types of defibrillators, external and internal. These can be further sub-divided into either manual or automatic/semi-automatic types depending on whether an individual or machine recognizes the ventricular fibrillation. Defibrillators can be further subdivided based on charge direction, monophasic or biphasic of the defibrillator. Defibrillator energy levels range from 0 to 360 joules for manual defibrillators and to a preset range of 200 to 350 joules with automatic/semiautomatic defibrillators.

Among paramedics accidents occur at a rate of 1 per 1,700 defibrillator shocks and 1 per 1,000 for EMTs trained in the use of defibrillators. The most commonly reported injuries in these groups are accidental shocks. In patients, the most common accidental injuries are skin burns, and occasionally myocardial muscle damage. Rarely, an automatic defibrillator may shock a patient with a normal rhythm and cause fatal arrhythmias.

Two cases have been reported in which defibrillators were used in suicide attempts. In one a male nurse discharged the defibrillator into his head. He survived and recovered fully. The second case involved a hospital employee who discharged a defibrillator into his chest. He was found in ventricular fibrillation and died despite resuscitative efforts.

No reported cases of the homicidal use of external defibrillators were found in a review of the literature. This case represents a unique and to date unreported form of homicidal electrocution.

Defibrillator, Electrocution, Homicide

G18 The Influence of Violence in the Media on Unusual Methods of Murder and Suicide

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After attending this presentation, forensic pathologists and crime scene officers will learn about the difficulties in detecting hidden homicides and that knowledge of the latest media releases is vital in crime scene analysis.

This presentation will impact the forensic community and/or humanity by describing to the forensic community the subtleties in signs of murder; addressing the need to be aware of the latest film releases; and addressing the need for an integrated scene analysis team.

There is a wealth of research about the influence of the media on violence, particularly homicides. Most recent reports show little or no correlation between crime and viewing habits. This has not stopped the calls for censorship of the media which may restrict freedom of speech.

The cases to be presented have been linked to a film in which there was an unusual method of causing death. The film showed the perpetrator encasing the victims in a film of plastic wrap causing asphyxiation. He then removed the wrap and the murders remained unsolved for a long period of time. Similarly subsequent concealment of the homicide method occurred in one case so that crime scene analysis would have been difficult if the recent release of the film had noted been identified.

A teenage girl was found lying in an undisturbed bed in the bedroom of a house occupied by her boyfriend. She had two broken fingernails, a small bruise on the thigh and a few petechiae in her eyes. Not far from her head was a roll of unused plastic cling-type wrap while the remainder of the wrap was found in the garbage bin some distance away. At trial the perpetrator confirmed that he copied the method of murdering his victim after viewing the film.

In another case a woman was found with the plastic wrap around her head requiring intense crime investigation into the circumstances surrounding her death. After seeing the film, she used the method to kill herself. In a similar case suicide was thought to be the manner of death in a man who was found with wrap around his head and neck.

Each case will demonstrate the difficulty in scene analysis, the problems in excluding homicide and the need for an awareness of the latest film releases. There are features in each case that suggest that the deaths were due to homicide. Each case died after seeing the same film, utilizing the same method as shown in that film. The media has influenced the deaths in these cases.

Homicide, Media, Concealment

G19 Use of the Impact Baton or So-Called “Rubber Bullet” as Less Lethal Force in Air vs. Water

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After attending this presentation, attendees will be able to recognize and differentiate wounds associated with impact baton, versus gunshot wounds associated with handguns and/or high velocity projectiles. Comparison will be made between impact baton wounds occurring in air as opposed to water.

This is a case of an officer involved shooting with a local law enforcement SWAT Team intervention using “less lethal” force which recently occurred at our office. The decedent is a 34-year-old white Hispanic man measuring 69 inches in height and weighing 283 pounds. The decedent had barricaded himself inside his trailer and was armed with a weapon. He was apparently depressed over his mother’s illness and had a history of drug abuse. Less lethal force was used to subdue the decedent in the form of a police dog as well as the use of the “Impact Baton” or so-called “Rubber Bullet.” The Sage Control Ordnance KO1 ammunition in a 37 mm Arwen 37 Mark III was used. This is known as the Sage Less Lethal Launched Ammunition and Ordnance System (L3A0S). The less lethal means used to subdue this man were unsuccessful and he was ultimately subdued with the use of .223 high velocity rifle wounds. The Arwen round wounds observed in this case will be compared to a second case in which rubber bullets were used to subdue an armed man in the San Gabriel River in Los Angeles County. In the second case the impact batons were fired through water, thus altering the wound characteristics. No fatal bullet wounds were incurred and the man ultimately drowned.

Rubber Bullet, Impact Baton, Less Lethal

G20 Dissection, Preservation and Sexual Abuse of Bodies and Body Parts – An Exceptional Case of Necrophilia

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After attending this presentation, attendees will learn that necrophilia is a rare disorder which can reach extreme dimensions with long-term sexual abuse of dissected and partially preserved body parts. He will retain that cooperation between police, forensic pathology and forensic psychiatry is essential to deal with such cases.

Necrophilia is rare and only few cases have been published in the literature. The cases presented here are unique because the crimes were committed by one individual in a period of 20 years. The stolen bodies were dissected and the organs and body parts partially preserved. The offender abused the corpse and the dissected body parts in a way that is hard to imagine and he documented this abuse on thousands of digital images.

The objective of this presentation is to demonstrate a cases of necrophilia committed by a 40-year-old man with mutilation, dissection and sexual abuse of three bodies and with extensive sexual abuse of dissected body parts which, in the last case, was documented by the offender on thousands of digital images.

The Greek term necrophilia or necrophilism refers to a morbid fondness of being in the presence of dead bodies and, in a stricter sense, to the impulse to have sexual contact or the act of such contact with a dead body, usually of males with female corpses (*Stedman's Medical Dictionary*, 24th ed.). Necrophilia is classified as psychiatric disorder (other disturbance of sexual preference) and the psychopathology of necrophiliacs is an interesting, but largely unknown field of forensic psychiatry based mainly on the work of Krafft-Ebing from 1886 (*Psychopathia sexualis*). However, since this disorder is directly associated with bodies and body parts, forensic pathologists play an important role in the investigation of such cases. The following case series demonstrates that the anatomical and pathological know-how of forensic pathology is indispensable for the police investigations and the psychiatric examination. Furthermore, forensic science is necessary to reunite body parts by morphological and molecular analysis thus ensuring that a dignified funeral finally can take place which is extremely important for the next-of-kin as they try to cope with this traumatizing event.

The chronologically last case of this series, which was the most spectacular, illustrates all features of necrophilia in an extreme dimension which, to our knowledge, never was reached in previous publications and case reports.

In October 1999, the body of a 14-year-old girl, who had been killed by a train accident, disappeared from a morgue at a small cemetery located in a rural area in Northern Bavaria, Germany. Extensive investigations were started but did not provide any results. Regional and national media reported on the case and considerable public pressure was exerted on the investigators.

Three months later, a forester observed a man who was taking photographs of intestines spread out in front of him. Although this observation was not reported to the police until 4 weeks later, the man could be identified and he immediately confessed having taken and sexually abused the body. Because of beginning putrefaction, the 40-year-old engineer had started to dissect the body after a few days, removing organs and body parts such as the intestines, liver, uterus, vagina and breasts. Using these specimens, he continued with sexual activities in his home bathroom and documented every detail with a digital camera. More than 7000 images were found on his computer hard disk showing extreme situations which are difficult to cope with even for experienced forensic pathologists.

The remains of the girl consisting of the trunk, parts of the extremities and the skull were found in a hole filled with mud on the property of the man. Some of the dissected specimens had been treated with an alcoholic solution to stop decomposition and could be recovered in his home. He also admitted having abused 2 other cadavers of young females: in 1985 he had opened a casket and mutilated a body by removing breasts, eyeballs and other body parts and in 1981 he had dismembered the corpse of a 21-year-old woman and further dissected and abused the torso at his home leaving the extremities in the casket. This body-snatching had not been noticed at that time. From this case there were still some specimens kept in his home such as a carefully prepared spine column with the pelvis attached by a Velcro fastening. He was suspected of being involved in more cases of body-snatching or body-stripping that had occurred in the region between 1985 and 2000 but no evidence could be found and he denied those accusations.

According to German criminal law he was convicted to two years and three months of prison because of disturbance of human remains. A psychiatric examination was ordered by the court and the diagnosis “necrophilia” (ICD 10: F65.8, other disorder of sexual preference) was made. According to the forensic psychiatrist, the criminal responsibility of the defendant was diminished and the probability of repeating similar crimes with corpses was high. The risk of committing homicides to satisfy his sexual urges in the future was considered to be significant and he was moved to a criminal mental hospital for an indefinite period of time.

Necrophilia, Sexual Abuse, Body Parts

G21 Too Many Causes of Death: What's the Manner?

Wendy M. Gunther, MD, Office of the Chief Medical Examiner and Department of Legal Medicine, Virginia Commonwealth University, 830 Southampton Avenue, Suite 100, Norfolk, VA 23510*

After attending this presentation, attendees will be able to evaluate the importance of competing causes of death discovered at autopsy. Rank causes of death in a hierarchical order depending on importance to the mechanism of death. Integrate scene information, gross autopsy discoveries, histologic findings, and toxicology results to determine the hierarchy of causes of death. Relate manner of death to the most important cause of death.

This presentation will impact the forensic community and/or humanity by recalling and reviewing the importance of integrating scene information, autopsy findings, histology, and toxicology into the determination of the most important cause of death, in order to determine an accurate manner of death. Understand the likelihood of multiple converging natural diseases in the homeless and alcoholic population. Increase awareness of recognizing significant and even predominating natural disease in persons with worrisome but nonfatal injuries, which may affect determination of manner of death.

A 53-year-old homeless man, familiar to local storeowners for about 15 years, had been living for the last three months beneath the trailer of an abandoned tractor-trailer behind a strip mall. Nearby storeowners said he appeared to be losing weight, and undergoing general health degeneration. He had no regular medical care. He had a history of admission to local hospitals for peptic ulcer disease and for chronic pancreatitis, with a splenic artery aneurysm recognized at one admission. The night before his death, children were observed throwing rocks in his direction. The children ran off when adults approached.

He was found dead beneath the trailer, surrounded by empty beer cans and vodka bottles. The scene investigators saw a bruise behind his left ear. At autopsy, he had numerous bruises of different ages on his shoulders, arms, chest, and legs, although no external bruise was appreciated in the livor behind his left ear. Small abrasions were noted on his elbow and hand; there was no other evidence of external injury.

The following lesions were found on internal examination: a small subgaleal hemorrhage behind the left ear, with a recent left-sided subdural hematoma; fresh injury to the left thoracic wall, without rib fracture; three separate ulcers or tears at the esophago-gastric junction, one of which appeared to have perforated, but might have been post-mortem; an ostium secundum defect of the heart, with right ventricular dilatation; slight coronary atherosclerosis, with a left predominance of the coronary system, and with a remote infarct of the posterior left ventricle, which was surrounded by a faint hyperemic area; micronodular cirrhosis of the liver, with diffuse, prominent fatty change; severe chronic pancreatitis, with a stented splenic artery aneurysm; three peptic ulcers in the first part of the duodenum, without frank bleeding; an intrahepatic aneurysmal dilatation of a large branch of the portal vein, with thrombosis; and moderately severe emphysema with chronic bronchitis. It was not possible to answer police inquiry, at gross autopsy, as to which of these had caused his death; or whether his manner of death was natural, accident, or homicide.

What do you do when you have too many causes of death, without a clear manner? The ramifications of multiple severe illnesses and injuries in a single case are discussed, particularly in a setting of homelessness and chronic alcoholism, with relevance to the manner of death.

Multiple Causes of Death, Manner of Death, Alcoholism

G22 Postmortem Analysis of Anastomotic Suture Line Disruption Following Carotid Endarterectomy

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The goal of this presentation is to describe a case report of a suture line disruption following surgery and how proper specimen handling and microscopic analysis allowed us to determine the cause of this therapeutic complication.

This presentation will impact the forensic community and/or humanity by providing this first report of its kind in which a postmortem analysis of suture material from a failed suture line implicated improper surgical technique in the death of a patient. In cases where an anastomotic failure is successfully repaired, a broken suture is often discarded along with any clot and blood-soaked gauze. The failure may be reported in the surgical literature or to the suture manufacturer but, without photography or an ultrastructural evaluation of the filament, it cannot be confirmed whether surgical technique or defective manufacturing was at fault.

In the forensic setting there is a singular opportunity to examine the sutures and resolve these issues. The findings can have both medico-legal and public health implications. In this study it was clear that tissue debris and formalin fixation did not significantly hinder such an analysis and we, therefore, recommend that in future death investigations of this nature, the medical examiner should refrain from handling the suture ends with dissecting implements, and preserve the anastomotic suture line with the surrounding tissue en-bloc so that a more detailed analysis can be performed.

The tensile strength of a surgical suture is essential in maintaining the integrity of vascular anastomoses. In the surgical literature, there have been several reports of suture line disruptions due to apparent fracture of polypropylene suture, including failure of an atrial septal defect repair, a proximal anastomosis of a coronary artery bypass, an aortic closure in a patent ductus arteriosus repair, a femoral-popliteal bypass repair, and a carotid endarterectomy. These previous case reports do not present a detailed analysis of the suture tips and there is no photography to document the findings.

While faulty operative technique and the loading strength of individual sutures have been implicated in spontaneous suture line disruptions, there has, to date, never been a published post-mortem analysis of a suture that has known to have failed. We present the case of suture line disruption leading to fatal exsanguination in a 77-year-old man following carotid endarterectomy with a facial vein patch. As part of the public health role performed by the medical examiner's office and in compliance with the requests of family, hospital and the suture manufacturer, we performed a detailed analysis to address the question of whether the suture or the surgical technique were at fault.

A 77-year-old white man with a history of hypertension, coronary artery disease and remote myocardial infarction underwent a carotid endarterectomy for high-grade stenosis of the right carotid artery. Under general anesthesia, the endarterectomy was performed and a right facial vein patch was placed using a double armed, #6-0 Prolene suture. He expired approximately 18 hours after surgery, following a sudden, fatal exsanguination from the surgical site. At autopsy, there was a 1 cm defect of the sutured anastomotic line. At the defect, two suture tips were identified: a straight cranial end and a tightly coiled caudal end. There was no knot on either side, nor were any loose suture fragments identified. The smooth edges of the vein graft and carotid artery confirmed that the tissue itself didn't fray or tear.

The carotid specimen was preserved en-bloc in 10% formalin and photographed using both dissecting and scanning electron microscopy. Examination of the specimen under a dissecting microscope demonstrated that other suture knots from the specimen, some involving vascular ligatures and others involving a distant line of interrupted sutures, were tied in stacked granny or half-hitch configurations. Several of these interrupted sutures were in various stages of untying, with one that had completely untied but had not yet pulled through the tissues.

For scanning electron microscopy, suture tips from the disrupted anastomotic line and from elsewhere on the specimen were carefully removed and oriented. For controls, several #6-0 Prolene control sutures were removed directly from the manufacturing package and were alternately cut with a scalpel blade, surgical scissors, or were manually broken and "popped off" the suture needle. Ultrastructural photography demonstrated that suture tips cut by a scalpel have a squared-off, straight edge while ones that have been cut by scissors are flattened or wedge-shaped with horizontal linear shear marks along the cut surface.

The microscopic shape and contour of the disrupted suture tips, and the complete absence of a knot or additional suture fragments, indicated that surgical technique (an untied knot) was the cause of the suture line disruption. The removal of a broken or untied suture at surgery or at autopsy should not preclude proper analysis of the failed suture, as the results can have both medico-legal and public health implications.

Forensic Science, Forensic Pathology, Anastomosis

G23 Advanced Flow Cytometric DNA Degradation Analysis: Utility in Postmortem Interval Estimation

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After attending this presentation, attendees will be able to determine if application of a statistical model and objective computer modeling to DNA degradation data will yield reproducible, accurate results, and help in post-mortem interval estimation.

This presentation will impact the forensic community and/or humanity by providing preliminary results which indicate that more advanced analysis, including statistical evaluation and computer modeling, of DNA degradation data is possible. These methodologies could be then be applied to forensic autopsy samples to assess their validity in estimating a post-mortem interval.

This poster will show data used to develop a mathematical model for PMI estimation as well as juxtapose two different flow cytometric computer models in an effort to select the most reliable methods of estimation.

Over the past decade, since the first proposal by Cina that flow cytometry might be useful in post-mortem interval estimation by monitoring DNA degradation, several papers have been published attempting to establish a link. Using flow cytometry, previous studies on splenic and hepatic tissue have suggested that cellular DNA degradation increases with time, and could thus potentially be used as a tool for post-mortem interval estimation. However, much of this previous work has been focused on selecting the best type of sample for analysis, rather than on perfecting the technique and analysis of the data obtained. In an

attempt to delineate the best analytical method, this study involved the collection of easily obtainable blood samples, from normal living donors, which were stored at room temperature, then assayed for DNA content at varying times post collection (0-191.5 hrs) to determine the amount of DNA degradation. This amount of degraded DNA was quantified using two different computer programs: CellQuest™ v. 3.11 (Becton-Dickinson, San Jose, CA) and Modfit™ v. 3.0 (Verity Software, Topsham, ME, U.S.A). The first program allows for subjective analysis of the amount of DNA degradation, while the second program uses a computer model which can objectively assign the amount of DNA degradation, without user input.

After DNA degradation determination by both computer programs, the relationship of DNA degradation and sample age was plotted and further analyzed with a random coefficient statistical model to yield a population regression curve.

The validity of this curve was then tested using blood collected from another group of normal donors and analyzed at varying times in a blind study. In 20 of 28 samples, a correct 24 hour period was able to be assigned (71%). These preliminary results suggest that a mathematical model, combined with objective computer analysis, can be applied to the monitoring of DNA degradation of cellular material, and can potentially become a tool in determining post-mortem interval.

Post Mortem Interval, Flow Cytometry, DNA Degradation

G24 The Impact of Dermatologic Consultation in Autopsy Examination: A Case of Pseudoxanthoma Elasticum

Carrie L. Kovarik, MD, UT Clay J. Cockerell, MD, Sheila D. Spotswood, MD, and Jeffrey J. Barnard, MD, University of Texas Southwestern Medical School - Forensic Science, 5323 Harry Hines Boulevard, Dallas, TX 75390*

After attending this presentation, attendees will understand and realize the usefulness of dermatologic consultation in autopsy examinations through a case presentation of pseudoxanthoma elasticum.

This presentation will impact the forensic community and/or humanity by demonstrating that a dermatology consultation may be a very useful addition to forensic and hospital autopsies. We present an example of how this consultation may lead to the diagnosis of systemic disease and possible cause of death.

Dermatologic consultation in the autopsy examination may be very useful in many cases. We present a case of pseudoxanthoma elasticum, a genetic disease, that was diagnosed by a thorough external examination and histologic evaluation of the skin.

A forty-nine-year old white female was found unresponsive in an apartment fire and was taken to the local area hospital. On arrival, the patient was in asystole and had a carbon monoxide concentration of sixty percent. She was also found to have evidence of smoke inhalation and burns over approximately fourteen percent of the total body surface area. The patient was pronounced dead and was transferred to the Dallas County Medical Examiner's Office.

On skin examination, the patient had a large leathery, firm, dark brown plaque with surrounding erythema on her back and right flank. On the leading edge of the plaque, there were multiple bullae and skin sloughing. The leathery plaque was clinically consistent with the most severe burn site and was likely the area closest to the heat source given the intense drying of the skin. The bullae and skin sloughing was clinically consistent with a third degree, full thickness, burn. On the skin of her neck, antecubital fossa, and inguinal area, the patient had small yellow papules and a wrinkly appearance that resembled "plucked chicken skin." A biopsy was taken of the bullae on the right flank and the skin the inguinal area.

The biopsy of the bullae was consistent with a full thickness burn and showed a necrotic epidermis and polarization of the nuclei around the hair follicles. The biopsy of the skin taken from the inguinal area was characteristic of pseudoxanthoma elasticum and showed degeneration of the elastic fibers in the middle and lower dermis. On hematoxylin and eosin staining, the elastic fibers were basophilic, irregular, and widely dispersed among the collagen bundles. On von Kossa staining, these elastic fibers were highlighted in a dark brown color.

Pseudoxanthoma elasticum is an autosomal recessive disorder due to a mutation in the ABCG6 gene on chromosome 16. The patients have clumped, distorted, calcified elastic fibers which manifest as disease in many organ systems. The patients typically have flat, yellowish papules on the skin of flexural areas that sometimes coalesce to resemble "plucked chicken skin." Most patients also develop angioid streaks in the eye that may lead to blindness, and many develop progressive calcification of the medium sized arteries which leads to hypertension and myocardial infarctions at a much younger age. Patients may also have calcification of the cerebral and gastric vessels.

Upon further investigation into this patient's history, she was found to be blind and have severe hypertension. These findings, along with the characteristic histologic findings on skin biopsy, lead to a definitive diagnosis of pseudoxanthoma elasticum. This disease has tremendous implications for the family given that it is inheritable and may cause significant morbidity and mortality.

Dermatologic consultation was extremely useful in this case, given that the skin findings, combined with the knowledge of the patient's medical history, provided the diagnosis of a rare, genetic, and life threatening disease.

Dermatology, Consultation, Autopsy

G25 Homicidal Injury or Resuscitation Artifact?

Amy P. Hart, MD, Venus J. Azar, MD, and Boyd G. Stephens, MD, Medical Examiner's Office, City and County of San Francisco, 850 Bryant Street, San Francisco, CA 94103*

After attending this presentation, attendees will become aware of resuscitation artifact created by mechanical cardiopulmonary resuscitation systems.

Objectives: to present a case of resuscitation artifact from mechanical cardiopulmonary resuscitation system which could be potentially confused with homicidal injury and two additional cases involving the use of a mechanical cardiopulmonary resuscitation system; and, to discuss the mechanical cardiopulmonary resuscitation system used in the City and County of San Francisco.

Evaluation and correct identification of resuscitative artifact is critical in the diagnosis and determination of cause and manner of death in certain cases. Resuscitative artifact can emulate inflicted injuries and possibly be misinterpreted. Occasionally new technology and/or medical procedures will create original and distinctive artifact. This presentation discusses one new technology and its related artifact.

The decedent is a 69-year-old obese white man with a history of hypertension who is found dead on the floor of the bedroom/office in the home that he shared with his daughter and a downstairs tenant. On the evening of his death, his daughter was out with her fiancée. During the evening, the decedent reportedly engaged in a verbal altercation regarding the use of the oven in the kitchen with the downstairs tenant. The tenant reported that the landlord seemed very agitated, angry, and tense, which was unusual for him. The tenant called the decedent's daughter, who returned with her fiancée to the residence. While the daughter's fiancée was speaking with the tenant he noted an abrasion on the back of the tenant's right hand, which the tenant claimed was from striking a wall after the verbal altercation with the landlord. The daughter went upstairs and found her father lying on the floor, unresponsive.

Hearing the daughter scream, her fiancée went upstairs. The daughter called 911 while the fiancée started cardiopulmonary resuscitation. When the paramedics arrived, they continued resuscitation using a mechanical cardiopulmonary resuscitation system. Despite all efforts, the decedent was pronounced dead at the scene.

External examination showed an abrasion on the top of the head, abrasions on the right side of the forehead, the right cheek, and the right side of the nose, and contusions of the lateral right eyebrow and left temple. There were petechial hemorrhages on skin of the forehead, the upper and lower eyelids, and cheeks. There were petechial and confluent hemorrhages of the conjunctivae and sclerae. There were large abrasions on the lateral left chest and abdomen. There was a contusion of the left knee. The decedent's doctor was contacted and reported that he considered this death sudden and unexpected.

This presentation will discuss the autopsy findings of this case and two additional cases in which a mechanical cardiopulmonary resuscitation system was used. The City and County of San Francisco Medical Examiner's Office participated in the development of prototypes of a mechanical cardiopulmonary resuscitation system (Revivant AutoPulse). Recently, the San Francisco Fire Department emergency personnel began using this mechanical cardiopulmonary resuscitation system in the field. This presentation will discuss the rationale and operation of mechanical cardiopulmonary resuscitation systems and associated findings at postmortem examination.

Forensic Pathology, Resuscitation Artifact, Mechanical Cardiopulmonary Resuscitation

G26 Screening Items of Evidence for the Presence of Body Fluids/DNA in Forensic Biology Casework — A Hypothesis-Driven Approach

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After attending this presentation, participants will learn how the implementation of various case screening strategies and initiatives developed in response to case hypotheses has assisted in addressing pertinent forensic questions in a timely and efficient manner.

This presentation will impact the forensic community and/or humanity by adapting processes and undertaking examinations specifically in response to hypotheses formulated by information in case histories has permitted us to work more efficiently while addressing the most pertinent questions in cases. Sharing these successes will assist other laboratories in implementing similar measures.

This poster will present specific examples of case screening strategies and initiatives adopted at the Centre of Forensic Sciences (CFS) designed to facilitate hypothesis-driven examinations. The aim is to promote the examination of relevant items only, in a manner that is timely and efficient.

Many forensic cases require a small number of items to be examined in order to address the pertinent questions at hand. On the other hand, larger and more complex cases require that decisions be made with respect to which items are to be examined, the order in which those items are examined, and, given a particular result, the necessity of additional examinations. Information provided through the case history and case conferencing as well as knowledge gained through experience and training can be used to formulate a hypothesis in accordance with the scientific method to address these decisions.

Recently, CFS case screening procedures were updated and further aligned with the principles of hypothesis testing. An increased emphasis was placed on assessing the relevance of an examination. The following statement from our DNA Case Screening Manual is one example:

"Scientists are required to evaluate the relevance of an examination using the principle of reasonable expectation and to be mindful of the limitations such an examination confers."

The approach is demonstrated through the following examples of classes of cases typically encountered at the CFS:

Sexual Assault Cases

Sex assaults comprise roughly two thirds of the workload of the Biology Section. Examples of initiatives undertaken to screen items more quickly in accordance with the case history provided include:

- The sexual assault examination kit (SAEK) provided to treatment centres throughout the province has been redesigned such that only relevant samples are collected. Furthermore, the design of the kit dovetails with our screening procedures in the laboratory, and provides samples that can be retained for independent testing.
- In sexual assault cases, relevancy of item examination is evaluated and hypothesis-based flowcharts govern the order in which selected items are examined. When vaginal intercourse is the only allegation, oral and rectal samples are not examined. Vaginal samples are examined beginning with the examination of the vaginal smear. If semen is identified, DNA testing of the vaginal swab is immediately initiated and case screening is terminated pending DNA results. In the absence of semen on the vaginal samples, underwear from the complainant is examined for the presence of semen and/or saliva only if vaginal penetration and/or cunnilingus is alleged, and if the underwear were worn shortly after the alleged assault. Clothing is examined for the presence of semen only if the case history indicates that external ejaculation is suspected or if the complainant cannot reliably describe the circumstances of the assault.
- A process was designed to expedite the examination of microscope smears made from internal samples collected during the SAEK. The examination provides a rapid screen in order to expedite the processing of positive sexual assault cases while minimizing the consumption of related samples.
- A Cold Case Program was established through the joint efforts of the CFS and a major metropolitan police service. This initiative involves the examination/re-examination of unsolved cases by targeting only those cases and those items that are most likely, based on case history, to produce a DNA result attributable to the perpetrator. Strict criteria for submission as well as a hypothesis-based flowchart provided to investigators ensure submission of only relevant items, which leads to a timely examination and the highest chance of success.

Property Crime Cases

The CFS has initiated a "Break and Enter" program to accommodate the submission of evidence from break and enter cases where no suspect is known. The focus of this program is to produce DNA profiles, in a timely fashion, for upload to the National DNA Databank in cases where there are no other investigative leads. To control a potentially unmanageable influx of break and enter casework, strict guidelines were established to target the submission of one item per case that is most likely to be attributed to the perpetrator. Items that are accepted as per the guidelines include swabs of blood, cigarette butts, and swabs from drink containers. Items such as swabs of doorknobs, where there is a prior expectation of low levels of DNA having been deposited through innocuous means, are not accepted.

Blood Cases

The principle of hypothesis testing can also be applied in situations where the examination for the presence of blood is required. For example, when processing assault cases where the case history suggests only one bleeding person (complainant), and where a large number of items from the suspect are submitted, the examination of a single item is sufficient if in fact blood is detected. Item selection is based on the circumstances of the event (e.g., a shoe, if there was kicking involved, or the outermost upper garment if there was punching or an assault with a weapon).

Ultimately, the hypothesis-based approach promotes representative sampling over exhaustive sampling and leads to more meaningful results for clients in a timely fashion.

Case Screening, Forensic Biology, Hypothesis Testing

G27 Fatal Kawasaki Disease Associated With Cardiac Rhabdomyomas in an Infant

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The purpose of this report is three-fold: to present a hitherto undescribed association (Kawasaki disease and cardiac rhabdomyoma); to illustrate an extremely rare cause of sudden death in infants (cardiac tamponade due to a ruptured Kawasaki aneurysm); and to demonstrate the co-existence of two coronary complications of Kawasaki disease: proximal coronary aneurysm (common) and non-aneurysmal stenosis (rare).

This presentation will impact the forensic community and/or humanity by presenting a hitherto undescribed association in a rare cause of death (cardiac rhabdomyomas in fatal case of Kawasaki disease due to rupture of a coronary aneurysm in an infant).

The purpose of this report is three-fold: to present a hitherto undescribed association (Kawasaki disease and cardiac rhabdomyoma); to illustrate an extremely rare cause of sudden death in infants (cardiac tamponade due to a ruptured Kawasaki aneurysm); and to demonstrate the co-existence of two coronary complications of Kawasaki disease: proximal coronary aneurysm (common) and non-aneurysmal stenosis (rare).

Introduction: Kawasaki disease (KD), or mucocutaneous lymph node syndrome, is an inflammatory disease of infants and children that is often associated with a systemic vasculitis preferentially involving the coronary arteries. Although the acute illness usually resolves spontaneously, 15-30% of untreated children develop cardiovascular complications, including proximal coronary artery aneurysms and rarely coronary stenosis without aneurysm formation. Fatal complications are uncommon, occurring in an estimated 0.5% of cases. Sudden deaths are usually related to myocardial ischemia secondary to thrombosis of coronary aneurysms or coronary scarring. Among fatal cases of KD, coronary artery rupture has been reported in approximately 5% of those autopsied.

KD usually afflicts children under five years of age, and the diagnosis is based on a constellation of clinical features. The signs include fever unresponsive to antibiotics, cervical lymphadenopathy, bilateral conjunctival injection, labial and oropharyngeal mucosal erythema and fissuring, and cutaneous erythema and exanthema that often involves the palms and soles. Infants under six months of age can present with aggressive coronary vasculitis with aneurysms in the absence of the typical clinical signs.

The etiology of KD is unknown. Although a number of toxins and infectious agents have been implicated, acting as direct pathogens or via superantigen mediated autoimmunity, no constant associations have been identified. Moreover, case reports have described rare cases of KD occurring in association with other medical conditions, including congenital anomalies of the coronary arteries, Beckwith-Wiedemann syndrome, and cystic fibrosis. To our knowledge, KD has not been previously reported in association with cardiac rhabdomyomas.

Cardiac rhabdomyomas are rare congenital hamartomatous tumors usually discovered in infants and children. Most are multiple, occurring anywhere in the myocardium. Rhabdomyomas of the heart are strongly associated with tuberous sclerosis. The clinical presentation and prognosis depend on the size and location of the tumors.

Clinical History: The decedent was a four-month-old white male infant who was the product of a 38 week gestation, delivered via cesarean section for maternal pre-eclampsia. The early neonatal period was marked only by transient hyperbilirubinemia, which resolved spontaneously. The infant was healthy until approximately three months of age, when he developed a cough and intermittent fevers that reportedly responded to treatment with acetaminophen. He was seen by his primary pediatrician several times during the ensuing 2-3 weeks and diagnosed with otitis media. Despite treatment with antibiotics, fevers and cough persisted, prompting an emergency department visit. At the time, his temperature was recorded at 102.1. He had no lymphadenopathy, rash, or oral mucosal abnormalities, although redness of the eyes was noted. He was discharged home with continued antibiotics and symptomatic treatment. Ten days after being examined in the emergency department, the infant became suddenly unresponsive while being dressed by his mother. Resuscitative efforts were unsuccessful.

Autopsy Findings: The body was that of a well-developed, well-nourished white male infant who was large for the age of four months. The skin was pale and free of exanthema. The oral mucosa was free of lesions, and the conjunctivae were clear. There was no lymphadenopathy. The brain was free of tubers, and the kidneys had no masses. The pericardial sac was distended with 400 cubic centimeters of partially clotted, bright red blood. The heart was normally formed. The epicardial coronary arteries were markedly thickened and firm, most with a cord-like appearance. Focally (predominantly in the distal left obtuse marginal branches), the arteries had a beaded appearance, with areas of thickening alternating with thin, grossly normal-appearing segments. The proximal right coronary artery had a 0.8 x 0.8 x 0.7 centimeter thin walled aneurysm with a 0.1-0.2 centimeter rupture in the epicardial surface. Transverse sections of the thickened arterial segments demonstrated firm, yellow-white, circumferentially thickened arterial walls surrounding narrow, focally pinpoint residual lumina. The cardiac valves and chamber dimensions were normal. The myocardium was firm, red-brown, and free of gross abnormalities. A 0.2 x 0.2 x 0.2 centimeter smooth excrescent nodule was on the right ventricular aspect of the septum, just below the right ventricular outflow tract. The endocardial surfaces were otherwise unremarkable. The pulmonary artery, the aorta, and the major systemic arterial branches were free of thickening or other gross abnormalities.

Microscopic examination: Histologic sections of the coronary arteries demonstrated diffuse chronic and mixed inflammatory infiltrates involving the intima, media, and adventitia. Focally, the inflammation was accompanied by intimal hyperplasia and non-occlusive adherent luminal surface thrombi. The media was focally disrupted and obliterated. Both the media and the adventitia had large areas of sclerosis and neovascularization resembling granulation tissue. Sections of the right coronary aneurysm demonstrated attenuation of the arterial wall with destruction of the media and transmural mixed inflammation with eosinophils. The thin wall was focally disrupted, with transmural fibrin deposition at the rupture site. Myocardial histologic sections revealed multiple small subendocardial and intramural rhabdomyomas in the left and right ventricles, characterized by well demarcated foci of large, clear cells, some with spider cell morphology.

Discussion: Coronary artery aneurysm rupture due to KD and cardiac rhabdomyomas are both independently rare. To our knowledge, they have not been previously reported together. In addition, the coexistence of proximal aneurysm with diffuse non-aneurysmal stenosis in the acute phase of KD is described. The relationship, if any, between these entities is not clear, and the rhabdomyomas may represent an incidental finding in this case of fatal KD.

Kawasaki Disease, Rhabdomyoma, Coronary Aneurysm

G28 Hmong Cultural Aversion to Forensic Autopsy: Bridging Communication and Cultural Barrier

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The goal of this presentation is to share with the forensic community practical experience in communication methods, including the use of community public radio broadcasting, to both increase understanding of the autopsy and to lessen cultural resistance to forensic autopsy among the Hmong cultural community in the USA.

This presentation will impact the forensic community and/or humanity by increasing understanding and acceptance of the forensic autopsy by Hmong people as an instrument of "good" for the entire community as well as greater sensitivity by the forensic community to the culture of the Hmong and their desired treatment of the dead.

This poster presents the work of the authors and a dedicated group of Hmong who addressed a series of cultural problems discovered during the course of a routine forensic autopsy performed on an Hmong elderly woman, a member of one of the five Hmong clans living in Butte County, located in northern California. After resolution of the cultural issues of this individual clan member, the scope of our work was expanded to examine cultural objections to autopsy by all eighteen clans which compose the some 300,000 Hmong currently residing in the United States. Over several months a series of meetings to identify Hmong cultural/religious objections to autopsy were held among members of the Hmong community, the Butte County Chief Deputy Coroner, and the county forensic pathologist. Given deeper insight, understanding, and sensitivity to the Hmong cultural aversion to autopsy examination, a number of mitigating steps were initiated by the Butte County Sheriff-Coroner and forensic pathologist which assured surviving Hmong relatives that the spirit of their deceased family member could enter the after-life with minimal negative cultural consequences for the decedent. The risk of the decedent's spirit returning to haunt surviving relatives because of the perceived failure of the relatives to prevent autopsy, a palpable fear among the relatives, was also eliminated. At the same time the requirements of the law necessitating forensic autopsy were also upheld.

Mitigating steps initiated included:

(1) Performing a full autopsy only when absolutely necessary.
(2) When a decedent coming to forensic autopsy was known, or suspected, to be Hmong, the next-of-kin was contacted by the forensic pathologist to inform them that an autopsy would be done and for what purpose. An offer for the family to elect a family member, or family representative, to 'talk' to the spirit of the dead person prior to autopsy in the presence of the body was proffered. Because of the Hmong belief that the spirit resides in the dead body, it is believed possible to communicate to the person's spirit after death. The purpose in talking to the dead body was to relate why an autopsy had to be done for which the family members bore no responsibility. Currently, a native Hmong-speaking liaison between the Hmong community and the Coroner's Office is being sought to replace the time consuming contact role of the forensic pathologist.

(3) Replace all organs back into the body after autopsy.
(4) Allow no metallic foreign items to be left in the body after autopsy.

Delay performing the autopsy until appropriate family ritual arrangements could be made.

Recognizing that the Hmong cultural aversion to autopsy affected not only the local community but also the broader Hmong community throughout the United States, a one hour long radio program titled, "Forensic autopsy and the Hmong" was carefully scripted employing very simple Hmong terms to explain medical terms totally foreign to the Hmong language. The radio program was broadcast over a local

northern California Community Public Radio station, FM 90.1 KZFR – Chico, with an estimated local listening audience of 4,000 Hmong. The radio program was recorded, burned to CD, and redistributed throughout the United States to numerous Hmong Cultural Centers as well as forensic pathologists who expressed an interest through the National Association of Medical Examiners (NAME) internet-based computer listserv.

A conservative estimate is that tens of thousands of Hmong listeners will ultimately be exposed to this radio program.

Hmong Culture, Autopsy Resistance, Radio Broadcast

G29 Postmortem Diagnosis of Genetic Arrhythmia Syndromes

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After attending this presentation, attendees will understand current methods of postmortem diagnosis of genetic arrhythmia syndromes.

Genetic arrhythmia syndromes, which are almost certainly under-diagnosed by medical examiners, have been theorized to cause some deaths from Sudden Infant Death Syndrome and have been implicated in the development of fatal arrhythmias during exercise. A presentation by an M.E. about cases where genetic analysis supported an etiology for fatal arrhythmia may encourage others to increase their index of suspicion for these disorders and to support efforts to develop cost-effective screening methods.

Genetic disorders predisposing to sudden death from arrhythmia in the absence of cardiac anatomic abnormalities account for an unknown number of deaths presenting to the medical examiner. Two cases illustrate the importance of clinical history in such deaths and the methods by which postmortem diagnosis of these conditions can be accomplished.

A 15-year-old girl collapsed in front of witnesses while swimming and died despite immediate medical attention. Autopsy revealed no injuries, anomalies or acute disease process, and electrolyte analysis and toxicology were non-contributory. Medical history was significant for two fainting episodes in the past year under conditions of emotional stress. Review of antemortem EKG's showed mild prolongation of the Q-T interval and increased Q-T with increased heart rate. Molecular studies of frozen myocardium have shown a mutation in a cardiac ryanodine receptor gene associated with catecholaminergic polymorphic ventricular tachycardia. Also present was a polymorphism in the KCNE1 potassium subunit gene; mutations in that gene have been associated with Long Q-T Syndrome. The death has been classified as due to cardiac arrhythmia; further molecular studies are ongoing.

A 43-year-old woman was found dead where she had been shoveling snow. A complete autopsy revealed no cause of death. The information that her previously healthy sister had collapsed and died on hearing of her death prompted molecular analysis of a liver specimen archived for toxicology. A mutation was present in a cardiac potassium channel gene known to be associated with congenital Long Q-T Syndrome.

Genetic sequencing for mutations associated with sudden death from fatal arrhythmia is expensive, time-consuming and not widely available. Review of the circumstances of death, family history and medical records following a negative autopsy facilitates selection of the rare case appropriate for molecular testing. Frozen myocardium is currently the best specimen for analysis, and should be retained in suspected cases.

Simplification of screening for known mutations or abnormal gene products would enhance the ability of the medical examiner to determine that a genetic arrhythmia syndrome caused a death. These conditions are heritable and can often be managed by pharmacotherapy, avoidance of

arrhythmia inducing substances and medications, and/or defibrillator placement. Surviving family members may therefore benefit from counseling and electrophysiologic screening. These interventions have the potential to save lives.

Long Q-T Syndrome, Molecular Diagnosis, Arrhythmia

G30 Is Hypertension a Risk Factor for Fatal Rupture of Intracranial Aneurysms?

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After attending this presentation, attendees will be able to describe detail of the characteristics of the subjects dying from ruptured berry aneurysms, including age, gender, and risk factors, detailed location, size, and anatomic extension of the subarachnoid hemorrhage depending on the location; and describe the risk factors for fatal rupture of berry aneurysms.

This presentation will impact the forensic community and/or humanity by demonstrating a better understanding of the epidemiology and risk factors of nontraumatic subarachnoid hemorrhage, specifically ruptured berry aneurysms

Background: Berry (saccular) aneurysms of the circle of Willis arteries are the most common cause of fatal subarachnoid hemorrhage in the absence of pre-existing trauma. The incidence of intracranial berry aneurysms increases with age, with a 1% prevalence in the overall population, 2% in middle age individuals and 5% in older people. The annual risk of rupture is estimated as 0.6%, with a very high fatality rate. Berry aneurysms have a multifactorial etiology. They are most commonly found at points of branching. An underlying defect in the wall of the vessel where the aneurysm subsequently forms is frequently found. They are familial in about 5% of the cases, and multiple in a similar percentage of cases. Besides age, other risk factors for the development and rupture of berry aneurysms are smoking, hypertension, heavy alcohol use or drugs. The role of hypertension in the development and rupture of aneurysms is controversial, and there are no previous studies correlating heart weight (raw or normalized) with the development or rupture of berry aneurysms.

Goals: To better define the population affected by fatal rupture of berry aneurysms and detect and characterize risk factors. A primary hypothesis of the study is that an increased heart weight represents a risk factor for aneurysmal rupture.

Subjects and Methods: We designed and performed a case-control study. Cases were all individuals autopsied at the Office of the Chief Medical Examiner for the State of Maryland in whom subarachnoid hemorrhage secondary to ruptured berry aneurysm was identified.

Two controls were selected per case in order to increase the power of the study. In order to minimize bias, controls were matched for age (within five years) and gender; we only selected individuals who died accidentally, and had an autopsy performed in our office, prior (one of the controls) or subsequent (the other control) to the matching case.

Anthropometric parameters including age, gender, race, height and weight were recorded. We obtained clinical information including history of smoking, alcohol or drug use and hypertension. At autopsy, heart weight, presence and severity of coronary atherosclerosis, brain weight and toxicologic findings were tabulated. Heart weight is normalized for height, weight and body surface, as previously described. In addition, detailed information regarding the ruptured aneurysm was con-

sidered for the cases (side, location, size, distribution of the subarachnoid hemorrhage, presence of additional, unruptured aneurysms). Data was analyzed by multiple logistic regression, with case/control status as dependent variable and heart weight and other predictors as potential risk factors.

Results: A total of 145 cases (65 women [aged 47.5+/-12.7 years] and 80 men [aged 44+/-10.7 years]) and 290 controls (130 women [aged 47.5+/-13.2 years] and 160 men [aged 43.9+/-11.1 years]) were included in the study. Results of the multiple logistic regression analysis include odds ratios and confidence intervals for additional risk factors.

Berry Aneurysm, Hypertension, Fatal Rupture

G31 Fatal Acute Thrombosis of Anomalous Right Coronary Artery Arising From the Left Sinus of Valsalva

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Anomalous origin of coronary artery(s) may be an isolated cause of sudden death. Many different mechanisms have been suggested. The goal of this presentation is to illustrate a previously undescribed complication of this anomaly, namely fatal acute thrombosis occurring in an anomalous right coronary artery, otherwise free of atherosclerosis.

Previously postulated mechanisms of death in cases of isolated anomalous origin of coronary arteries have focused on functional insufficiency of the coronary vessel because of periodic compression, either between great vessels, or within the aortic wall. The present case suggests that another mechanism of death may be acute thrombosis of the anomalous artery. This mechanism may be related to other postulated mechanisms through intraluminal turbulence.

A 63-year-old Caucasian woman was found dead in her secure residence. She was of average height and weight with no external or internal injuries. The aorta and great veins were normally distributed; moderate atherosclerotic plaques were in the aorta. The 600-gram heart had concentric left ventricular hypertrophy, measuring up to 2.1 cm; the right ventricle was 0.5 cm; hypertensive changes were evident in the kidneys. The myocardium was uniform with no diffuse or discrete zones of fibrosis. The valves had a normal configuration, but the aortic valve cusps were partially calcified with no vegetations.

The left main coronary artery originated normally, from the left sinus of Valsalva; the left main coronary artery bifurcated to give rise to the anterior descending and circumflex branches. The right coronary artery also originated from the same ostium in the left sinus of Valsalva and traveled between the aorta and the pulmonary artery. The proximal 0.2-0.3 cm segment of the right coronary was intramural within the aorta and had an ovoid, narrow lumen. A 0.3 cm occlusive acute thrombus was within the lumen of the right coronary artery, 0.5 cm from its origin, extending for a length of 1 cm. The thrombus was in the portion of the right coronary artery interposed between the aorta and the pulmonary trunk, just distal of the intramural segment. The right coronary artery supplied the posterior apical myocardium. The coronary arteries were free of atherosclerosis.

Several mechanisms of death have been proposed in cases of isolated anomalous coronary origin. Because of the abnormal position with respect to the aorta, these vessels typically follow a course between the great vessels. One possible consequence is compression between the great vessels (a "scissors" mechanism). Since the aorta and pulmonary arteries are distended at different phases of the cardiac cycle, and because the coronaries are filled primarily during diastole, strenuous

exercise, and consequent increased heart rate and shortening of the cardiac cycle, should present an increased risk of death for these patients. Indeed, most such deaths occur during strenuous exercise. Additionally, the proximal segment of the anomalous artery generally follows an intramural course; that is, it is within the aortic root, sharing tunica media with the aortic wall, without an intervening adventitia. This intramural segment typically has an ovoid cross section, and may well be further compromised with intra-aortic pressure. The latter mechanism is supported by clinical *in situ* intravascular ultrasound studies. In most cases the anomalous coronary emerges at an acute angle with the aortic wall, such that blood flow into the vessel would be less direct than in the "typical" arrangement. Other anatomic or functional features have been proposed, such as ostial ridges impeding flow into the vessel lumen. The present case indicates that another mechanism may occur in some patients, thrombosis of the anomalous origin. Turbulence of the intraluminal blood, perhaps caused by any (or a combination) of the other postulated mechanism(s) may lead to focal thrombosis. The absence of atherosclerosis in the thrombosed segment indicates that the anomalous origin was the likely cause of the thrombosis.

Anomalous Coronary Artery, Acute Thrombosis, Sudden Death

G32 Undiagnosed Cardiac Sarcoidosis and Sudden Death: Report of 14 Cases

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After attending this presentation, attendees will be able to recognize the significance of the postmortem diagnosis of sudden death due to undiagnosed cardiac sarcoidosis in the field of forensic medicine.

Cardiac sarcoidosis is often clinically silent. It has been reported that sudden death is the most common manifestation of myocardial sarcoidosis. Our study has demonstrated that it is important for forensic pathologists to consider cardiac sarcoidosis in sudden unexpected deaths and to perform a complete autopsy including histological examination of the regional lymph nodes in addition to the major organs.

The Office of the Chief Medical Examiner (OCME) for the state of Maryland documented 37 deaths caused by sarcoidosis from 1993 through January 2003. Of the 37 cases, 14 (37%) carried no previous diagnosis of sarcoidosis. Five of the 14 cases (36%) were witnessed to suddenly collapse (including 1 case of collapse after a non-fatal assault). The remaining 9 cases (64%) were found unresponsive at home. All 14 cases had a complete autopsy with histological and toxicological studies. The mean age of the 14 patients at death was 40 years (± 5.9 , range 35-47 years). There was an equal distribution of sexes (7 males, 7 females) with a race distribution of 12 African Americans and 2 Caucasians. The majority of the cases (79%) were clinically silent. Only 3 (21%) of the cases had a prior cardiac history, including one who had biventricular hypertrophy with cardiac pacing, one with congestive heart failure and 1 case with non-specific cardiac complaints. Other known medical conditions included depression (2), obesity (2), diabetes mellitus (2), and asthma (1).

The diagnosis of cardiac sarcoidosis was based on microscopic findings of non-caseating granulomatous inflammation involving the heart and at least one other organ (lungs and/or regional lymph nodes), or with microscopic evidence of cardiac involvement and grossly enlarged regional lymph nodes in the absence of evidence of other infection or other granulomatous processes.

Mean heart weight for all 37 cases was 518 g (± 140 , range 310-830 gm). Of the 14 cases of previously undiagnosed sarcoidosis, 13 (93%)

showed cardiac involvement. Five of the 13 (38%) cases had gross evidence of cardiac sarcoidosis that ranged from pericardial, epicardial or endocardial plaques to fibrosis of the ventricles and septum. However, the majority, 62% (8/13) of the cases showed no significant gross pathological changes in the heart and the diagnosis of cardiac sarcoidosis was made on histological examination. None of the 13 cases showed cardiac involvement alone. Three of the 13 (23%) cases had no gross evidence of disease in any organs. Of the 13 cases, non-caseating granulomatous inflammation was identified in the lung (13/13 cases), lymph nodes (5/5 cases with histological examination), liver (4/13 cases), spleen (3/13 cases), and kidney (2/13 cases). One patient died of extensive pulmonary sarcoidosis without cardiac involvement.

This report emphasizes the significance of the postmortem diagnosis of sudden death due to previously undiagnosed cardiac sarcoidosis. The implications of the medicolegal autopsy including histological examination are addressed.

Sarcoidosis, Sudden Death, Forensic Autopsy

G33 Accidental Insulin Overdose

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After attending this presentation, attendees will understand the postmortem laboratory tests required to make a diagnosis of insulin overdose.

This presentation will impact the forensic community and/or humanity by using a case of accidental insulin overdose which occurred in a hospital setting as an example, this paper addresses the difficult task of attempting to diagnose an insulin overdose after death. Guidelines are presented regarding the proper collection, storage, and evaluation of postmortem blood samples in cases of suspected insulin overdose.

Exogenous insulin has been used for many years to treat diabetes mellitus. Over the years there have been numerous accidental overdoses by these patients. However, in other instances insulin has been used as an agent for suicide and homicide in diabetics as well as non-diabetics. Presented here is a fatal case of accidental insulin overdose in a nondiabetic.

An 82-year-old white male, postoperative day 12 from incarcerated hernia repair, was transferred to the hospital's rehabilitation unit for care of continuing medical problems. A week after admission to the unit, the patient's nurse entered his room to check on him and to flush his PICC line. One hour later, the patient was noted to be in distress and a "Code Blue" was called. During the code a rapid blood sugar was found to be low and the physician ordered one ampule of D50 to be given. Blood glucose was 13 mg/dl initially and 33 mg/dl (normal range 64-105 mg/dl) eighty minutes later. During the code, it was noted that the PICC line was not usable, as it had "clotted-off." The patient's clinical course became substantially worse following this event and he died two days later.

Autopsy, limited by previous embalming, revealed severe hypertensive and atherosclerotic cardiovascular disease. Laboratory testing on a blood sample stored from the night of the hypoglycemic event included a C-peptide level of 0.9 ng/ml (normal range 1.1-4.6 ng/ml) and an insulin level of 297.5 (normal range 0-22.7 mIU). The cause of death was determined to be insulin overdose. Investigations were conducted to detect the cause of this incident. It was deemed that the patient mistakenly received from 100 units to 500 units of insulin. No reason or evidence of malicious administration could be found during investigation. Investigation concluded that nursing personnel accidentally flushed the PICC line with insulin, instead of heparinized saline. The containers for heparinized saline and insulin are of similar size and appearance.

Insulin is a major regulatory hormone that serves to lower the serum concentration of glucose. A proinsulin molecule, consisting of a two peptide chain molecule (insulin) linked by a connecting peptide (C-peptide), is synthesized in the beta cells of the pancreas. Rising serum glucose causes cleavage of the proinsulin molecule and yields the active insulin molecule and the inactive C-peptide in a 1:1 ratio. A major difference between commercial insulin and endogenous insulin is the absence of C-peptide in commercial preparations. With a large dose of exogenous insulin, the expected laboratory values include an elevated insulin level and a low C-peptide level.

Considering the difficulty of making a diagnosis of hypoglycemia postmortem, the interpretation of insulin and C-peptide levels becomes a crucial aspect of making a diagnosis of insulin overdose. In the case of a diabetic individual, postmortem anti-insulin antibody levels and free and total insulin levels also are appropriate tests. Peripheral blood is preferred as blood samples from the right heart have much higher insulin levels than peripheral blood. All samples should be placed in red-top serum separator tubes, spun down, and frozen as soon as possible. Samples for insulin and C-peptide levels are also valid in green-top plasma tubes, when spun down and frozen as above. Samples in purple-top EDTA tubes are not valid for analysis, nor are hemolyzed specimens. Anatomic autopsy findings in cases of insulin overdose are often unremarkable.

In any case of insulin overdose a comprehensive scene investigation to document the amount and type of insulin used, along with information revealing the source of the insulin is crucial. In addition, a complete autopsy, including appropriate laboratory studies, is needed to make a firm diagnosis in these cases. Special attention should be given to properly collecting and storing blood samples, as these specimens often yield the strongest evidence of insulin overdose.

Insulin Overdose, Accident, Complication of Therapy

G34 Unexplained Sudden Death and the Likelihood of Drug Abuse

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After attending this presentation, attendees will be able to define the relationship between drug abuse and deaths where neither anatomical nor toxicological cause for death is found.

This presentation will impact the forensic community and/or humanity by recognizing that a history of drug abuse may be sufficient to explain death in appropriate circumstances, just as chronic alcoholism can be accepted as a cause of death even in the absence of acute ethanol intoxication.

Rationale: Our office regularly receives cases of young adults with a history of drug abuse who have died suddenly and unexpectedly in whom neither anatomical nor toxicological cause for death is found at autopsy. In forensic pathology, these deaths are likely to be classified as undetermined in cause and manner. The common presence of a history of drug abuse, however, has led us to hypothesize that drug abuse induces some change that increases the risk of sudden death and that this change persists after the drug is no longer detectable in the body.

Methods: We conducted a retrospective case-control study of deaths investigated by the Jefferson County Coroner/Medical Examiner Office, Alabama between 1986 and 2002. The study group consisted of decedents between 10 and 70 years of age whose cause and manner of death remained undetermined following an autopsy and toxicological analysis for ethanol and drugs of abuse. The control group was chosen to most closely represent a random sampling of the population of Jefferson County, Alabama. The decedents chosen for the control group were either pedestrians or passengers in motor vehicle accidents, people

who died suddenly and unexpectedly while engaged in ordinary pursuits. Every decedent in the control group received an autopsy and toxicology analysis for ethanol and drugs of abuse. The control group was age matched to the study population within 5 years of the age of the study decedent and within 2 calendar years of the date of death of the study decedent (to keep social trends similar). The charts of all cases and controls were reviewed for the circumstances surrounding death, a documented history of drug abuse, and any compelling physical signs at autopsy that indicated drug use, i.e. needle track marks, nasal septum perforation, or polarizing particles in foreign body giant cells within the lungs. All toxicology results were noted including the presence of cocaine, any other drugs or medications, and ethanol. Decomposed remains were included in the study.

Results: The study group of undetermined deaths consisted of 62 decedents, 24 of whom had some evidence of drug abuse (history, physical signs, positive toxicology for cocaine or its metabolites in urine or bile, opiates, or methamphetamine). In the matched control population 9 decedents had a positive drug history or a drug of abuse detected by toxicology or both. These results are shown below.

	Evidence of drug abuse	No evidence of drug abuse	Total
Case study group (undetermined cause)	24	38	62
Control group (pedestrian or wreck)	9	53	62
Total	33	91	124

Analysis of these data shows that a decedent with a history of drug abuse has a risk odds ratio of 3.7 (95% confidence interval 1.59-8.69). In other words, an individual with an undetermined cause and manner of death is 3.7 times more likely to have evidence of drug abuse as is an individual who dies in a motor vehicle collision as either a pedestrian or passenger. For this study $p = 0.0015$, so chance is an unlikely explanation for these results. Nor is simple intoxication alone the explanation for death in the study group. Analysis revealed no statistically significant difference between the study group and the control group for the presence or absence of ethanol in the blood at the time of death.

Conclusion: A history of drug abuse is far more common in sudden, unexplained deaths than it is in a control group chosen to represent a random sample of the population, even in the absence of a level of drug sufficient to account for death at the time of death. Research suggests that cocaine use in particular induces chronic biochemical and physiological changes that persist beyond the presence of circulating cocaine in the blood, just as the induction of hepatic enzymes by alcohol persists beyond the presence of ethanol in the blood. These findings imply that a history of drug abuse may be sufficient to explain death in appropriate circumstances, just as chronic alcoholism can be accepted as a cause of death even in the absence of acute ethanol intoxication.

Sudden Death, Drug Abuse, Cocaine

G35 Acute Bacterial Meningitis With Predominance of Immature Granulocytes

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This presentation highlights three cases of acute meningitis with a predominance of immature granulocytes and compares these cases to a retrospective evaluation of cases diagnosed as "acute meningitis."

While a rare phenomenon, knowledge of the fact that immature granulocytes may constitute the principle cell type in the CSF and subarachnoid space of acute bacterial meningitis may prevent misclassification of these cells at the time of evaluation of CSF in the hematology and cytopathology laboratories and during surgical and autopsy pathology examinations.

Background: Bacterial meningitis, in its acute stage, is typically characterized by a "purulent" inflammatory cell infiltrate of abundant polymorphonuclear cells and necrotic debris. Intracellular or extracellular bacteria can be observed in some cases. The neutrophils seen are typically mature, or degenerating. As the process gains chronicity, neutrophils are eventually replaced by mononuclear cells. Recognition of neutrophils in the cerebrospinal fluid (CSF), as opposed to mononuclear cells (macrophages and lymphocytes), is a key clinical finding that guides therapy.

Case Reports: During a period of a year, at two institutions, a total of three fatal cases of acute bacterial meningitis were evaluated at autopsy in which the predominant cell type was immature granulocytes with only rare polymorphonuclear cells recognized.

Case 1: The first case involved a 12-year-old female with a history of morbid obesity and systemic lupus erythematosus, treated with corticosteroids. She was reported to have collapsed suddenly after a two day history of fever, diarrhea, and dark urine. Despite resuscitation efforts, the patient could not be revived and she was pronounced brain-dead the following day. Peripheral blood evaluation had demonstrated a marked left shift. CSF was not evaluated. She had been treated for 1.5 days with antibiotics prior to her demise. An autopsy revealed an inflammatory infiltrate composed of predominantly immature and mature granulocytes within the meninges, lungs, gastric mucosa, and adrenal glands. The bone marrow was normal, suggesting that these cells were the result of a left shift. Organisms were not initially identified by histology, histochemistry, or culture, but subsequent immunohistochemical testing performed at the Center for Disease Control was positive for *Neisseria meningitidis*.

Case 2: The second case involved a one day old female infant, born at 36 weeks estimated gestational age. At birth the infant was unresponsive with Apgar scores of 0, 1, and 5, requiring aggressive resuscitation. Blood cultures identified a *Listeria monocytogenes* bacteremia, and the patient died the following day. Development of a marked left shift occurred during a 20 hour period on a series of three peripheral blood smears. CSF was not evaluated. Antibiotics had been administered prior to death. An autopsy demonstrated miliary microabscesses involving the trachea, lungs, esophagus, stomach, intestine, liver, spleen, and adrenal glands. In addition, an inflammatory infiltrate within the leptomeninges showed a predominance of immature granulocytes rather than mature neutrophils. *Listeria monocytogenes* was cultured from lung and meningeal samples.

Case 3: The third case involved a 44-year-old male with a history of paranoid schizophrenia. He had no known history of immunosuppression and did not drink alcohol or abuse drugs. He had been in his usual state of health until one day prior to his demise when he had complained that he "felt bad." The next morning he was found unresponsive on the floor next to his bed. He was not taking antibiotics prior to his demise. At autopsy, histologic examination of the meninges revealed a dense inflammatory infiltrate of immature granulocytes. Postmortem cultures of cerebrospinal fluid were positive for *Neisseria meningitidis*.

Materials and Methods: Histologic sections were evaluated by hematoxylin and eosin and Gram stains and immunohistochemically for

CD68, CD20, CD3, and myeloperoxidase. Findings from these cases were compared to and contrasted with, by retrospective evaluation, all routinely diagnosed acute bacterial meningitis cases in our database.

Results: Myeloperoxidase positive immature granulocytes constituted the predominant cell type in each of the three cases; only very rare segmented forms were identified. Scattered admixed CD68 positive macrophages and CD3 positive T lymphocytes were identified; only rare CD20 positive B lymphocytes were identified. Gram stain failed to identify bacterial clusters in any of the three index cases.

Discussion: While a rare phenomenon, knowledge of the fact that immature granulocytes may constitute the principle cell type in the CSF and subarachnoid space of acute bacterial meningitis may prevent misclassification of these cells at the time of evaluation of CSF in the hematology and cytopathology laboratories and during surgical and autopsy pathology examinations. The organism, treatment, and host factors that may predispose toward manifestation of immature granulocytes in these patients remains unclear.

Acute Bacterial Meningitis, Autopsy, Forensic Science

G36 Coronary Artery Anomalies and Sudden Death: Two Case Reports in Young People

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The goal of this presentation is to present to the forensic community two cases of sudden death due to coronary artery anomalies by autopsic and clinicopathologic findings and histological studies.

This presentation will impact the forensic community and/or humanity by presenting to the forensic community two cases of sudden cardiac death due to rare coronary artery anomalies in young people. These two cases have been studied by means of autopsic and histological examinations. It would be an important contribute to the scientific community for the diagnosis of one of the possible causes of sudden death in infant and young people.

Coronary artery anomalies may cause sudden death. This presentation discusses the clinicopathologic features, the autopsic findings and microscopic features in two cases with different coronary anomalies.

Case 1: A 13-month-old infant, white male, was found unresponsive in his crib. The infant was transported to the hospital, where resuscitative efforts were unsuccessful, and the infant was pronounced dead. Previous clinical history: at the age of 6 months numerous episodes of apnea's crisis, cyanosis and convulsion and at the age of 7 months, the infant was diagnosed as epileptic. Cardiologic examinations (ECG, echocardiogram, Holter monitor evaluation) and chest X-Ray were normal.

The autopsy revealed a well developed and well nourished 13-month-old white male. All internal organs were in their normal anatomic relationship. The heart, in the fresh state, weighed 45 grams. Upon sectioning, the myocardium was reddish. Atrio-ventricular and semilunar valves were normal. The right coronary artery arose from the left sinus of Valsalva associated to a tunneled passage of the posterior interventricular coronary artery. The first section of this artery presented a take-off and a passage between the aortic and pulmonary root. The coronary circuit was dominant to the right.

The histological examination of the cardiac tissues revealed diffused and biventricular myocytolysis in contractile subendocardial bands characterized by altered, eosinophilic, hypercontracted myofiber. In many areas the myofiber appeared fragmented into irregular, partially acidophilic transverse bands. The immunohistochemical exams, effected on cardiac fragments, resulted positive to the anti - desmin and anti-actin antibodies, and negative to the anti C5 antibodies. Examination of the other organs were unremarkable except for pulmonary edema and polyvisceral stasis.

Case 2: A 22-year-old white male collapsed and died while exercising in a swimming pool; prompt medical assistance and attempted resuscitation were unsuccessful. At the age of 21, he was hospitalized in a Neurological Clinic, where instrumental and clinical data suggested the diagnosis of Friedreich's ataxia. The subject underwent molecular genetic analysis for the FA gene that revealed neither expansion nor point mutation of the FA gene. One year later, he was hospitalized at another Neurological Clinic where a general examination showed kyphoscoliosis, pes cavus, and a neurologic examination showed nystagmus, hypotonus, distal hypotrophy of the arms and legs, ataxia, areflexia, abnormalities in superficial and deep sensations. Ncv and EMG examinations were compatible with a severe axonal-myelinic sensory-motor neuropathy, while vitamin E, B12, folic acid, antigliadin antibodies, hexosaminidase, transferring isoforms, lactate and pyruvate were all normal. The diagnosis was spinocerebellar heredodegeneration, Friedreich's type. A treatment with idebenone, CoQ100 and Vitamin E associated with physiotherapy was suggested.

At autopsy the body was that of a well-developed young adult. Skin, ostia, oral and scleral mucosae were normal. On evisceration the heart had a normal intrathoracic position with the following diameters: longitudinal 11 cm, transversal 13 cm and antero-posterior 7 cm; the weight was 475 gr. On opening, the ventricular chamber was 30 mm wide, the wall and the inter-ventricular septum measured 28 mm each. The endocardium was white, smooth and bright, no trombi or vegetations were detected. Atrio-ventricular and semilunar valves were normal. The right coronary artery normally arose from the right ostium. In the left sinus of Valsalva two distinct ostia were detected instead of the left coronary artery ostium. The diameters of the two ostia measured 1,5 and 2,5 mm respectively and were separated by a septum that divided the stem determining a separate origin of the two left coronaries. Incannulation and a careful dissection demonstrated that the larger ostium was one of the circumflex branch, the smaller one the ostium of the anterior branch.

The histological examination of the sections revealed diffuse interstitial fibrosis due to the presence of thin fibrous septa dividing the muscle cells. Miocytes showed fragmentation of the fibers, nuclear enlargement, sometimes pyknosis and cytoplasmatic vacuolization. A section taken from the interventricular septum showed hemorrhagic infiltration of the wall with single erythrocytes between the single myocytes and small blood extravasations. Examination of the other organs were unremarkable except for pulmonary edema and polyvisceral stasis.

The autopsic findings and the histological studies effected lead us to conclude that these are both cases of sudden cardiac death in subjects affected by coronary anomalies.

In the first case death was caused by cardiac arrhythmia sustained by myocardial hypoxia induced by an anomalous origin of the right coronary artery from the left Valsalva sinus.

In the second case death was caused by cardiac arrhythmia, sustained by myocardial hypoxia induced by an anomaly of the left Valsalva sinus, divided into two distinct ostium: one in the anterior interventricular coronary and one in the circumflex associated with myocardial hypertrophy, in subjects affected by Friedreich's ataxia.

Congenital coronary anomalies constitute a statistical incidence of 0,3-0,8% and represent 0,1-2% of all congenital cardiac conditions worldwide. If we consider the anomaly originating of the right coronary artery from the left Valsalva sinus, as revealed in one of the two cases examined, the prevalence from autopsic studies is reduced to 0,026%.

Congenital anomalies of the coronary arteries present great difficulties in diagnosis because these diseases can be absolutely asymptomatic and, although rarely, can manifest themselves with syncopal episodes or with a fading symptomatology leading to heart failure. However, the prognosis is influenced by the seriously of coronary anomaly.

The anomalous origin of the right coronary artery from the left Valsalva sinus has long been considered a mostly benign disease and only in 1982 three cases of sudden death are described whose cause depends on this type of congenital alteration.

In literature, the stenosis or coronary take-off in the initial tract are interpreted as causing ischemia and sudden death.

The origin of the right coronary artery from the left sinus may be an incidental observation during autopsy. Ischemia is usually precipitated by strenuous, prolonged effort, and this explains why a basal ECG or even a stress test ECG may be negative. Syncopal episodes are the only prodromal symptoms. Repetitive ischemic episodes may cause patchy myocardial necrosis and fibrosis as well as ventricular hypertrophy, which eventually can elicit arrhythmias because of the malignant combination of acute and chronic substrates. This may explain why sudden death, associated with an anomalous origin of a coronary artery from the wrong sinus, may occur in adults even though the anomaly has been present since birth.

An anomalous origin of the left circumflex artery from the left coronary sinus itself with a separate ostium, has also been described in victims of unexpected arrhythmic sudden death. This anomaly was considered a benign condition until cases were reported, both clinically and pathologically, with evidence of myocardial ischemia in the absence of obstructive coronary atherosclerosis or causes other than the malformation itself.

It should be noted that in cases of coronary anomalies sudden death, in children and young adults, often occurs during or following physical exertion. In the second case reported death occurred during physical activity and the anomaly of the left Valsalva sinus, divided into two distinct ostium: one for the anterior interventricular coronary and one for the circumflexed, was associated with cardiac hypertrophy, a pathology present very frequently in subjects affected with Friedreich's ataxia.

Sudden Death, Anomalous Origin Coronary Artery, Contraction Band Necrosis

G37 Neurofibromatosis Type 1 Associated With Hydrocephalus and Acute Cardiac Failure: A Fatal Case

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The goal of this presentation is to contribute to the diagnosis of the cause of death in a case of intracranial hypertension due to hydrocephalus and associated acute cardiac failure.

This presentation will impact the forensic community and/or humanity by providing a rare case of tetraventricular hydrocephalus associated with intracranial hypertension and acute cardiac failure in a young boy affected by neurofibromatosis type 1. Disturbance in central sympathetic control resulting in sympathetic hyperactivity has been suggested to be the most likely mechanism responsible for the cardiovascular complications during acute ICH. It would be an important contribute to the scientific community for the diagnosis of the cause of death in ICH.

Test: Neurofibromatosis type 1, also known as von Recklinghausen's disease, is an autosomal dominant genetic disorder, with an extremely wide range of manifestations, and a multisystemic involvement; its incidence is of 1 in 3,500 newborns, and its prevalence of 1 in 4,500 newborns, this makes it one of the most common inherited diseases. It is caused by a mutation of the NF1 gene, located on the chromosome 17, whose product, the neurofibromin, is a GAP-protein which functions as a negative growth regulator, and is thought to be a tumor suppressor. NF1 is clinically characterized by its cutaneous manifestations, café au lait spots, axillary and inguinal freckling, Lish nodules, and multiple neurofibromas with a variable clinical expression,

even in the affected members of the same family. The complications of this disease are numerous and can often be fatal. One severe complication is represented by the development of malignant tumors. The less known vascular lesions, in particular in the arterial tree, may also represent a potentially important complication of NF1, in fact they may be the cause, for example, of hypertension, aortic coarctation, cerebral and visceral infarcts, haemorrhage resulting from aneurysms rupture, etc. Moreover, also cardiovascular abnormalities may occur in NF1, in particular cardiovascular malformations (2.3% of patients) such as pulmonary stenosis, aortic coarctation, etc., hypertrophic cardiomyopathy, and other miscellaneous cardiac abnormalities (such as intracardiac tumors, mitral valve prolapse, aortic dilatation, etc.). Other severe complications are hydrocephalus, and osseous dysplasia, which causes severe scoliosis.

We have seen that patients with NF1 have an increased risk for a variety of cardiovascular disorders (vasculopathy, hypertension, congenital heart defect, etc.), but we want to underline that, in some cases, they are the direct complications of NF1 itself that may induce fatal cardiac disorders.

Case Report: A 12-year-old white male, affected by neurofibromatosis type 1 was admitted to our University Hospital with the suspected diagnosis of meningitis. He was diagnosed as having NF1 at the age of 4-years-old, on the basis of the clinical manifestations. His mother was also affected by NF1. The family history was negative for cardiovascular disease. On physical examination upon admission he measured 155 cm in height, and 48 Kg in weight. He presented dysmorphic features including coarse face with frontal bossing, flat nasal bridge, large nose with anteverted nostrils, large lips, prominent mid-face, numerous café au lait spots (> 1.5 cm) over the body, axillary and inguinal freckling, and multiple dermal and nodular neurofibromas over the trunk and limbs. Moreover he presented macrocephalia (head circumference 58,5 cm), neck stiffness, headache, and he had a temperature of 38°C with vomit for three days. On neurological examination the patient appeared conscious, but sleepy. The remaining physical examination was otherwise unremarkable. The laboratory analysis excluded signs of inflammation.

An urgent CT cranium revealed a tetraventricular hydrocephalus. In the meantime the clinical conditions got worse: the child presented a violent headache, agitation, cyanosis. So he underwent surgery for an emergency ventriculo-peritoneal shunt, 20 cc of clear fluid were drained, but during the operation he had a bradycardia, which progressed to cardiac arrest, and then he died for a cardiocirculatory arrest. Death was attributed to acute cardiac arrest during intracranial hypertension resulting from tetraventricular hydrocephalus.

A complete autopsy was performed. External examination confirmed the clinically noted features of NF1. Internal examination of the cranium revealed an edematous brain, which measured gm 1900 (normal 1400 gm) in weight, with tetraventricular hydrocephalus, a glioma of the left optic nerve, and vasal congestion. Both lungs were heavy and reddish (right 350 g, normal 210, left 300 g, normal 190). The heart weighed 140 g (124 norm), and was in appearance normal in all respects. The epicardial coronary arteries arose normally in a right dominance manner. The autopsy examination was otherwise normal. Microscopic sections of the brain showed a marked edema, cribriosis, little intraparenchymatous haemorrhages, vasal congestion. In the lung it was found edema, acute emphysema, acute stasis, endoalveolar haemorrhages, areas of fibrosis, while in the heart numerous foci of contraction band necrosis, acute stasis, and areas of disarray were found.

The cardiac histological findings require a careful investigation and an adequate interpretation. Contraction band necrosis is a specific morpho-functional entity. Histologically, this form of necrosis is characterised by irreversible hypercontraction of the myocell, extremely short sarcomeres, with markedly thickened Z-lines, paradiscal lesion which progresses to a breakdown of the whole contractile apparatus. This breakdown varies from irregular, pathological and eosinophilic cross-bands, consisting of segments hypercontracted or coagulated

sarcomeres, to a total disruption of myofibrils, the hole cell assuming a granular aspect without visible clear-cut pathological bands. CBN is observed in many human pathologies, it is not an ischemic change, but the expression of catecholamine toxicity, as confirmed by experimental intravenous catecholamine infusion, and by the equivalent human cases with pheochromocytoma. The excess of catecholamines produces cardiotoxicity through two mechanisms: a) a direct cardiotoxicity, due to the binding of catecholamines to adrenoceptors; b) an indirect cardiotoxicity, due to the formation, during the metabolism of the catecholamines, of highly toxic substances such as aminochromes (adrenochrome) and free radicals, which damage different types of heart membranes, causing intracellular Ca^{2+} overload and myocardial cell damage. The finding of CBN, even if microfocal, could be an important histological signal for interpreting the cause of death and the natural history of a disease in any single patient. It may represent a sign of adrenergic stress linked with malignant arrhythmia/ventricular fibrillation.

Now it only remains to clarify which has been the cause of such catecholamine surge. The obstructive hydrocephalus related to NF1, generally results from a periaqueductal gliosis which may cause the stenosis of Sylvius's aqueduct, or the blockage of the IV ventricle, resulting in the block of the draining of the cerebro-spinal fluid, the hyperdistension of the upper ventricular cavities, and the increase of the intracranial pressure. In literature there is evidence of myocardial injury following acute intracranial hypertension. It is well established that traumatic head injury with intracranial hypertension (ICH) initiates a cascade of physiological but deleterious events that result in haemodynamic perturbations, electrocardiographic abnormalities. Recent clinical and experimental studies have demonstrated that the pressor and dynamic response of the heart to head injury with acute ICH is mediated by catecholamine surge, which represents a stress response, mediated by medullary vasomotor centers, triggered by the increased circulatory needs consequent to the decreased cerebral perfusion that follows the sudden ICH. The transient hyperdynamic response of the heart following the excessive sympathetic nervous activation is short-lived and gives way to cardiovascular collapse. In failed hearts, there is histologic evidence of focal myocardial damage that is characteristic of catecholamine-mediated cardiac necrosis.

The patients affected by NF1 have a reduced lifetime expectancy, because of an increased risk for a variety of fatal disorders, which may be the direct complications related to NF1, but also diseases due to the complications themselves. In the case we report, the obstructive hydrocephalus related to NF1 causes an acute ICH resulting in central sympathetic hyperactivity, that is responsible for the cardiovascular complications during acute ICH.

Neurofibromatosis 1, Hydrocephalus, Sympathetic Hyperactivity

G38 A Cluster of Child Deaths: A Medical Examiner System Participates in an Epidemiologic Investigation in Virginia

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After attending this presentation, attendees will learn how to recognize a developing cluster of deaths in children; how to cooperate with

the Centers for Disease Control, local and national laboratories, and public health departments in analyzing the deaths of individuals involved in a cluster, allaying public fears, and meeting media demands; and to avoid mistakes previously made.

This presentation will impact the forensic community and/or humanity by increasing the ability to recognize a developing epidemiological cluster, and how to optimally communicate with all parties involved, including colleagues at a local and national level, parents and relatives of the decedents, the "worried well," and the media.

A two-year-old girl with a history of multiple upper respiratory infections, and a prodrome of a week of ear pain and fever, presented to an emergency room at 0300 in the morning with a fever of 102 degrees F. She was diagnosed with otitis media, and prescribed antibiotics. Five hours later, she was found dead in bed. Autopsy showed no evidence of bacterial infection; a viral infection was suspected. On the day of her autopsy, a three-year-old boy was diagnosed at a local military hospital clinic with a viral upper respiratory infection. He died in his sleep at home the next morning, after lying on the living room floor watching cartoons, with his mother asleep nearby on the couch. Within three days, two more children in the same geographic area had died at home after short febrile illnesses. When the four deaths were reported, media attention and public concern became intense.

The medical examiner system of the Commonwealth of Virginia was put on alert, and invited the Center for Disease Control to participate in analyzing the developing cluster, utilizing fluids and tissues obtained at autopsy. Two more children died in the following week, and three more in the next ten days. Early results were conflicting and noncontributory. Several weeks passed before it could be determined that this was a temporal cluster of unrelated childhood deaths, that there was no single pathogen responsible, and that the public had been protected.

This half hour discussion follows the experience of multiple medical examiners within a single statewide system coping with an unexplained cluster of child deaths. We review the recognition of the development of the cluster. We re-examine how we dealt with the issues of cooperation with public health colleagues, the CDC, and the laboratory, as well as communicating optimally with each other, the bereaved parents, the media, and the public. We revisit how we learned to utilize the CDC's expertise and resources, while performing optimal post mortem examinations within our medical examiner system. It was necessary to implement new methodologies that were foreign to our system, if well known to the CDC, and to develop new networks of communication as we relied upon colleagues in different states and many different institutions. The goal was to find answers for grieving families, bewildered colleagues, a hysterical public, and the voracious media. Special attention will be paid to the mistakes that were made, and how they could have been handled differently.

Child Death, Epidemiologic Cluster, Infectious Etiology

G39 Police Custody Deaths in the State of Maryland: Passing the Torch

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The goal of this presentation is to highlight and briefly discuss the major autopsy findings of deaths that occurred during police custody in the state of Maryland.

Medicolegal Investigation of police custody deaths has been a great challenge to our forensic investigators. It may be argued that much more information is needed on this subject. The establishment of a national database has been discussed. It should combine national statistics as well as grouping the information by state. It is hoped that recognizing more trends will perhaps establish criteria that may ease the difficulty of investigating and thus rendering a decision in these cases. Most impor-

tantly, established criteria may assuage the public's perception of police misconduct and ultimately save more lives.

This retrospective study was undertaken to enhance the academic examination of these potentially volatile cases. The Office of the Chief Medical Examiner (OCME) has jurisdiction over all municipalities in the state of Maryland, including twenty-three counties and the city of Baltimore. A total of twenty-five deaths that occurred during police custody were investigated by the OCME from 1993 through 2003. Examination of each case included the autopsy report, the police report, the investigative report and photographs. Highlighted characteristics included race, age and sex distribution, jurisdiction, nature of incident, type of restraint used, autopsy findings, toxicological findings and the cause and manner of death.

Nineteen of the cases involved African-American men, most of whom were in their thirties. Twenty-one of the incidents occurred in the major urban areas of Baltimore City (16) and Prince George's County (5). Cocaine use was found in twelve of the cases.

The reasons for police involvement and the use of restraints included physical assault against another person, irrational behavior and other aggressive actions. The primary methods of restraint involved handcuffing. Eight cases involved the use of handcuffs in the prone position. Four of the eight handcuffed cases had leg irons also. One subject was hog-tied and placed on his side.

Common autopsy findings included abrasions and contusions of the face and extremities. Petechial hemorrhages were found in three cases. Subgaleal hemorrhage was the most commonly documented internal injury. Cocaine intoxication contributed to the cause of death in twelve cases. The manner of death was concluded as undetermined in fourteen cases.

Literary review has recognized some common variables involved in these cases. Most notably, the risk of the prone restraint position and understanding the increased risk of death in individuals experiencing excited delirium caused by either illicit drug usage or psychiatric disorders.

Given the intense public scrutiny that surrounds these cases, it is the manner of death that requires the greatest objectivity when investigating these deaths. The circumstances of each case should stand independently of prior, similar incidents. A primary reason for the difficulty of custody death investigation is the paucity of evident, lethal physical injury. These cases exhaust the importance of the combined major facets of post-mortem examination, specifically the autopsy, the toxicology report and scene investigation. More than usual, heightened cooperation between law enforcement personnel and the medical examiner investigating the case is required.

Police Custody, Death Investigation, Autopsy

G40 Characterization of Recent Cocaine and Methadone-Related Death Trends in Caddo Parish, Louisiana, With Comparison to National Trends

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After attending this presentation, attendees will recognize recent trends in drug-related deaths, specifically cocaine and methadone-related.

Cocaine has dominated the picture in drug-related deaths presenting to the forensic pathologist. Recently, there has been a trend toward decreased cocaine-related deaths and increased methadone-related deaths. Unlike cocaine, methadone is not ordinarily considered

an illicit drug, as it is regularly prescribed to heroin users (methadone maintenance programs) and to those with chronic pain. The forensic pathologist will become aware of the increase in methadone-related deaths in general, and the community-specific demographics with respect to each drug.

This study explored a local trend in cocaine and methadone-related deaths for years 2000 through 2002, with comparison to those seen in the major U.S. metropolitan areas. The general local trend in decreased cocaine-related deaths with concurrent increased methadone-related deaths paralleled that in many of the major metropolitan areas in which drug data was available. Discrete local trends were noted with respect to age, race, sex and marital status.

A recent increase in methadone-related deaths has been documented in medical and forensic literature, as well as in the mortality data from the Drug Abuse Warning Network (DAWN). A preliminary assessment of drug-related deaths presenting to the Caddo Parish Coroner's Office in Shreveport, LA, revealed a similar trend, therefore a comparison of local and national demographic data was performed to further characterize this trend.

We conducted a search of cases presenting to the Caddo Parish Coroner's Office between 2000 and 2002 in which death was attributed to drug use. Drugs found on toxicological analysis, as well as demographic information were documented. Finally, we compared our local demographic data with that provided in the most recent available (2000 and 2001) DAWN mortality analyses.

The search of local records yielded 22 cases, all listing either cocaine (13) or methadone (9) as contributing to death. Polypharmacy was documented in 2 of the cocaine-related deaths and in 5 of the methadone-related deaths; however, this was not pursued further as the cocaine/methadone-related mortality trend was the focus of this study. The results are listed in the table below.

Drug	Year	No. Cases	Mean Age (yrs)	Race		Sex		Marital Status	
				B	W	M	F	M	S
Cocaine	2000	7	34	5	2	5	2	0	7
	2001	4	57	3	1	3	1	2	1
	2002	2	51	1	1	1	1	1	unk
Methadone	2000	1	32	0	1	1	0	1	0
	2001	2	37	0	2	1	1	1	1
	2002	6	37	1	5	3	3	4	2

M=married S=single (never married, divorced, widowed)

These results show a gradual transition from greater cocaine-related deaths to greater methadone-related deaths in the years 2000 to 2002. Cocaine-related deaths were seen more often in a younger population of black males (mean 34 years) in 2000, with an increased age seen in subsequent years (mean age 57 and 51 years in 2001 and 2002, respectively). Methadone-related deaths were seen more often in a younger age group (mean age 35 years) and whites in all years. Another demographic trend that emerged and perhaps warrants further investigation was that of marital status. Eight (61%) of the cocaine-related deaths were single (never married, divorced, widowed), while 3 (23%) were married. Marital status of 2 decedents was not known. Three (33%), of the methadone-related deaths were single, while 6 (67%) were married.

A review of the most recent available DAWN mortality data (2000 and 2001) revealed that methadone was one of the top ten drugs reported in 25 of the 33 major metropolitan areas studied and cocaine was one of the top ten drugs reported in all areas. A comparison of the 2000-2001 data revealed an increase in methadone-related deaths by 7 to 72% (median 36.5%) in 17 of the 25 areas. Ten of the 17 experienced a concurrent decrease in cocaine-related deaths, similar to that observed in Caddo Parish, LA. Additionally, 9 of the 10 areas were located within the regions traditionally described as southern (4), midwestern (1), and western (4) United States.

These results indicate a recent trend toward fewer cocaine-related deaths, with concurrent increase in methadone-related deaths in both the region of study and in specific national regions. While local demographic trends were noted with respect to age, race, sex, and marital status, comparison of local trends to national trends was not possible, as the data provided by DAWN does not include specific drug-related demographic information. Additionally, since our study area has less population density than those included in the DAWN analyses, it would be desirable to compare our local data with that of similarly populated areas.

Cocaine, Methadone, Mortality

G41 Positional Asphyxia and Alcoholism: Review of Three Cases

Elizabeth L. Kinnison, MD and Wendy M. Gunther, MD, Office of the Chief Medical Examiner, 830 Southampton Avenue, Suite 100, Norfolk, VA 23510*

After attending this presentation, attendees will recall and consider the role of positional asphyxia in alcoholic deaths. Raise the index of suspicion of alcoholism in positional asphyxia deaths. Using case histories, consider the role of acute intoxication with ethanol, versus no intoxication, versus other agents. Be aware of issues in certification of manner of death in positional asphyxia deaths in alcoholics.

This presentation will impact the forensic community and/or humanity by creating awareness of possible role of alcoholism in positional asphyxia deaths, which has not received deserved consideration previously. Open the dialogue on how chronic alcoholism or acute intoxication in alcoholism is likely to affect positional asphyxia. Remind the forensic community that the manner of death deserves careful attention, as it may still be homicide, even in a person with scene evidence of positional asphyxia, and multiple intoxicants on board.

We report three cases in which positional asphyxia caused death, but was abetted or affected by alcoholism. In one of the cases, acute alcohol intoxication was present; in another, despite fatty liver, no alcohol was found on toxicology; in a third, homicidal assault may have been the instigating factor.

A 46-year-old woman, who had a history of a seizure disorder, was found dead at home. She had consumed a large quantity of beer and a half pint of Jack Daniels whiskey the evening before. She was found lying prone, with her neck hyperextended against the fabric of the foot of a couch. Scene photographs and autopsy findings both indicated that positional asphyxia was the cause of death. A faint bitemark on the tongue, and the absence of any seizure medication in the blood on toxicologic study, suggested that a seizure might have caused her to collapse in that position. However, the blood alcohol level was 0.43% weight per volume.

A 41-year-old man, with a history of probable chronic alcohol abuse and a known seizure disorder, was found dead at home, collapsed across the metal frame of a coffee table, which had had its glass top removed. Prominent pressure marks across his anterior neck and lower abdomen corresponded to the rails of the coffee table frame. The right cornu of the thyroid cartilage had fractured beneath the pressure mark, suggestive of a direct collapse onto the frame, possibly during a seizure; a probable tongue bitemark was present. Although fatty liver and micronodular cirrhosis were found at autopsy, the blood alcohol level was 0.0%. Toxicology did not reveal any anti-seizure medications.

The final case is more problematic. A 54-year-old woman, with a history of both chronic alcoholism and prescription drug abuse, was known to be unsteady on her feet; neighbors said she often had bruises. She was found dead at home, collapsed in her cluttered bedroom, with the head and neck extended into an awkward position. Autopsy showed a linear perimortem neck abrasion, with bruising over the anterior neck, and focal hemorrhage into the strap muscles. She had multiple bruises on

the face, torso, and extremities, but no petechiae, and no fracture of the hyoid bone or thyroid cartilage. Postmortem toxicology showed an elevated amount of mirtazapine (0.6 mg/L), with no alcohol, street drugs, or anti-seizure medications. Death was attributed to asphyxia due to neck compression, due to positional asphyxia, with mirtazapine toxicity contributing. It was unclear whether some of the bruising or the linear abrasion might have been inflicted by an assailant.

These three deaths concern positional asphyxia in a setting of alcoholism. Although it is intuitively obvious that alcoholism should lend itself to deaths by positional asphyxia, there is a dearth of reports in the literature evaluating both. Reports in the popular media anecdotally mention alcoholism in a rare positional asphyxia death with homicidal intent, but the forensic literature has not addressed it. This report aims to open the forensic pathologic discussion on the effect of acute or chronic alcoholism on deaths by positional asphyxia

Positional Asphyxia, Alcoholism, Manner of Death

G42 Causes of Death in Chronic Alcoholics: A Comprehensive Retrospective Analysis of Medical Examiner Cases

Martha J. Burt, MD, Matthew J. Bowes, MD, and Mark J. Shuman, MA, MD, Miami-Dade County Medical Examiner Department, Number One on Bob Hope Road, Miami, FL 33136*

After attending this presentation, attendees will understand the necessity for complete autopsy examination, scene investigation and toxicology in the evaluation of individuals with chronic alcoholism. The spectrum of causes of death in individuals with chronic alcoholism.

This presentation will impact the forensic community and/or humanity by illustrating the spectrum of causes of death in chronic alcoholics and the need for complete death investigation in such deaths.

Acute and chronic alcohol abuse is a common issue faced by medical examiners and death investigators. The morbidity and mortality of chronic alcoholism is well-documented in the hospital population, but little data is available describing those who die outside of the hospital or without medical care. The teaching/dogma in the forensic pathology community is that chronic alcoholics suffer certain injuries, such as subdural hematoma, much more frequently than the general population, though little is published in the scientific literature to support these claims. This study was undertaken to assess the causes of death in chronic alcoholics in a large urban area over a seven year period.

The Miami-Dade County Medical Examiner Department case file computerized database was retrospectively searched, using the keywords "alcohol" and "heavy," and "alcohol" and "abuse" in the history field, and "alcohol" or "ethanol" in the cause of death fields, for the years 1996 to 2002, inclusive. Inclusion criteria were: performance of a complete autopsy; a history of chronic alcohol abuse or scene evidence suggesting the same; acute alcohol use prior to death; and/or alcohol caused or contributed to the death after complete autopsy and toxicology examination. Case files were reviewed to ensure the cases met the inclusion criteria.

During this seven year period, 17,463 autopsies were performed at the Miami-Dade County Medical Examiner Department. 1,457 cases were identified that met the above inclusion criteria, and were broadly grouped into two categories, those with a history of chronic alcohol abuse and/or circumstances of chronic alcohol abuse or acute use (1297 cases, 89%), and those with no history of chronic alcohol abuse or circumstances to suggest alcohol abuse or acute use (160 cases, 11%). The cases were also categorized by the cause of death: blunt injuries (159, 11%), drowning (65, 4%), polydrug intoxication with alcohol present (149, 10%), polydrug intoxication without alcohol present (48, 3%), other single drug intoxication (58, 4%), other alcohol related causes, such as pancreatitis, bleeding varices, and liver failure (501, 34%), and

natural diseases with chronic alcohol abuse as a contributory condition (104, 7%). Gunshot wounds, stabblings and hangings each accounted for 1% or less of the cases. The most common cause of death in both those with and without history of alcoholism fell into the “other alcohol related deaths” category (438/1297, 34% in those with history; and 63/160, 39% in those with no history). Twenty-one percent of those with a history of chronic alcohol abuse died as a result of a natural disease unrelated to alcohol abuse. A total of 19 cases were identified where the cause of death was related to a subdural hematoma (3 in the group without a history of alcohol abuse and 16 in the group with a history of alcohol abuse), for an overall incidence of roughly 1% in our study population. Within the chronic alcohol abuse group, pedestrians struck by vehicles accounted for more than those killed in a motor vehicle crashes (23 versus 18).

This retrospective study of medical examiner cases shows that those who suffer from chronic alcohol abuse are more likely to die from a non-natural process, such as trauma, drug intoxication or drowning, than they are to die from a natural complication of abusing alcohol. A thorough death investigation, including scene investigation, autopsy and toxicology is necessary to clearly establish the cause and manner of death in individuals with a history of chronic alcohol abuse.

Cause of Death, Alcohol Abuse, Autopsy

G43 FluiDDB.com: A Model Database for Unidentified Bodies

Michael C. Britt, BS and Marta U. Coburn, MD, District Twenty Medical Examiner, 3838 Domestic Avenue, Naples, FL 34104*

The goal of this presentation is to highlight the importance for medical examiners to have a database where information about unidentified decedents can be kept and ultimately used as a central clearing-house for interested parties searching for information about missing persons.

It is our hope that FLUIDDB.com will serve as a model for medical examiner's offices in all states and that it will be instrumental in identifying at least a portion of the unidentified bodies that previously established criminal databases have not been able to successfully identify. It is also our goal to encourage newfound interest in medical examiners and their staff to re-examine the case files that lay dormant in their offices of these “forgotten” bodies.

This presentation will highlight the reasons why there should exist an easily accessible website where information about unidentified bodies found may be readily accessed by family members, police, and any other interested party. Dr. Marta Coburn, Chief Medical Examiner of Collier County, Florida realized the need to create such a website and designed a simple, yet comprehensive, database. FLUIDDB.com, an acronym for Florida Unidentified Decedents Database, employs existing computer technology in a user-friendly format that engages the interested party in the search process, while maintaining the integrity of sensitive criminal data. This fact is instrumental in the success of the identification process because current criminal databases are not available for public use.

Identification of a body is often hampered for many reasons and the longer a body remains unidentified, the less likely it is that their identity will be discovered. To compound the problem, the majority of medical examiner's offices do not have the means to readily access all of their cases of unidentified bodies. Therefore, even the most cursory search cannot be executed when medical examiners receive requests for information from family members searching for missing loved ones. The database will serve to organize these cases into a format that permits medical examiner staff immediate retrieval of information. A complete list with information about all of the unidentified deaths is obtainable given the participation of each medical examiner's office in a given state. The searcher may then streamline their focus and pursue only

those published cases that match the information about the missing person they seek. The website was also designed to allow each office to easily update or delete information as needed. The discussion will include insight about entering information into the various data fields from the medical examiner's perspective and how to retrieve information from the searcher's viewpoint.

This presentation also discusses future plans to link FLUIDDB.com to other websites that may contain purely scientific information such as dental records or anthropological data. Recommendations for medical examiners and their staff of the most effective methods for establishing identification of unidentified bodies will also be provided. These guidelines will hopefully serve as a checklist of steps that should be taken during the early part of an investigation in an effort to exhaust all means of conventional identification procedures.

The office of the District Twenty Medical Examiner is confident that this database will eliminate the need for families or police to write, call or fax each individual medical examiner's office or law enforcement agency and will instead utilize the website as a means to narrow their search.

Unidentified Bodies, Identification, Missing Persons

G44 Compressional Asphyxia Due to a Crowd Stampede: The E2 Nightclub Disaster

Adrienne Segovia, MD, Mitra B. Kalelkar, MD, Aldo J. Fusaro, DO, Scott Denton, MD, Edmund R. Donoghue, MD, Kendall V. Crowns, MD, Eupil Choi, MD, J. Lawrence Cogan, MD, Ronald Knoblock, MD, Cyndi D. Gardner, MD, and Barry D. Lifschultz, MD, Cook County Medical Examiners Office, 2121 West Harrison Street, Chicago, IL 60612*

After attending this presentation, attendees will be able to recognize the findings in cases of compressional asphyxia, understand the proposed pathophysiologic mechanism for their development, and become acquainted with models of crowd panic behavior.

This presentation will impact the forensic community and/or humanity by recognizing the findings in cases of compressional asphyxia in your daily forensic pathology practice, understand the proposed pathophysiologic mechanism for asphyxial deaths, and become acquainted with models of crowd panic behavior.

We present 21 deaths due to compressional asphyxia that occurred in a Chicago nightclub stairwell in February, 2003. For reasons that remain unclear approximately 500 persons fled down a long narrow 28 step stairwell. The alleged trigger for the event was an altercation between two women on the dance floor, and the use of pepper spray to control the situation.

The victims ranged in age from 19 to 43 years. Nine were male and twelve were female. At autopsy external evidence of injury, when present, consisted of abrasions and contusions. Petechial hemorrhages of the sclera and conjunctiva, face and neck region were present in 17 of the 21 victims. The remaining five showed scleral and conjunctival congestion without petechiae. Petechiae were also present on the shoulders and the mid back. Petechial hemorrhages of the larynx, oral mucosa, pleura, epicardium, epiglottis and scalp were also present in the majority of the victims. One victim had bite marks of the lips and two had bite marks of the tongue. When present, muscle hemorrhage involved the temporalis and sternocleidomastoid muscles. Hemorrhage was also present in the soft tissues overlaying the thyroid. The only bony injury present was a fracture the right second rib anteriorly. Petechial hemorrhages were not identified in the lower extremities of any of the victims. Hyperaeration of the lungs was present in four of the 21 victims. Toxicology studies revealed the presence of alcohol and the presence of an antidepressant in one victim.

Asphyxia due to crowd compression was first described by Ollivier d'Angers in 1837. Ollivier reported that twenty-three persons died when they were compressed by a crowd of approximately 300,000 exiting the

Champ de Mars in Paris following a re-enactment of the storming of the citadel of Antwerp. Ollivier used the term ‘masque echymotique’ to describe the physical findings consisting of subconjunctival hemorrhage, craniocervical cyanosis and cerebral vascular congestion. In 1900, Perthes described the clinical syndrome and included mental dullness, hyperpyrexia, tachypnea, hemoptysis and “contusion pneumonia” to the complex of findings. Since then the syndrome has been further defined and can include neurological complications, ophthalmic complications, petechiae of the mucosal membranes, epistaxis, hematemesis, microscopic hematuria and albuminuria. Associated traumatic injuries have been described. Of these, thoracic injuries are most common and include rib fractures, hemothorax, pneumothorax, pulmonary contusions, cardiac contusion, and clavicle fractures. Fractures of the upper extremities, pelvis, lower extremities and spine are the second most commonly associated traumatic injury. More severe, crushing injuries may produce lacerations of the liver, rupture of the diaphragm, as well as injury to the small bowel and colon.

The majority of the victims demonstrated the classic findings of asphyxia by compression - petechial hemorrhages in the absence of associated fatal internal traumatic injuries. The etiology for the development of the classical findings is unclear. A “fear response” leading to closure of the glottis and contraction of the abdominal muscles was proposed in 1905 by Lejars. The work of Williams et. al., in 1968 supported this. Their study monitored blood flow and intrathoracic pressure in anesthetized dogs. They reported that blood flow through the jugular vein and carotid artery decreased with thoracic compression. To simulate closure of the glottis, Williams and co-workers occluded the endotracheal tubes of the dogs, which resulted in an increase in pressure of the jugular vein and the development of the classic findings. The classic findings, however, have been documented in situations when the glottis was not closed; for example, in entrapped victims who were screaming. Nontraumatic/compressional mechanisms can produce the classic findings such as paroxysmal coughing, which can only occur when the glottis is open. Closure of the glottis may be responsible for the hyper-aeration of the lungs seen in some of the victims, but not necessarily in the development of subconjunctival, scleral or facial petechiae. The absence of petechial hemorrhages in the lower extremities has been shown to be the result of collapse of the inferior vena cava, which occurs with increasing levels of thoracoabdominal pressure. This protects the veins of the lower extremities.

The twenty-one deaths described above occurred when the crowd panicked and rushed into one of two available stairwells. The term panic will be used here to describe flight from a perceived danger. For panic to develop a specific threat to physical survival having immediate effects must exist. The behavior of panicking individuals in a crowd has been studied. Panicked flight is directed towards escaping imminent danger. The convergence of fleeing persons in a collective panic frequently occurs because individuals flee in one direction assuming that escape is possible in that direction while ignoring other exits. This behavior is called “herding.” Herding behavior occurs when the crowd moves in the same direction and other exits are not efficiently used. Models show that this behavior pattern frustrates escape. Individual behavior occurs when each person finds an exit only by accident and is similarly ineffective in effecting escape. Models show that escape is best accomplished when there is a mixture of individual and herding behavior. Individual behavior allows some to detect the exit, while herding allows successful solutions to be imitated by others.

A review of the literature found few case reports which described compressional asphyxia caused by crowds, and also lacked traumatic injuries and presented the autopsy findings. Several articles emphasized the management of patients, discussed the implications for disaster planning, and emphasized that morbidity and mortality were the result of associated internal injuries. Little mention has been given to the duration of the compression, which we believe contributes significantly to mortality.

In summary, we describe twenty-one deaths from compressional asphyxia due to a crowd stampede. The majority demonstrated the classic findings first described in 1837 by Ollivier. Mortality resulted from chest compression inhibiting respiratory movement and was related to the duration and the amount of weight rather than internal or related traumatic injuries.

Compressional Asphyxia, Crowd Stampede, Petechiae

G45 Perspectives on the Variety of Mass Identification Projects

Charles H. Brenner, PhD, Consultant in Forensic Mathematics, 6568 Sobrante Road, Oakland, CA 94611-1123*

The goal of this presentation is to relate considerations and strategies for identifying a large collection of corpses.

The incidence of mass identification efforts looks to increase in the future as it has in the past. The aim of this presentation is to encourage the use of experience from past identification efforts in solving new ones.

Experience with previous mass identification projects establishes a general framework to apply to such problems, but also teaches the lesson to expect novel challenges each time.

Airplane crashes (SwissAir 111 near Halifax in 1997, American 587 in Queens shortly after 9/11/2001), wars (Bosnian mass graves, Kuwaiti POWs), and the destruction of the World Trade Towers have in common a large number of deaths with most of the corpses damaged beyond recognition. Given the condition of the bodies, DNA is the most reliable modality for identification. Given the large numbers, sorting out the identities requires efficient and carefully-designed routines. A few general ideas seem to be always applicable; other kinds of ideas, the list of which grows with each new experience, are important for one disaster or another.

The first category, the generalities, includes: DNA profiles are obtained from the victims, and from references – family members and/or personal effects. Tentative or candidate identities are determined by a screening step in which every victim is rapidly compared with every reference sample, highlighting related-seeming pairs. The screening list should be prioritized by degree of similarity. Each candidate identity is then tested beginning with the easiest. The DNA part of the test consists in making appropriate kinship and/or DNA matching calculations taking into account all typing information. The result of the calculation is a number, a likelihood ratio that is usually either very large or very small – virtually ensuring or else contradicting the tentative match – but sometimes inconclusive. Common sense dictates that even when the likelihood ratio is very large, all available information must be carefully checked for any inconsistencies that might suggest a human error occurred. If all is well, the identity will be assumed.

Other ideas are sometimes critical but not universal. The DNA of victims from old graves or the smoldering ruins of the WTC (unlike that from plane crashes) is often of poor quality; analysis must cater to allelic dropout. Related victims are a salient feature of some tragedies, which needs to be appreciated lest a war victim be mistaken for his son or his brother. Moreover, in the airplane crashes, the relationships among victims were even an essential component of some of the identifications. For the WTC alone bodies are generally so fragmented that association of victim parts is an important preliminary to screening. One site or several? Where the victims are distributed among multiple graves, as in Bosnia and Kuwait, the criterion for a “very large” likelihood ratio varies with site and circumstances. One grave found in Iraq had about 150 bodies and there was a list, of unknown reliability, of mostly Kuwaitis claimed to be there. It turns out that tentative identifications reinforce each other as the pattern emerges that the list is largely accurate though it has some omissions. Large disasters of course magnify difficulties.

culties, but also create a new problem in kind: For a plane crash a seeming parent-child or even sibling-sibling relationship between a victim and a reference person usually proves to be a correct relationship, but in the case of WTC or Bosnia it usually does not. When the number of victims is very large, the screening process needs to emphasize combinations of at least two family members both of whom match the same victim. Otherwise false leads in the candidate list swamp the good ones. If a project is ever mounted to identify a hundred thousand or more dead, such as the Kurds or Shiites killed in Iraq, it is a safe bet that previously unnoticed difficulties will come to light requiring some new ideas to solve.

The process of identifying a large number of victims using DNA is rapidly gaining maturity. Many mass identification projects have been attacked in isolation, as if each were a new problem. But now there is a sizeable body of experience. The ideas from past work provide useful lessons and tools for approaching new identification projects. One of these lessons is to keep an open mind. There is always something new.

Mass Disaster, DNA Identification, War Victims

G46 Investigation, Identification, and Repatriation of Contaminated Fatalities

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After attending this presentation, attendees will understand the complications involved in the investigation and identification of infectious remains and have a raised level of awareness of the potential complications involved with the transportation of contaminated remains from overseas into theater.

The presentation should alert and inform medical examiners, policymakers, investigators and others as to the complexities involved in investigation, identification and repatriation of contaminated fatalities.

The recent war in Iraq raised the specter that chemical, biological or radioactive agents would kill soldiers. Although most remains contaminated with most chemical or nuclear agents could be decontaminated, remains contaminated with smallpox, anthrax or other agents such as Ebola virus would remain hazardous and present a potential threat to if returned to the United States.

Current DoD policy and commitment is to return remains the remains of all fallen service members to the United States as expeditiously as possible. Cremation prior to return renders biological and chemically contaminated remains safe, but is contraindicated for radioactive remains. Unfortunately, involuntary cremation is specifically prohibited by U.S. military regulations. To date, the United States military did not have a good strategy to return of radioactive or potentially infectious remains to the United States.

For the occasional civilian case of contaminated remains being returned to the United States, the Centers for Disease Control (CDC) issues a permit allowing importation. To obtain this permit, the remains must be a hermetically sealed and remain sealed until buried. Such a hermetic seal would be adequate for transportation of biological, chemical and radioactive remains except for gamma emitters.

As this issue was addressed, there were two guiding principles. Paramount of these was protecting the health of mortuary affairs teams, medical personnel, other service members, and the American public. Protection of the living must take precedence over rapid repatriation of remains. There was also a commitment to fully and scientifically account for those who died in service to this country, even if the remains could not be returned.

A system was designed consisting of a commercially available "Zeigler casket" enclosing a "Ziegler case" that the manufacturer

claimed to produce a hermetic seal. Inside the case the remains were to be contained within a "Bioseal" pouch. This triple seal containment system failed several tests conducted in early March 2003 in an altitude chamber. The Zeigler case leaked, even at sea level. The Batesville casket and Zeigler case warped and lost integrity under a drop of only four feet. The Bioseal system was hard to seal properly, even while testers were wearing normal clothes and in clean controlled conditions. It did maintain a seal to 67,000 feet when sealed properly. Small amounts of sand in the seam ruined the seal. Thus, we currently do not have a system that maintains a hermetic seal under testing.

Temporary interment was chosen as the next best option at that time (March, 2003), but was not deemed as a desirable. It would be done only when decontamination attempts were not successful. A tissue sample would be obtained prior to interment and shipped to Armed Forces DNA Identification Laboratory (AFDIL) for identification of the decedent and for possible identification of the pathogen.

Three other options are currently under study: a better containment system; irradiation in place; and voluntary cremation in theater. A better containment system is being developed. Irradiation in place requires that a mobile irradiator be developed. Mandatory cremation would also require a crematorium in theater. Although the end of the war meant that those options were not needed immediately, it is anticipated that future conflicts will produce the same issues.

Contamination, Identification, Repatriation

G47 When is SIDS Over-Laying?

W.P. Ryan, MBBS, PO Box 267, Nowra, NSW 2541, Australia*

The goal of this presentation is to acknowledge the powers of observation as perhaps the most important factor at a crime scene is vital.

This presentation will impact the forensic community and/or humanity by encouraging practitioners to be observant.

When called to a dwelling on the eastern aspect of our town, I was advised by the police officer in charge that "It looks like a SIDS." Observation at the scene, not only of the victim but of the domestic surrounds within the dwelling, made an indelible impression on my mind.

From the evidence gleaned from family members and, basing my opinion on my personal experience in such cases, I formed an opinion that the case was rather one of over-laying.

I will demonstrate by way of slides, the total scene.

SIDS, Over-Laying, Crime Scene

G48 Unexpected Death From Ureterocele in an Infant

Joyce L. de Jong, DO, Sparrow Hospital, Forensic Pathology, 1215 East Michigan Avenue, Lansing, MI 48909*

After attending this presentation, attendees will recognize ureteroceles as a possible cause of unexpected death in infants.

This presentation will impact the forensic community and/or humanity by creating awareness of a possible cause of unexpected death in infancy.

An infant died suddenly of an ectopic ureterocele which was undiagnosed in life. Ureteroceles are cystic dilatations of the submucosal portion of the terminal intravesical ureter. They are generally classified as intravesical (entirely within the bladder) or ectopic (some portion is situated permanently at the bladder neck or in the urethra). The incidence of this abnormality is about 1 in 5,000 to 12,000 births. In infants, the most common presentation is a urinary tract infection within the first few months of life. Other common presentations include a palpable abdominal mass from an obstructed renal unit or detection during an

antenatal maternal ultrasound. In the case presented, a 4-month-old white male died within minutes after his arrival at an emergency department. The parents reported the child had "not felt well" for about a week prior to his death. The autopsy revealed a right ectopic ureterocele with bilateral ureteral obstruction, urethral obstruction, and a urinary tract infection due to Escherichia coli. Sudden death in an infant caused by a previously undiagnosed ureterocele has not previously been reported.

Ureterocele, Infant Death, Genitourinary

G49 An Unusual Motorized Vehicle Fatality

Russell T. Alexander, MD, John Turner, MD, and Louis Dibernardo, MD, Duke University Medical Center, Department of Pathology, DUMC Box 3712, Durham, NC 27710*

After attending this presentation, attendees will understand the clinical features, classification, and pathogenesis of Osteogenesis Imperfecta. The high risk that these patients have for fatal intracranial injury after relatively minor trauma. The common causes of death of these patients. The possible diagnostic confusion of this disease with child abuse

This presentation will impact the forensic community and/or humanity by making the forensic community become aware of the disease Osteogenesis Imperfecta, its clinical features, and the likelihood of these patients to die after what would normally be considered minor trauma. The forensic community will also become aware of the typical causes of death of these patients and the possible confusion of this disease with child abuse in young patients. The typical external features and radiographic appearance of the disease will be shown so that the forensic community will be able to recognize patients with Osteogenesis Imperfecta in the future.

The goals of this presentation are to present a case that summarizes the typical clinical features of osteogenesis imperfecta (OI) and that highlight the high risk that these patients have for fatal cranial injury following relatively minor trauma.

The decedent was a 20-year-old female with a past medical history of OI who was living independently at a local college. She was riding in her motorized wheelchair on a level concrete path at an unknown speed when it came to a sudden unexpected stop. She was unrestrained and was thrown forward out of the wheelchair. The left side of her head impacted the ground. There was no loss of consciousness or altered mental status at the time of the accident. She was transported to a local hospital where physical examination revealed a small scalp laceration and blood in her left external ear canal. Extreme body dysmorphism consistent with the history of OI was noted, but no new trauma to the extremities was identified. A computerized tomography (CT) scan of the brain revealed a large epidural hematoma and multiple fractures through the left side of the calvarium. Approximately 5 hours after the accident, her level of consciousness decreased. A repeat head CT confirmed a left sided epidural hematoma now with significant midline shift and subfalcine herniation. An emergent craniotomy was performed for evacuation of the epidural hematoma. She died soon after surgery.

Postmortem examination revealed the head to be disproportionately large for the body. Reflection of the scalp revealed a complex comminuted left temporal bone fracture status post repair. The bones of the skull were "egg shell" thin. A 10 x 6 cm temporal-parietal epidural blood clot compressed the underlying brain. A thin layer of subarachnoid hemorrhage overlay the cerebral convexities. Marked cerebral edema was associated with bilateral herniation of the parahippocampal gyri and cerebellar tonsils. Sectioning of the brain disclosed left to right midline shift and subfalcine herniation. Additionally, the sclera were blue and soft. The teeth were opalescent, brownish, and chipped. Both upper extremities were dysmorphic and tortuous. The lower extremities exhibited marked bowing and deformity. Radiographs revealed severe

scoliosis of the spine with placement of a fixation rod. The legs contained internal fixation rods in both femurs and tibias. Representative samples of bone from the ribs and spine were soft and friable. Microscopic examination showed decreased amounts of bone that were disorganized and only focally calcified.

OI ("brittle bone disease") is a heterogeneous genetic disorder of type I collagen. Affected individuals have fragile bones and abnormalities in other tissues rich in type I collagen including teeth, sclera, and ligaments. The disease is due to mutations in the COL1A1 or COL1A2 genes that encode type I procollagen. The disease is divided into types 1 – 4 based on skeletal abnormalities, the extra-skeletal tissue affected, and the genetic defect present. Type I OI is a mild form of the disease characterized by less severe bone involvement, blue sclera, deafness, and variable involvement of teeth (dentinogenesis imperfecta). The most severe form of OI, type II, presents with extreme bone fragility, intrauterine fractures, crumpled long bones and ribs, severe deformity, blue sclera, and is usually fatal in the perinatal period. Type III OI is characterized by progressive bone deformities, frequent fractures, short stature, scoliosis, deafness, dentinogenesis imperfecta, variably hued sclera, and survival often into adolescence and young adulthood. Type IV OI is intermediate in severity between types I and III, and it is characterized by moderate bone fragility and deformity, deafness, variable dentinogenesis imperfecta, and normal sclera.

McAllion and Colin (1996) have reviewed the causes of death for non-type II OI patients. Patients with types I and IV OI had increased numbers of deaths due to respiratory complications of their disease, as well as compression of the brain due to basilar invagination of the skull. However, many type I and IV OI patients had a normal lifespan and died due to diseases that affect the community at large. The type III OI patients often died of respiratory complications of their disease. Five percent of the type III OI patients died due to cranial injury after falling out of a wheelchair.

A concern for the forensic community is the possible confusion of child abuse with OI since both can present with unexplained fractures. It has been estimated that up to 1% of infants presenting with fractures in the first year of life have OI (Byers, 2000). This highlights the need for accurate recognition of OI. The usual other signs of abuse including lacerations, burns, retinal and intracranial hemorrhages, and signs of sexual trauma should be sought. Laboratory evaluation of collagen, imaging studies of bone, and genetic analysis may provide support for a diagnosis of OI.

This case presentation highlights the increased risk that OI patients have for fatal intracranial trauma after relatively mild traumatic injury. Because of this risk, OI patients should always wear a seat belt when riding in a wheelchair.

Osteogenesis Imperfecta, Epidural Hematoma, Trauma

G50 Three Unusual Cases of Sudden Unexpected Death in Pregnancy Occurring in One Week in the State of Maryland

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After attending this presentation, attendees will become aware of relatively uncommon causes of death in the pregnant woman.

This presentation will impact the forensic community and/or humanity providing the opportunity for the forensic community to learn about relatively uncommon causes of sudden unexpected maternal death that they may see in their practice.

From June 24 through June 30, 2003, three cases of sudden unexpected death in pregnant women presented to the Office of the Chief Medical Examiner for the State of Maryland.

The first was a 40-year-old, previously healthy G7P6 female, carrying triplets as a surrogate mother for another couple. Her pregnancy history was significant for anemia during pregnancy, a previous large for gestation baby with shoulder dystocia and postpartum hemorrhage, and there was less than one year between the last delivery and the current in vitro fertilization and conception. She was being evaluated for possible pregnancy-induced hypertension (PIH) and it was recommended that she be admitted to the hospital for further care, but she refused. On the day of her death, she complained of shortness of breath, collapsed and was unable to be resuscitated. Emergency cesarean section delivered a stillborn male fetus. The other two fetuses were left inside her uterus. Autopsy was significant for focal 50% atherosclerotic narrowing of the left anterior descending coronary artery, left ventricular hypertrophy, and features of Hashimoto's thyroiditis, previously undiagnosed. The presumptive cause of death was a cardiac arrhythmia, most likely due to hypothyroidism. The second was a 39-year-old, previously healthy G2P1 female, who complained of abdominal fullness and cramping, then passed out while shopping. She was unable to be resuscitated and a stillborn male fetus was delivered by emergency cesarean section. Autopsy findings included diffuse hemorrhage into the retroperitoneal and peritoneal soft tissue originating from a lateral rupture of the spleen. There was no history of illness or trauma. Microscopy failed to indicate an infectious or malignant process underlying the rupture, and also identified prominent lymphocytic infiltration of the pituitary gland. The cause of death was determined to be spontaneous rupture of the spleen in pregnancy, with lymphocytic hypophysitis considered a contributory condition. The third case was a 28-year-old, previously healthy G1P0 female, who had a two week history of sporadic palpitations, occasional dizziness and shortness of breath. On the day of her death, she was diagnosed at the hospital with supraventricular tachycardia (SVT), became unresponsive, and was unable to be resuscitated. Autopsy findings were negative. The presumed cause of death was determined to be SVT.

These cases represent three relatively rare causes of death in pregnant women and are conditions of which the forensic community should be aware.

Spontaneous Rupture of Spleen, Hashimoto's Thyroiditis, Supraventricular Tachycardia

G51 Compressed Gas Cylinder Related Injuries: Case Report of a Fatality Associated With a Recreational Paintball Gun, Review of the Literature and Safety Recommendations

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By describing a fatality involving the pressurized canister of a paintball gun, this case report highlights the potentially serious hazards associated with these devices and reviews relevant safety guidelines in handling pressurized gas cylinders.

This presentation will impact the forensic community and/or humanity by underscoring the serious injury potential of gas powered paintball guns, the authors hope to: i) dispel the misconception that paintball markers are mere toys, ii) promote the safe use of compressed gas cylinder-powered devices, like paintball guns, by encouraging a

healthy respect for their injury potential and emphasizing the need for adherence to age restrictions, game rules, and use of protection gear, and iii) prevent potentially avoidable paintball gun injuries by contributing to accident reporting and statistics and increasing public awareness.

The purpose of this paper is to draw attention to the potentially significant morbidity and mortality that may result from the recreational use of compressed gas cylinder-powered equipment, illustrated by a fatality involving a paintball marker/gun. Because such injuries are more common in a non-commercial setting lacking rigorous enforcement or consistent operator implementation of established paintball game rules, it is important to recognize the need for adherence to safety recommendations common to all devices employing pressurized gas cylinders, irrespective of the application involved.

Compressed gas cylinders, used in a variety of industrial, occupational and recreational devices and settings, present a substantial accident hazard due to the large amount of energy stored in the pressurized gas cylinder, which is released upon sudden decompression. Property damage and serious, or even fatal bodily injury may result from the careless or improper handling of gas cylinders, modification of equipment, or device malfunction.

This report describes a case of severe, fatal blunt force injury of the head sustained when a compressed carbon dioxide gas cylinder decompressed suddenly upon disconnection from a paintball gun. The gas cylinder was propelled from the gun, striking the head of the 15-year-old who was holding the gun. The impact resulted in craniocerebral injuries including depressed, comminuted skull fractures and cerebral contusions leading to death. Subsequent inspection of the device found that the gas cannister separated from its own coupling rather than from the connector attached to the device. The operator was apparently oblivious to the dangers inherent in handling pressurized cylinders when he unscrewed the cannister from the gun.

Although there have been numerous anecdotal and well documented reports of paintball equipment-related injuries, this appears to be the first report of a fatality involving a paintball gun. Previously, the most commonly reported injuries have involved ocular trauma resulting from paint pellets striking the eyes. Considering the current case report and previous reports of non-fatal injuries, it is apparent that failure to adhere to established safety standards accounts for the vast majority of serious injuries involving paintball guns.

Initially designed for the purpose of marking trees in the setting of forestry, the use of gas powered paintball markers/guns has gained increasing popularity over the last decade as a 'toy weapon' used in combat simulation or 'war games,' whether for sport or military training. As gas cylinder-powered devices, paintball guns are subject to the standard safety recommendations addressing the physical, chemical, mechanical, and inhalation hazards of compressed gas cylinders, tailored to the specific purposes of recreational combat simulation maneuvers. Users of compressed gas cylinders are strongly advised to follow the manufacturers' and suppliers' safety instructions with regard to proper storage, labeling, hazard designation, transport, inspection, handling, and maintenance of cylinders and their connections as well as operator age restrictions and recommended personal protective gear.

High pressure gas cylinders present a multitude of hazards including sudden decompression, flammability, inhalation toxicity, cryohazard, heavy object hazard, risk of explosion, and asphyxiation. For these reasons, pressurized gas powered devices are essentially accidents waiting to happen with potentially lethal outcome. The fatality reported herein illustrates the serious accident hazard of gas cylinders, particularly in a non-commercial recreational setting and emphasizes the need for awareness and strict adherence to relevant safety practices.

Paintball Marker/Gun, Compressed Gas Cylinder, Fatality

G52 Cerebral Air Embolism: An Uncommon Complication of a Common Procedure

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The goal of this presentation is to describe air embolism which is an uncommon but potentially fatal complication of esophagogastroscopy.

Forensic pathologists should be made aware of this uncommon complication as endoscopy is a commonly performed procedure. Cerebral air embolism can occur in the absence of an obvious right-to-left shunt. Careful review of imaging studies may be helpful in confirming the diagnosis and cause of death.

Esophagogastroscopy is routinely performed at most hospitals and is considered a very safe procedure. The two most common major and potentially life-threatening complications are perforation and bleeding. Another rare and potentially fatal complication of this procedure is cerebral air embolism. We present an example of cerebral air embolism following esophagogastroscopy eventuating in patient death.

The patient, a 71-year-old female, presented to hospital with a history of chronic abdominal and back pain. Investigations revealed a decreased hemoglobin level and her stool tested positive for occult blood. She underwent esophagogastroscopy to try to identify a bleeding source. Several abnormalities were identified including three small linear ulcers at the distal esophagus, a prepyloric ulcer, and an abnormal inflamed area within the duodenal cap. Biopsies of the stomach and duodenum revealed chronic active gastritis and duodenitis. Fragments of hepatic parenchyma were also present in the duodenal biopsy.

Immediately following the procedure, the patient developed an acute decline in her level of consciousness. She did not respond to verbal or painful stimuli. Her pupils were equal and pinpoint. She had a bilateral positive Babinski sign.

An emergency CT scan of her head demonstrated air within the arterial and venous cerebral vasculature. The cranial bones were normal. Bifrontal cortical infarcts involving the middle cerebral and the anterior cerebral artery territory were identified on a repeat CT scan performed 3 days later.

The patient's condition did not improve and she expired 6 days after endoscopy. Autopsy confirmed the presence of a 3 cm duodenal ulcer with penetration into the liver and associated peritonitis. Bilateral, hemorrhagic, frontal, recent infarcts were evident grossly and confirmed microscopically. Examination of the heart did not reveal a right-to-left shunt. Bilateral bronchopneumonia, involving all lung lobes, was identified in the lung tissue sections.

Given her large duodenal ulcer that penetrated into her liver, we suspect that air, introduced at endoscopy under insufflation pressure, entered into the venous circulation, either through an exposed vein or through dissection into the hepatic sinusoids. The air then likely ascended to the right atrium, followed by the right ventricle, the lungs, through an unidentifiable pulmonary shunt, the left atrium, the left ventricle, the cerebral arterial circulation with resultant infarcts in the territories of the middle and anterior cerebral arteries.

Only a few cases of cerebral artery air embolism following esophagogastroscopy have been previously documented. In the absence of an intracardiac shunt, proposed alternative mechanisms for paradoxical air embolism include intrapulmonary shunts and transcapillary routes, both of which will likely be unidentifiable at autopsy. As intravascular air is rapidly absorbed, the obtainment of emergency head CT images is critical to the diagnosis and, in this case, the determination of the proximate cause of death. Delays in imaging would likely result in a failure of diagnosis and possibly a wrong or undetermined cause of death.

Cerebral arterial air embolism is a rare, potentially fatal complication of esophagogastroscopy and can occur in the absence of intracardiac shunts. Keys to diagnosis are awareness of this complication and the early obtainment of good quality head CT images following symptom development.

Embolism, Esophagogastroscopy, Fatality

G53 Legal Outcome of Sexual Assault Cases, The County of Aarhus, Denmark

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After attending this presentation, attendees will become aware of medical findings and legal outcome of sexual assault cases examined by forensic pathologists.

Forensic pathologists are qualified to do clinical forensic examinations of victims experiencing sexual assault, due to their great experience in describing traumatic lesions during autopsies. Objectivity is easier maintained since the Forensic Pathologist does not take part in the following treatment of the victims. In this study the victims testimonies seemed to have had greater influence on the legal outcome than the findings at the clinical forensic examination.

Introduction: The medical examination of victims of sexual assault is in Aarhus, Denmark performed by forensic pathologists at the Rape Crisis Center, the County of Aarhus. This center has existed since the first of November 1999 and is open to all victims of sexual assault irrespective of police reporting or not. It is located in a hospital setting close to the Department of Forensic Medicine. The Rape Crisis Center covers an area with about 645,000 inhabitants.

Material and Methods: This is a study of all cases reported at the Rape Crisis Center or to the police in a fourteen-month period (Nov. 1, 2000 – Dec 31, 2001) from the County of Aarhus which has about 285,000 inhabitants. Police and court files were studied in the reported cases.

Results: 87 cases, all women, were included of which 73 reported to the police and 48 of these had a clinical forensic examination performed.

- 37 (77 %) had the examination performed within 24 hours of the assault, 30(62.5%) had injuries mostly caused by minor blunt trauma and 7 (14,6%) had minor injuries to the genitals.
- 39 (53.4%) women reported vaginal penetration and semen was found in six of these women.
- 18 (24.7%) of the reported sexual assault cases were “stranger rapes”, 45 (61.6%) were “date rapes” and 10 (13.7%) “partner rapes.”

Legal outcome: 11 were convicted and one acquitted in court, the charges were dropped in 25 cases because of lack of evidence. Eight were false allegations (seven date rapes and one stranger rape). No charges were made in 24 cases, in 12 of these no perpetrator was found, of which 11 were stranger rapes. Partner rape had the highest conviction rate (three (30%)), compared to date rape (seven (15.6%)) and stranger rape (one (5.6%)).

Injuries to the body were found in four convicted cases and to the genitals in one. In six of the convicted cases vaginal penetration was reported. Semen was not a finding in any of the convicted cases.

Conclusion: The presence of injuries, vaginal penetration or the findings of semen had, in this study, no influence on the legal outcome. Partner rape had the highest conviction rate compared to date rapes and stranger rapes. Reservations however have to be taken due to the small number of persons.

Sexual Assault, Legal Outcome, Clinical Forensic Medicine

G54 Boating People Pathology

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This presentation will impact the forensic community and/or humanity by describing unusual injuries and manner of death in forensic pathology about boating people.

The Authors describes the autopsy findings observed in foreign people died during the attempts of crossing the Adriatic sea to get Italy illegally. The crossings usually took place at night on board a rubber dinghy (8-10 mt long) with powerful outboard engines, driven by affiliate of criminal organization, full up to 40 illegal immigrants.

In the last five years we performed autopsy 57 bodies victims of these accidents.

The autopsy performed on corpses showed two kinds of injuries: some victims ha extensive amputations, produced by violent impact during collision between boats or caused by outboard-motor propeller on victims falling overboard; some others non injuries at all. Survivors, providing information about boating, told that someone of them, before to fall in water, already lost consciousness. In these cases we find blunt injuries on the head associated with focal or multifocal subaracnoid haemorrhages, consistent with trauma to the head. Although the above findings the cause of death in those victims was determined as drowning based on additional evidence (lungs large and bulky, white foam from trachea and bronchi, water in stomach, swollen brain and chemical finds of drowning in sea-water).

These findings are unusual in forensic pathology. The Authors were supposed that subaracnoid haemorrhages, following of trauma to the head, were responsible of lost consciousness and then made easier drowning when people fell in water-sea.

We found often traumatic head injuries made in people boating on rubber dinghy driven speedy and forced to make abrupt maneuvers to escape the guard boats; these injuries were produced accidentally against stiff parts of the boat (many people boating lying or with head rested on the side) or intentionally by others on the ship.

Sometimes victims presented wounds, localized especially on trunk and lower limbs, chemical burns, produced on the skin by oil flowing from breaking. The water-sea, in fact, compromise permeability of skin, allowing contact of derma with oil, so that it produced injuries seem to burns.

The cause and manner of these uncommon deaths and injuries will be also discussed.

Boating People, Subaracnoid Haemorrhages, Chemical Burns

G55 Do Centenarians Die Healthy? – An Autopsy Study

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The goal of this presentation is to assess the prevalence of common causes of death and demographic variables in a selected population of centenarians.

This presentation will impact the forensic community and/or humanity by underlining the need for more baseline data of the elderly which can be obtained only by more and well-performed autopsies.

There is a common conception that the very old die of old age, but the prevalent cause of death in this age group remains poorly studied.

Only few necropsies have been performed in patients dying after age 100 years and, little attention has been made on the clinical and morphologic features observed in these oldest old. For that reason we reviewed 34,858 consecutive autopsies done during a 15- year- period (1988 to 2002) at the Institute of Forensic Medicine, Vienna, Austria.

We focused on cases who met our working definition of sudden natural death in very old people: Unexpected or unexplained deaths of non-hospitalized persons over the age of 100 years, which are apparently due to natural causes". In particular, all persons who had not consulted a physician within 10 days before death were included and autopsied.

Of the 30 study corpses, 9 were men and 21 were women; all were Caucasian. The age of these out-of-hospital patients ranged from 100 to 108 years.

Nine persons lived alone in their homes without periodical care from relatives or welfare centers. Another 11 persons also lived alone, but were regularly cared for by neighbors, relatives or welfare workers, 10 lived with at least one family member.

Sudden natural death occurred in all cases in private homes, and in 35% of these cases while sleeping. Resuscitation was attempted in 53% of the cases. More than 63% (n = 19) of those who died were described as having been previously healthy.

About 30% had cardiac antecedents such as stable angina pectoris. Three persons had a history of myocardial infarction. Other pre-existing conditions were hypertension (16%), diabetes mellitus (10%), respiratory (10%) and gastrointestinal disorders (5%).

A total of 22% of the men and 29% of the women had a body mass index exceeding normal range.

Cardiovascular diseases accounted for almost three quarters of the deaths (n = 21); 23% (n = 7) of the centenarians died of respiratory illnesses, and 7% (n = 2) of gastrointestinal disorders.

Myocardial scars or focal myocardial fibrosis were detectable in 2/9 men and in 4/21 women, who died due to cardiac disorders; 3 men and 10 women had acute myocardial infarcts. Calcification of the mitral annulus and of the aortic valves were present in 80%; 15% of the calcified valves were anatomically stenotic.

All deceased had extensive aortic sclerosis, mainly focused in the abdominal part. In all 30 corpses the aorta was dilated in its transverse and longitudinal planes, with aneurysm formation in 5 cases, 2 resulted in fatal rupture.

Four cases of sudden death were caused by pulmonary embolism emerging from the left femoral veins, 3 patients died of bacterial pneumonia.

A gastric ulcer caused perforation with acute diffuse peritonitis in one 100- year old man, and in one 100- year old woman.

Centenarians succumb to disease, they do not die of old age. Undiagnosed conditions in the oldest old present a clinical challenge that increases with the patient's age. However, despite progress in diagnostic technology, confirmation rates of death causes have not changed much. Therefore, as the age of death rises, it is important to preserve and foster postmortem examinations, the most reliable source of medical evidence.

Centenarians, Autopsy, Cause of Death

G56 Degenerative Changes of the Conduction Tissue in Drug Addicts

Michaud Katarzyna, MD*, Béat Horisberger, MD, and Patrice Mangin, PhD, Institut Universitaire de Médecine Légale, Rue du Bugnon 21, Lausanne, Vaud 1005, Switzerland

After attending this presentation, attendees will possibility of the influence of the degenerative findings in the cardiac conduction system in the pathophysiology of the death in chronic drug abusers.

This presentation will impact the forensic community and/or humanity by showing that degenerative changes of the cardiac con-

duction system are more often observed in drug addicts than in the control group.

The destructive effects of some drugs and especially of cocaine on the cardiovascular system are well known. The aim of this study was to evaluate if the degenerative changes concern also the cardiac conduction system and if these changes are more frequently observed in drug addicts.

The material included fatalities studied at the University Institute of Forensic Medicine in Lausanne for the period 1998-2001. The age of the patient ranged from 21 to 47 years (mean 32.4) for the drug addicts and from 21 to 50 in the control group (mean 32.5). In the group of the drug addicts we included 51 cases, all of them known by the police as drug users. Complete autopsy with histological examination were available for each case, and toxicological analyses in 50 cases. The toxicological analyses demonstrated the presence of one or more drugs in the blood in 43 cases, from which in 20 cases 3 or more drugs; cocaine or its metabolites were present in 18 cases. In the control group were included 52 cases not known as drug abuser. Complete autopsy with histological examination were available for each case and toxicological analyses in 40 cases. From 7 cases of intoxication which were included in this group, 4 were suicides by psychotropic drugs, one suicide by cyanide ingestion and 2 were consecutive to accidental monoxide intoxication. In 22 cases the toxicological analyses were negative. In 11 cases the therapeutic levels of different antidepressants were found. Cocaine or its metabolites were found in no case.

The degree of fibrosis and fatty infiltrations has been analysed using the semi-quantitative score evaluation. The changes were analysed in the following structures: the atrioventricular node (NAV), the penetrating part of the node (PB), the branching bundle (BB), the left and right branches (LBB and RBB) as well as the left and right part of the septum superior.

The mean scores for the degenerative changes were higher in the addicts group. The statistical analyses showed significant differences ($p<0.01$) for fibrosis in the atrioventricular node, in the penetrating part, in the left bundle branch, and in the septum superior as well as for fatty infiltration in the branching bundle and in the left bundle branch. No significant differences were found between the results in the group of cocaine-positive drug users and the results in the drug users without cocaine found in toxicological analyses.

The more frequent apparition of degenerative changes in the group of drug addicts, which are often cocaine users, can be explained by cardiotoxic effect of a chronic drug administration. On the other hand, it is evident that the pathomechanism of deaths in drug intoxication is multi-factor, and that interpretation of deaths by overdose can be difficult because the range of drug concentration in fatal cases can be very large. Therefore, the possibility of the influence of the degenerative findings in the conduction system and in the septum superior in the pathophysiology of the death in chronic drug abusers should also be considered. Moreover, in some deaths pathological changes may be associated with the electrical instability of the heart and even contribute to the death, in particular in some unexplained cases of sudden death.

Drug Addiction, Heart, Conduction System

G57 Systemic Amyloidosis in an Intravenous Drug Abuser

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The goal of this presentation is present to the forensic community a case of systemic primary amyloidosis in an intravenous drug abuser.

Recognition of systemic amyloidosis and the subsequent microscopic examination of tissues is important during autopsy. Autopsy pathologists, residents, and pathologists' assistants should be aware of

the correlation between systemic secondary amyloidosis and people with a history of illicit drug use/abuse, as well as the possibility of a chronic drug abuser having the primary form of amyloidosis. The type of amyloidosis can be further characterized through immunohistochemical staining of selected amyloid containing tissues.

This poster will present the incidental finding at autopsy of systemic amyloidosis in a 46-year-old African American male that was a former intravenous heroin abuser. Healed track marks were identified on the arms. The patient had cirrhosis and was Hepatitis B and C positive, underwent bimonthly serial paracentesis for refractory ascites, and had congestive heart failure, renal insufficiency, and dyslipidemia. The patient was noncompliant with treatment for his heart condition until 2000, which roughly correlates with the diagnosis of Hepatitis and his last illicit drug use. The patient's social history also includes a 15 pack/year smoking history, six 40-ounce beers per day for 6 years, and cocaine smoking. The patient was admitted to the hospital after paramedics arrived to a complaint at the patient's home of severe testicular edema, the last ascites tap having been performed two days prior. The patient's ascites did not resolve by the administration of albumin, and four litres of ascites fluid were drained three days after admission. The patient had a "seizure" the following early morning, witnessed by his roommate prior to the two attempting to sneak outside for a cigarette. The patient had no recollection of the event. An MRI revealed nothing of significance. Two days later, the patient was found to have a heart rate in the 60s, respirations of 8, and had no detectable blood pressure. Resuscitative efforts were continued for 35 minutes to no avail, and the patient was pronounced dead.

At autopsy, the cut surfaces of the heart and spleen had the typical heavy, waxy, glistening appearance of amyloid deposition. Microscopic sections of the heart, lung, spleen, liver, kidney, gastrointestinal tract, pancreas, thyroid, and prostate revealed amyloidosis, and were positive with Crystal Violet sensitivity and Congo Red specificity staining.

Amyloid is a pathologic proteinaceous deposit that collects in the tissues of persons having an immunologic dysfunction. Amyloid has a distinct gross appearance and under the light microscope appears as an amorphous eosinophilic extracellular substance. It is unique that in staining with Congo Red and viewed under polarized light an apple-green birefringence is visible, and the stain has a dramatic appearance with fluorescent microscopy. There are three major biochemically distinct forms of amyloid; the AL (amyloid light chain) type that is derived from immunocyte dyscrasia and is termed primary amyloidosis, AA (amyloid-associated) type that is often associated with people who have chronic inflammatory conditions and is known as secondary amyloidosis, and A beta amyloid, found in the brain and associated with Alzheimer's disease.

Amyloidosis has been cited in the literature to be a major cause of nephropathy in living heroin abusers. A technique used to inject the drug, called "skin popping," is resorted to when there has been such overuse of the vasculature to cause venous thrombosis and scarring of venous access. Skin-popping leads to skin ulcerations from reaction to the injected drug as well as non-sterile technique. Secondary amyloidosis occurs as a complication of this underlying chronic inflammatory process. An extensive search of the literature contains abundant discussion of heroin abuser renal amyloidosis, but few cases discussing autopsy findings of widespread systemic amyloidosis. This patient has extensive manifestation of the disease in virtually every organ in his body. Is this a case of secondary amyloidosis, or rare primary disease in a drug abuser? Either way, the ultimate cause of this patient's death is most likely an arrhythmia due to cardiac amyloidosis.

The widespread distribution of amyloid in the organs did not quite fit with the diagnosis of secondary amyloidosis as seen in other chronic intravenous drug abusers. The amyloid was further characterized as the AL-type through immunohistochemical staining of selected tissues with a negative result for the Amyloid A stain. The classification of an AL-type amyloid diagnose this patient's disease as primary amyloidosis.

Careful consideration in the differentiation of either primary or secondary amyloidosis is important in this case, since secondary amyloidosis is the type most commonly associated with chronic drug abusers.

Systemic Amyloidosis, Illicit Drug Abuse, Autopsy Pathology

G58 Photographic Imaging of Handgun Gas Clouds Compared to Gunshot Residue Swabs

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After attending this presentation, the attendee will understand that a false negative result may be reported from gunshot residue analysis when ammunition with lead free primers are used.

This presentation will impact the forensic community and/or humanity by demonstrating why gunshot residue analysis is so non-specific when different ammunition is fired, even from the same weapon, and the possibility of a false negative result when lead free primer ammunition is used.

High speed photography is used to capture images of the gas/particle cloud emitted when firing full metal jacketed ammunition, hollow point ammunition and lead free primer ammunition from the same weapon, showing that similar gas clouds are emitted. Gunshot residue analysis is performed by Scanning Electron Microscope and Induction Coupled Plasma screening (ICP).

Lead is typically one of three components reported in a GSR analysis, using ICP. When the type of ammunition primer is not known and lead free primer ammunition was used to fire the weapon, the results may represent a false negative.

This study calls attention to the fact that GSR analysis has many variables. The results may be skewed when lead free primer ammunition and full metal jacketed ammunition are used and false positives may result.

Handgun Gas Clouds, Gun Shot Residue Analysis, Lead Free Primers

G59 Who was Driving: A Case Report

Ersi Abaci-Kalfoglou, PhD*, Hulya Yukseloglu, PhD, Tanıl Baskan, PhD, and Sevil Atasoy, PhD, Istanbul University, Institute of Forensic Sciences, Cerrahpasa, Istanbul 34303, Turkey

After attending this presentation the attendee will learn the power of DNA technology in solving problems concerning traffic accidents.

The forensic community will realize the importance of the application of DNA technology to traffic accidents.

The traffic accidents form one of the major sources of socio-economic loss for almost all the countries. This loss figures as material as well as personal loss. One of the most important strategic approaches is the certainty with which the cause of the accident can be established together with the responsible. The possibility of the determination of the responsible can be considered as the best method of prevention.

In case where the responsible is the driver the question is to identify him. The denial of driving is a very common phenomenon in traffic accidents. However the development in DNA technology the last decade made possible the personal identification in a very high accuracy.

Using this technology we have identified the driver of an accident with two deaths. Following the accident that took place in Izmir, a city in Aegean cost of Turkey, the Institute of Forensic Sciences of The University of Istanbul was asked to determine the driver performing a

detailed crime scene investigation. There were two deaths and two survivors from whom the one had amnesia and the second accused the first to be the driver.

The car examination revealed biological material from the front seat and from the windshield that matched the DNA profile of the second survivor.

The success of the identification was not only because of the power of the technology used but also because of the careful and detailed car examination that was performed. It is true that to end up with a satisfactory result requires a correct crime scene investigation at first part.

Traffic Accidents, DNA Technology, Crime Scene Investigation

G60 The Contribution of Researching DNA Breaks to the Evaluation of Postmortem Delay

Anne Dorandeu, MD*, Eric Baccino, MD, and Maguy Ursule, MD, Lapeyronie University Hospital, 371 Avenue du Doyen Gaston Giraud, Montpellier, Herault 34295, France

After attending this presentation, attendees will understand the results of a study on intranuclear DNA breaks on skin in an animal model.

This presentation will impact the forensic community and/or humanity by demonstrating an initial approach to be followed by further study on human skin, in order to improve evaluation of PMD.

Introduction: Postmortem delay (PMD) evaluation remains a problem for the forensic pathologist. Although Professor KNIGHT recently resumed all the methods used in his last book, it still seemed worthwhile to test a pathological method as a first stage on an animal pattern.

Material and Methods: 2.1) Material: 30 adult male rats, sacrificed according to protocol.

Cutaneous samples 2 mm by 2 mm from the inner thigh every 3 hours up the 24th hour, then every 6 hours until the 48th hour.

2.2) Methods: TUNEL technique: a commercially available DNA end labelling kit, the TUNEL method was standardised, validated and used for this purpose. This TUNEL technique (apoptag oncor) has shown itself to be the most reliable (reference) in a previous work.

2.3) Statistical analysis: For each PMD the average and the standard variation in the number of marked cells was calculated. The comparisons between the different PMDs were analysed with the Fischer test. The estimated PMD from the number of marked cells was based on linear regression. All the statistics were treated with the SAS software and the threshold of 5% significance was retained.

Results: The statistic analysis allowed the establishment of the following regression based on the number of marked cutaneous cells and according to their topography:

$$\text{Delay} = 32.648 - 1.114 \times \text{basal} - 6.886 \times \text{intensity} + 0.209 \times \text{superficial} + 0.434 \times \text{intermediate}.$$

Interpretation of Results: From the statistical results it appears that before the 18th hour there is an intranuclear break in the DNA fragments particularly in the superficial layers mainly constituted of mature keratinocytes, that after the 18th hour whatever the layer these apoptotic phenomena diminish. This reduction in breaks thus presents an interest in the evaluation of post mortem delay since all the layers behave practically in the same way with almost parallel kinetics, up to about the 48th hour.

Conclusion: In the next stage of this work true apoptotic variations will be verified by immuno-histochemistry (detecting the expression of bcl2, P53, caspases 3/9) or simple post mortem DNA breaks related to apoptosis. But having said this the TUNEL technique retains all its relevance in the evaluation of post-mortem delay. If it is really a case of

apoptotic mechanisms, its evaluation in certain organs, taking into account an agonic phase such as brain death but with a heartbeat, the mechanisms leading to apoptosis, blocking some of the factors leading to it could be of interest in organ transplants. A second objective would be to study a human model by taking a sample from a skin fragment at the site where the corpse has been discovered, in order to study it very quickly.

PMD, DNA Breaks, Skin

G61 From VIRTopsy to VIRTObOT: Photogrammetry Based Optical Surface Scanning and Radiological Virtual Autopsy

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After attending this presentation, attendees will learn the newest cutting-edge technologies of 3D forensic documentation.

This presentation will impact the forensic community and/or humanity by demonstrating an upgrade of the newest techniques using 3D body surface documentation merged with radiological data sets.

Goal: 3D body-surface documentation and minimal-invasive, image-guided virtual autopsy utilizing optical and radiological scanning: Pushing low-tech documentation and autopsy procedures in a world of high-tech medicine to improve scientific value, to increase significance and quality.

Background: A main goal of forensic medicine is to document and to translate medical findings to a language and / or visualization, which is readable and understandable for judicial persons and for medical laymen. Therefore, in addition to classical methods, scientific cutting-edge technologies can and should be used.

The Institute of Forensic Medicine, University of Bern is, in collaboration with an internationally well selected research team, evaluating and validating several cutting- edge technologies such as 3D optical and photogrammetric surface scanning, Computed Tomography (CT), Magnetic Resonance Imaging (MRI), Magnetic Resonance (MR) Spectroscopy, Micro-CT, Micro-MR and synthetic body models (www.virtopsy.com).

Methods and Results: Through the use of the forensic, 3-D/CAD-supported photogrammetric and 3D body surface scanning method the documentation of so-called 'morphologic fingerprints' has been realized. Forensic, 3-D/CAD-supported photogrammetry and 3D body surface scanning create morphologic data models of the injury and of the suspected injury-causing instrument allowing the evaluation of a match between the injury and the instrument. In addition to the photogrammetric body surface registration and 3D body surface scanning, the radiological documentation provided by a volume scan (i.e., spiral, multi-detector CT, or MRI) registers the sub-surface injury, which is not visible to Photogrammetry and 3D body surface scanning. The new, combined method of merging photogrammetry/3D body surface scanning and radiology data sets creates the potential to perform many kinds of reconstructions and postprocessing of (patterned) injuries in the realm of forensic medical case work. Using this merging method of colored photogrammetric surface and gray-scale radiological internal documentation, a great step towards a new kind of reality based, high-tech wound documentation and visualization in forensic medicine is made. The combination of these methods has the advantage of being observer-independent, non-subjective, non-invasive, digitally storable over years or decades and even transferable over the web for second

opinion.

Results: Body surface and radiological imaging techniques are particularly beneficial for reconstruction and visualization of forensic cases, allowing the opportunity to use the data for expert witness reports, teaching, quality control and telemedical consultation. The preliminary results based on the concept of 'Virtopsy' are promising enough to introduce and evaluate these techniques in forensic medicine. Documentation by these methods is observer-independent, objective and non-invasive. Digitally stored data may be recalled at will and provide fresh, intact topographical and anatomico-clinical reconstruction. Quality control and expert supervision becomes possible in a new manner, as well as image transmission and forensic "telemedicine" consultation. Image and data processing allows two- and three-dimensional views of forensic and anatomical findings. MR Spectroscopy has the possibility of metabolic-chemical analysis. In certain cultural circles where conventional autopsy is stigmatised or even forbidden, virtual autopsy would allow sound medico-legal practice and support for the judicial system without violating religious prohibitions or personal reservations. Also, in the post-mortem examination of highly infectious cadavers this technique could be of particular use (bio-terrorism). Minimally invasive autopsy would reduce the number of conventional autopsies, which are often difficult to bear for relatives. This development could be similar to that observed with the advent of minimally invasive percutaneous or laparoscopic surgery. Our results showed that we strive to lead forensic medicine to new horizons by utilizing the newest technologies.

Discussion and Perspectives: Based on our results, we hope that the combination of forensic-pathologic "know-how" (experience) with high-tech imaging will open new horizons in forensic medicine and other forensic sciences, leading towards a minimally-invasive virtual forensic autopsy (www.virtopsy.com). The automatisation of this process will lead to the development of a "Virtobot."

Forensic Radiology, Photogrammetry, 3D Body Surface Imaging

G62 Comparative Study of DNA Yield and STR Profile Quality Obtained From Various Tissue Types of a Decomposed Body

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The goal of this presentation is to present the forensic community with comparative DNA quantification and STR profiling results obtained following routine extraction of DNA from a variety of tissue types obtained during the autopsy of a decomposed body.

When DNA testing is necessary on bodies that have undergone decomposition, the pathologist may wish to focus collections on bone and nails prior to collection of hair or muscle for downstream typing purposes. Collection of the most appropriate samples for DNA typing will eliminate the need to repeat the extraction and profiling process and will ultimately expedite the identification process.

STR DNA profiling of decedents, either for identification purposes or for casework applications, is commonly used in the forensic setting. Obtaining DNA profiles from decedents where substantial decomposition has occurred presents a challenge to the DNA analyst due to the compromised nature of the cellular material housing nuclear DNA. The forensic pathologist is tasked with collecting tissue from the decomposed body that will most likely yield DNA of high quality and quantity such that nuclear DNA profiling will be possible. This presentation will describe the results of DNA quantification assays and STR DNA pro-

filling results obtained following the DNA extraction of a variety of tissue types collected from a decomposed body at autopsy. The results presented here are useful for predicting the most appropriate tissue types to collect during autopsy when subsequent DNA analysis will be required.

The study involved collecting a variety of tissue types from various areas of the body. Scalp hair, pubic hair, deep muscle tissue (psoas), nail material (toenails), and cross-sectioned vertebral bone were harvested from a body exhibiting moderate decomposition. According to investigative reports, the body was initially placed in a grassy field for two days. Suspects then returned to the scene and buried the body in a shallow grave, where it remained until exhumation eight days later. Temperatures during this period ranged from 48-88° F, with a mean temperature of 67.5° F and a total rainfall of 1.84 inches. The body exhibited mild to moderate postmortem insect larvae activity.

A general description of each tissue type was made prior to further processing for DNA extraction. The scalp hair was matted and evaluation of individual hairs and/or roots was not possible; approximately 36.7 mg of this material was collected for DNA extraction. Pubic hairs were separable, therefore root ends were identified macroscopically; approximately 7 mm of the root ends of ten hairs were collected for DNA extraction. The muscle obtained at autopsy was further sectioned prior to DNA extraction, yielding two visually different tissue samples. One was central to the mass submitted for testing and was pink in color (referred to as "deep" hereafter), while the second sampling was more superficial and gray in appearance (referred to as "superficial" hereafter). The muscle tissues collected for DNA extraction from these two visually distinct samples had a mass of 159.6 mg, and 147.9 mg, respectively. Toenails were selected as nail material that would least likely bear DNA from a foreign source (as compared to fingernails); 190.4 mg of nail material was cut for DNA extraction. Finally, 190.5 mg of bone matrix was shaved from the wedged aspect of the cross-sectioned vertebra for subsequent DNA extraction.

Resulting tissue cuttings were each extracted using organic extraction methods and by Microconâ (Millipore, Corp., Bedford, MA) concentration and purification of the DNA. Extracted DNA from all samples was quantified using 1% agarose yield gel analysis in conjunction with the QuantiBlot® (Applied Biosystems, Foster City, CA) human DNA quantification kit. The quantity of DNA detected for each tissue type using the agarose product gel and human specific quantification systems, as well as estimated overall human DNA yield, was calculated in terms of nanograms of DNA per milligram of tissue extracted.

Quantification results indicated that high molecular weight DNA was detected all tissue types, with the exception of the hairs. Also with the exception of the hair samples, human DNA was detected from all DNA samples using the QuantiBlot® system; the bone sample yielded the highest overall quantity (ng DNA/mg tissue). Although the superficial muscle appears to exhibit a slightly higher overall yield than the deep muscle sample, the slight difference may be due to the subjective nature of visual comparative determination employed when determining quantifications from slot blot. Nevertheless, it can be concluded that resulting muscle tissue yields were similar regardless of sample stratification.

Samples were then amplified using the PowerPlex™16 BIO System (Promega Corp., Madison WI) and amplified products were detected using the Hitachi FMBIO® II Fluorescent Imaging Device (MiraiBio Inc., Alameda, CA). A target template amount of 0.5 ng was incorporated into each amplification reaction based on the QuantiBlot® quantifications; since no DNA was detected for the hair samples, the sample retentates were consumed during amplification.

The DNA profiles obtained from the pubic hair and both muscle tissue samples were partial in nature, while the nail material and bone yielded complete DNA profiles. No profile was obtained from the scalp hair sample. Although high molecular weight DNA of human origin could be harvested from deep muscle tissue of various strata, nail

material, and bone, the extracted DNA did not type with equal efficiency using common nuclear DNA typing techniques. While moderate results were obtained from pubic hairs that were separable upon extraction preparation, hairs submitted in bulky masses were not useful for typing using conventional methods. Deeper muscle tissue yielded a more complete profile than did the more superficial sample collected from the same muscle group. Although all were partial in nature, a more complete profile was generated from the pubic hair sampling than from either of the muscle cuttings. Nail material and bone both generated full DNA profiles and are therefore determined most useful for nuclear DNA typing following decedent body decomposition.

It can be concluded that although the agarose product gel indicates the presence of quality DNA from these samples, the DNA may have undergone damage not explicitly detectable by this method. Furthermore, the presence of microbial DNA complicates the analyst's ability to accurately determine the quantity of amplifiable human DNA present. As expected, due to the relatively short nature of the probe primarily responsible for recognition of human DNA in the blotting quantification system, the presence of adequate quantities of human DNA using these conventional blotting techniques is not necessarily indicative of the quantity of amplifiable DNA. However, data from both the agarose gel and blotting system can be used to predict the amount of human DNA within the total observed high molecular weight DNA, which can be useful for predicting which sample will most likely generate a well-balanced DNA profile across all 16 loci. In summary, this study indicates that nail material and bone tissue collected from decomposed bodies are more likely to yield full DNA profiles than are hairs or muscle tissue when straightforward processing and DNA extraction techniques are employed. When DNA testing is necessary on bodies that have undergone decomposition, the pathologist may wish to focus collections on bone and nails prior to collection of hair or muscle for downstream typing purposes.

Decomposition, PCR DNA Profiling, DNA Extraction

G63 Experimental Evaluation of Rigor Mortis Nysten's Law: Does it Apply to Rats?

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The learning objective consists in presenting the development of the intensity of rigor mortis in the different parts of the body of rats.

In 1811, the French physician and chemist P.H. Nysten published the first scientific description of rigor mortis. The law named after him states that "Cadaveric rigidity affects successively the masticatory muscles, those of the face and the neck, those of the trunk and arms and finally those of the lower limbs." It is often added that resolution occurs in the same order. The development of rigor mortis is thus descending, a finding thought to be related to the varying distances between the different muscles and the central nervous system. However, Nysten himself noticed that the destruction of the CNS did not affect the order of the development of rigidity.

In 1917, Naumann confirmed the descending development of rigor mortis, but he also noticed that in some special cases (e.g., in weak individuals, or those diminished by illness), rigidity may show an ascending pattern.

However, in 1950 Shapiro contested Nysten's statement: "it is difficult to understand why a physico-chemical process which takes place in recently dead tissues should follow the sequence usually described. It appears more likely that, because we are dealing with a physico-chemical process in what is virtually a lump of clay, this will take place simultaneously in all the recently dead muscles."

Some years ago, we developed a method to increase our understanding of rigor mortis through the objective measurement of the intensity of cadaveric rigidity in rats. The principle of the method is to determine the force required to cause a movement of small amplitude (4 mm) in the limb under examination. Since the movement doesn't break rigor mortis, serial measurements can be conducted. Our apparatus measures the resistance caused by rigor mortis in the knee and hip joints of rats. This method has been used in the past to evaluate the influence of several pre-mortem and post-mortem factors (i.e., body weight, muscular mass, age, physical exercise, ambient temperature, various causes of death, electrocution) on the development of rigor mortis.

In our present investigation, we tried to determine the validity of Nysten's law in the case of rats. For this purpose, we adapted our method to perform parallel measurements in the masticatory muscles, the neck, the front limbs and the hind limbs in rats, respecting the same principles of measurements.

Experimentation:

Animals: male albino rats, weighing approx. 300 g.

Measurement time points: 10 min, 1h, 2h, 3h, 4h, 5h, 6h, 8h, 12h, 16h and 24 post-mortem.

Results:

Group No 1: hind limbs.

The maximal values of the intensity of rigor mortis were reached at 5 hours post-mortem with a plateau of the intensity between 5 and 8 hours post-mortem, followed by the resolution of rigor mortis.

Group No 2: front limbs.

The time course of the intensity of rigor mortis was practically the same as in the hind limbs in spite of the fact that the muscular mass of the hind limbs was 2.89 times greater than that of the front limbs.

Group No 3: neck.

The maximal values of the intensity of rigor mortis were reached at 3 hours post-mortem in the muscles of the neck. The resolution began at 6 hours postmortem.

Group No 4: masticatory muscles

In the masticatory muscles the maximal values were reached at 2 hours post-mortem. The resolution began at 8 hours postmortem.

Conclusion: The intensity of rigor mortis reaches maximal values significantly earlier in the masticatory muscles and in the muscles of the neck as compared to the front and hind limbs in rats. Consequently, Nysten's law seems to apply to rats as far the onset of rigor mortis is concerned.

Rigor Mortis, Nysten Law, Rats

G64 Microbial Processes in Soils Associated With Skeletal Muscle Tissue and Cadaver Decomposition at Different Temperatures

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After attending this presentation, attendees will understand that the examination of soil microbiological and biochemical processes can provide insight into how temperature can affect the decomposition of cadavers and cadaver components in soil.

This presentation will impact the forensic community and/or humanity by demonstrating the soil microbial community has the potential to provide a basis for the estimation of postmortem and/or post burial interval.

Forensic taphonomy, and forensic science in general, has benefited greatly from the application of biological sciences. For example, the use of entomological principles and practices has led to an increased understanding of cadaver decomposition while providing an efficient and effective means to estimate postmortem and/or postburial interval. Considering that the decomposition of most resources in terrestrial ecosystems is due to the activity of soil microorganisms (often acting in conjunction with a variety of invertebrates) microbial processes in soils have been given little consideration. The microbiota are responsible for the regulation of nutrient transformation and storage in soils. As a result, all organic matter placed in the soil is acted upon (eventually) by soil microorganisms prior to being recycled into the wider ecosystem. The soil microbial biomass is a dynamic population, which can respond rapidly to environmental conditions (e.g., temperature, moisture) and the introduction of fresh substrates. These stimuli may result in a population adapted for specific circumstances.

There are a number of well established microbiological and biochemical methods for studying structural and functional characteristics of soil microbial communities. For example, substrate-induced respiration (SIR) and chloroform-fumigation incubation can be used to estimate the soil microbial biomass while fatty acid methyl ester and DNA analysis can be used to identify the taxa that make up the soil microbial community. Functional processes may be examined through measurements of CO₂ respiration, enzyme activity and nitrogen mineralization, among others. In this study we have applied a number of these methods (mass loss, microbial CO₂ respiration, SIR, enzyme assays) to determine whether temperature affects microbially mediated decomposition of skeletal muscle tissue (*Ovis aries*) and cadavers (*Rattus rattus*) in soils.

In experiment 1, skeletal muscle tissue (*Ovis aries*: 1.5 g) was incubated in soil microcosms at 2 °C, 12 °C and 22 °C in a sandy loam soil (100 g) from Dorset, England. Tissue mass loss was measured gravimetrically at seven day intervals over a period of 42 days. Microbial CO₂ respiration was measured every 24-48 hours using the alkali (0.3M NaOH) absorption method. Soil microbial biomass was estimated on day 21 using the SIR technique. Mass loss and SIR samples were collected using a destructive, sequential harvesting program.

In experiment 2, juvenile cadavers (*Rattus rattus*: ~20 g) were buried in a sandy loam soil (500 g) from tropical Queensland, Australia and incubated at 15 °C, 22 °C and 29 °C. Soil enzyme activities (arylsulphatase, dehydrogenase, phosphodiesterase, protease) were assayed on day 21 using standard soil enzymological techniques.

Experiment 1 demonstrated that each 10 °C increase resulted in an increase in the rate of tissue mass loss. These differences were maintained until day 42, when tissue incubated at 12 °C and 22 °C displayed similar levels of mass loss ($P = 0.266$). This may be due to the loss of readily available substrate (tissue) whereby the remaining tissue represents a more recalcitrant form of organic matter. The rapid utilisation of readily available nutrients was suggested by a flush of CO₂ following burial at 12 °C and 22 °C. Microbial CO₂ respiration gradually decreased following this flush. Test samples (soil with tissue) always demonstrated greater respiration rates than control samples (soil without tissue). Test samples incubated at 22 °C demonstrated greater levels of CO₂ respiration than samples incubated at 12 °C until day 23 ($P = 0.267$). Microbial CO₂ respiration at 2 °C was less than the other temperatures until day 42 ($P = 0.052$). A direct relationship was demonstrated between tissue mass loss and microbial CO₂ respiration (22 °C: $r = 0.690***$, 12 °C: $r = 0.810***$, 02 °C: $r = 0.836***$). Thus, the measurement of microbially respiration CO₂ can provide a basis on which to accurately predict soft tissue decomposition in soil. This can be achieved by calculating the amount of CO₂-C respiration. Microbial biomass estimations demonstrated no differences between test and control samples incubated at 2 °C ($P = 0.139$) or 12 °C ($P = 0.088$). Test samples incubated at 22 °C demonstrated a greater microbial biomass than control samples incubated at the same temperature ($P = 0.002$). This suggests

that temperature is able to control growth of the soil microbial biomass even in the presence of a highly utilizable substrate.

In experiment 2 test samples always displayed greater protease and phosphodiesterase activity than control samples. Protease activity in test samples incubated at 15 °C were less than in test samples incubated at 22 °C ($P = 0.013$). Phosphodiesterase activity in test samples incubated at 15 °C was greater than in test samples incubated at 22 °C ($P = 0.010$). These results demonstrate that cadaver burial can bring about an increase in the activity of some enzymes commonly associated with soil microbial communities. The activity of these enzymes seems to be influenced by temperature. Arylsulphatase and dehydrogenase results did not respond to the presence of the cadaver.

The decomposition of the organic matter used in these experiments may be attributed to increased microbial biomass and/or enzyme activity. These decomposition processes can be greatly influenced by temperature. Soil microorganisms can play a rapid and substantial role in the decomposition of skeletal muscle tissue buried in soil. The decomposition of this relatively simple substrate can be accurately predicted through the estimation of C mineralization (CO₂-C) and assimilation. This method may also assist in the study of the decomposition of amorphous materials such as blood and hair. The decomposition processes examined in the current work were most likely carried out by a diverse community of microorganisms. One particular feature of the taxa that comprise soil microbial communities is that they commonly exhibit a succession whereby a change in the composition of the community takes place over time as a result of change in environmental conditions or substrate. We believe that continued research into soil microbial succession in grave soils may possibly provide a basis for the estimation of post-mortem and/or postburial interval.

Forensic Taphonomy, Temperature, Soil Microbial Community

G65 Does Carcass Enrichment Alter Community Structure of Predaceous and Parasitic Arthropods? A Second Test of the Arthropod Saturation Hypothesis at the Anthropology Research Facility in Knoxville, Tennessee

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The goal of this presentation is to present to the forensic sciences community the latest findings on the scientific usefulness of the Anthropology Research Facility (University of Tennessee, Knoxville) as a research and training site for forensic entomology.

This presentation will impact the forensic community and/or humanity by describing an application of probability and power testing of several key variables of arthropod community structure to test the scientific usefulness of the Anthropology Research Facility (University of Tennessee, Knoxville) as a research and training site for forensic entomology.

The on-campus Anthropology Research Facility (ARF) at the University of Tennessee, Knoxville, established by Professor William Bass in 1972, is an outdoor scientific laboratory devoted to the study of human decomposition. In a previous study, probability and power testing of several independent variables of decomposition rate and community structure showed that porcine remains in the ARF do not decompose faster, nor are they saturated with forensically-important (sarcos-

aphagous) arthropods of reduced diversity, compared to remains in three non-enriched sites various distances away. In a second test of this 'arthropod saturation hypothesis,' we ask if the 30-yr history of carcass enrichment at the ARF has altered the community structure of predatory and parasitic arthropods that prey upon the sarcosaprophagous fauna. Over a 12-day period in 1998, using pitfall traps and sweep nets, we sampled over 81,000 invertebrates from freshly euthanized pigs (*Sus scrofa* L.) placed in the four sites: ARF: S2 (700 m away from ARF), S3 (6 km away), and S4 (40 km away). From these counts, we sorted 8,836 and 342 enemies of the sarcosaprophagous community (predators, parasitoids, and parasites) from pitfall and sweep-net counts, respectively, for a total enemy fauna of 9,178 individuals. The community structure of these organisms, measured by species and individuals' accumulation curves, rarefaction, and nonparametric correlation, was comparable in most paired-site tests with respect to colonization rates, ranked abundances, and colonization sequences of predatory/parasitic taxa on a per carcass basis. In the few exceptional cases, ARF differed from each of the three non-enriched sites in rarefaction-adjusted species richness (ARF pitfalls had more species). Spearman rank tests showed that correlations, although significantly positive between all site pairs, were stronger for sarcosaprophagous arthropods than for their natural enemies, confirming the tighter and more predictable relationship between carrion feeders and their carrion than between carrion feeders and their natural enemies. Overall, these findings parallel our earlier results on the sarcosaprophagous community, and except for species richness, bolster the conclusion that ARF is representative of surrounding sites with respect to the carrion-arthropod fauna.

Anthropology Research Facility (ARF), Forensic Entomology, Predatory and Parasitic Arthropods

G66 Trends in Forensic Entomology in the United States and Abroad

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The goal of this presentation is to provide those attending with an update on research trends in forensic entomology.

Due to the amount of forensic research conducted in general, it can be difficult for forensic specialists to remain up to date on research trends in their own field much less the countless other disciplines in the forensic sciences. We will provide those attending our presentation with a "snapshot" of current trends in forensic entomology research from around the world with an emphasis on research being conducted in the United States.

Initially, research on insects colonizing carrion was viewed as an attempt to better understand succession and nutrient recycling in terms of general ecology (Payne 1967). However, over the course of the past 20+ years, the aim and direction of such research has been largely focused on the use of insects as evidence in criminal investigations resulting in the development of the discipline of forensic entomology. Today, forensic entomology receives considerable attention from entomology and biology departments in universities throughout the United States and world.

The goal of this presentation is to provide those attending with an update on trends in forensic entomology. Published information on forensic entomology research was gathered through a search of the CAB database via Texas A&M University. Additional information on current research was gathered by contacting individuals from around the world who are known to have active forensic entomology programs. Articles located through the search were broken down into several categories;

research topic, locality of research, year published, and journal. Participants will be provided this information with special reference to states in the U.S. with ongoing programs in forensic entomology. Additional information will also be given on events occurring at the first North American Forensic Entomology Conference, which took place August 7-9, 2003, in Las Vegas, Nevada.

Articles with forensic entomology in the title or as a key word were located as far back as 1983. The number published gradually increased from 3 that year to 50 in 2001. A total of 22 countries published 101 articles on forensic entomology from 1999 through 2003. The top five countries during this period that produced articles in English according the CAB database search are the United States, France, Italy, Germany, and Australia. Other countries with significant contributions have been Thailand, Canada, and India.

Articles from 1999 through 2003 were grouped in one of seven research areas; insect biology (26%), review articles (16%), succession studies (15%), DNA (14%), case study (12%), entomotoxicology (10%), and morphology/taxonomy (7%). These articles were primarily published in three locations; *Forensic Science International* (31%), *Journal of Forensic Sciences* (14%), and the *Journal of Medical Entomology* (9%). Additionally, it was determined that forensic entomology research had been conducted in 18 states during this period: TX, AL, SC WV, CA, VA, NY, OH, GA, HI, MD, CO, LA, TN, MI, FL, MO, PA, and the District of Columbia. A summary of this survey and bibliography is located at: <http://stephenville.tamu.edu/~jktomberlin/forensic.html>

Entomology, Literature, Research

G67 Temperature-Dependent Development of the Blow Fly *Calliphora Vicina* (Diptera: Calliphoridae) and the Effects on the Estimation of the Postmortem Interval

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After attending this presentation, attendees will understand the importance of temperature on the development of the forensically important blow fly *Calliphora vicina* and present new research on the same.

This presentation will impact the forensic community and/or humanity by attempting to improve the quality, accuracy, and reliability of scientific data upon which estimates of the postmortem interval using insects are based. This will help strengthen the science of forensic entomology, but more importantly, serve to help investigators come closer to the truth when investigating the circumstances surrounding a death.

Forensic entomology deals largely with the estimation of the postmortem interval, or PMI, of the victim of a violent crime. There are several ways that entomological evidence may be used to calculate the PMI, but the most commonly used method involves using the developmental rates of blow fly (Diptera: Calliphoridae) and flesh fly (Diptera: Sarcophagidae) larvae. One forensically important blow fly is *Calliphora vicina* Robineau-Desvoidy, commonly known as the blue bottle fly. This species is nearly worldwide in distribution, and is commonly recovered on human remains through the course of forensic investigations.

Because insects are poikilothermic (cold-blooded), blow flies develop at rates which are largely dependant on the temperature of their surroundings. In general, development slows with cooler temperatures and accelerates with warmer temperatures. These developmental rates are of prime importance when calculating the PMI estimate. The temperatures experienced by the developing larvae must be taken into consideration when estimating the time it has taken for them to reach a given stage of development.

There have been a number of studies published on the developmental rates of blow flies at different temperatures. Because of variations in the experimental design, equipment, and sampling regime, there are some discrepancies in the literature regarding the accumulated degree-hours (ADH) and accumulated degree-days (ADD) needed for completion of the life cycle in these flies, as well as their developmental thresholds (those temperatures at which the larvae cease development). These discrepancies, when used to analyze evidence in a capital murder case, for example, can cause an exaggerated estimate of the PMI and cost an innocent person their freedom or help free a guilty person.

Our research has attempted to correct these problems and provides reliable data which forensic entomologists may use when estimating PMIs. Temperature trials over seven constant temperatures were conducted to determine developmental rates. Flies were reared on beef liver within plastic containers in environmental chambers. Thermocouples were placed within each container to accurately record the temperatures experienced by the developing larvae. Development times recorded to the nearest half-day were used to construct a degree-day model for each larval stage. The minimum temperature required for egg hatching within a five-day period was determined and ADH were calculated.

Forensic Entomology, Postmortem Interval, Calliphoridae

G68 Evidence for Neglect of Children and Elderly Persons by Use of Forensic Entomology

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After attending this presentation, attendees will recognize and collect evidence in severe cases of neglect, understand how to interpret the evidence, and the importance of the actual scene where the body was found, not only the state at the Institute of Legal Medicine.

This presentation will impact the forensic community and/or humanity by demonstrating forensic entomology in difficult cases: Insects on living persons — investigation however after death of persons.

Wounds of living persons are a potential target for the same flies that live, or feed early on corpses. This can lead both to complications in estimation of PMI (post mortem interval), or to additional information that might be valuable in a trial, or during the investigations. With forensic entomology, and forensic entomologists being more and more present, even lower profile cases like the neglect of elderly people (without violence being used against them (i.e., natural death), and neglect of children comes to our attention. Furthermore, much more people grow older than in the past years which leads to increased awareness of malpractice of caregivers in the professional, and personal environment.

Case 1: Elderly women found dead in October 2002 in her 3rd floor apartment in urban Cologne, Germany. Apartment was very clean except of the bathroom in which a bathtub had been filled with water, and clothing. Exclusively dead adult flies of the species *Muscina stabulans* FALLÉN were found spread on the floor; no blow flies in the zoological sense of the meaning were present in any live stage. Calculation of PMI led to an interval of around three weeks. This would have been a misconduct of the paid professional care giver who was supposed to check for the women every week.

The caregiver claimed that she had called the women ca. two weeks ago to check on her; the now dead women allegedly rejected a visit. This possibility could not be ruled out since the old woman was known to be healthy, yet mentally unstable and behaving "difficult" against everybody.

In clear contrast to the entomological findings, it was assumed that the caregiver tried her best; no prosecution followed.

Case 2: In September 2002, an old woman was found dead in her apartment in an urbanized town in western Germany. Her foot was wrapped in a plastic bag; inside, numerous larvae of *Lucilia sericata* were found. The caregiver openly stated that "it was well possible that the foot of the person was wrapped in a plastic bag, and that maggots may have been present inside during the lifetime of the woman."

The age of the maggots was estimated as four days (4x 24 hrs). However, judging from the deep tissue loss at the foot, it was discussed that most likely, the maggots had been feeding on the living woman for at least a week whilst she was still alive but then left the bag to pupate elsewhere. The apartment could not be checked for pupae, however.

Case 3: In March 2002, the corpse of an old woman found in her apartment in an urban apartment in a western German town. The apartment was not cleaned up, and on the actual corpse, the following insects were found: Larval *Fannia canicularis* flies, larval *Muscina stabulans* flies, and adult *Dermestes lardarius* beetles. These insects are known to build up populations inside of human housings but *Fannia* frequently hints towards the presence of feces, and urine in cases of neglect. In this case, further evidence for this possibility was found in the fact that the skin of the corpse was not fed on by the larvae. Pupae (of an unknown species) were reported but not collected. The son of the woman who was convicted of misconduct of taking care of his mother. It remained however unclear if the insects had inflicted pain on the woman or not.

Case 4: On the skin surface under the diaper (anal-genital area), third instar larvae of the false stable fly *Muscina stabulans* FALLEN, and the lesser house fly *Fannia canicularis* L. were found. *F. canicularis* adults are attracted to both feces and urine. From the face, larvae of the bluebottle fly *Calliphora vomitoria* L. were collected. *C. vomitoria* maggots are typical early inhabitants of corpses. From the developmental times of the flies, it was estimated that the anal-genital area of the child had not been cleaned for about 14 days (7-21 day range), and that death occurred only 6-8 days prior to discovery of the body.

Conclusion: From the actual case work, we get the impression that misconduct of elderly people currently becomes a severe problem in our aging societies. From a juridical standpoint, it is – and will be – very difficult to judge if the care giver is guilty of misconduct, or not. Forensic entomology can give important insights into the dynamics, the amount, and the final state of bodily care that was given to the neglected person.

At the same time, forensic entomology helps to excuse care givers who did actually do their duty whilst maggot infestation of a person's wounds occurred during a normal interval of non-visits.

Forensic Entomology, Child Neglect, Neglect of the Elderly

G69 DNA-Based Identification of Forensically Significant Blowflies of Australia and Southern Africa

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After attending this presentation, attendees will understand the DNA-based identification of flies; potential of improved identification of flies to increase the efficiency and accuracy of forensic entomology as an investigative technique; the importance of consideration of DNA variation between geographically isolated populations in estimating time since death; species status and implications for forensic entomology.

This presentation will impact the forensic community and/or humanity by demonstrating the potential of DNA for use in improving

the accuracy of the estimation of time since death will be explored. This will aid scientists to incorporate DNA-based forensic entomology into investigations, increasing the efficiency and accuracy of the technique for aiding investigators to focus their investigations more effectively. These DNA-based techniques improve the performance of entomology in casework, an important facet of any science used in criminal investigation, as standards must constantly be improved.

Entomology is an important forensic investigative tool, commonly applied to the estimation of time since death, referred to as post mortem interval (PMI). Blowflies (*Diptera: Calliphoridae*) are commonly found in association with corpses and may be used to estimate PMI. A critical step in entomologically based PMI estimation is the identification of insects to species level. Many species display affinities with corpses in any given area, and all will develop at different rates. Blowflies, and particularly their immatures must therefore be accurately identified. Based on morphological characters this was generally problematic, but more recently DNA-based techniques have been utilised for identification.

In applying DNA-based techniques, careful consideration is required to ensure that DNA characters used are robust and thus present throughout the entire of a species. This requires not only study of many individuals of a species from a locality, but analysis of individuals from isolated populations of the species.

The majority of studies have addressed the corpse fauna of the United States, Europe, Britain and Australia, but generally neglected Africa. In southern Africa, forensic entomology is being incorporated increasingly into death investigations.

This study consequently focused on the molecular-based identification of flies from southern Africa and Australia, considering distinction between species as well as differences between geographically isolated populations. The cytochrome oxidase I (COI) encoding region of mitochondrial DNA (mtDNA) was sequenced over 1167 base pairs, and analysis performed using phylogenetic techniques to compute similarity and difference between individuals.

Results proved the region to be useful in species level identification, with robust characters present. Variation between species was consistently calculated at 3.0% or higher, while intraspecific variation did not exceed 0.8%. While the distinction between these two values indicates the ability to clearly distinguish between species, there is little scope for identifying the geographical provenance of insects considering the low variation between conspecific populations. Consequently, an alternate region is suggested for this purpose. In conclusion, many southern African and Australian species of blowflies can be successfully distinguished on the basis of DNA.

Entomology, DNA, Blowflies

G70 Fatal Pediatric Head Impact Biomechanics: Homicide vs. Accident

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After attending this presentation, attendees will develop skill in determining the head impact accident scenario and injury mechanisms responsible for fatal pediatric head injuries. In addition, attendees will develop skill in determining injury causation in possible homicide cases involving complex, interdisciplinary medical and biomechanical engineering concerns.

When handling death cases where issues involving occupant dynamics and impact injury biomechanics have to be addressed, medical examiners should increasingly feel more comfortable seeking input and support from skilled biomechanical engineering colleagues.

A 14-month-old male in good health sustained a severe closed head injury at a babysitter's house, and he died in the hospital few hours later. Head CT Scan performed prior to his death demonstrated a large

occipital fracture, diffuse cerebral edema and tentorial subarachnoid hemorrhage with no midline shift. An autopsy was performed 27 hours post death. Autopsy findings are provided below, prior to addressing accident witness statements and reconstruction of the accident versus homicide scenario responsible for the death of this child.

Autopsy findings Summary:

1. Blunt Force Craniocerebral Injury:

- a. No lacerations, abrasions or contusions seen on skin of posterior scalp.
 - b. A 15 x 11 cm area of subscapular and periosteal blood extravasation in occipital and posterior parietal regions.
 - c. Extensive displaced fractures of occipital bones extending into the posterior aspect of both parietal bones.
 - d. Film of epidural blood extravasation over skull fractures.
 - e. An estimated 10 ml of liquid and partially clotted subdural blood extravasation, predominately over vertices of cerebral hemispheres, but also over base of skull.
 - f. Moderate diffuse subarachnoid blood extravasation over entire brain with increased concentrations in left para sagittal/sagittal cortex and left temporal lobe.
 - g. Apparent tear of falx cerebri anteriorly.
 - h. A 2 x 1.5 cm contusion, right cerebellar hemisphere.
 - i. A 1 cm contusion, right parieto-occipital lobe.
 - j. Blood extravasation surrounding each optic nerve.
 - k. Retinal blood extravasation.
 - l. Blood extravasation on the left nerve roots of C1 and C2 vertebrae.
 - m. Subdural spinal cord blood extravasation.
2. Evidence of hypoxic-ischemic encephalopathy:
 - a. Diffuse gyral flattening and sulcal narrowing.
 - b. Cerebral tonsillar herniation.
 - c. Cerebral edema and early neuronal degeneration on histology.
 3. Small, scattered, circular areas of erythema with central dried punctures resembling insect bites on skin.

Witness Statement:

The babysitter, the only adult witness to this accident, provided accident scenario descriptions (a) during the 911 call post-accident, (b) to the EMS crew, (c) to the emergency room and hospital personnel, and (d) to investigating police officers; all of the accident scenario statements provided by the babysitter remained consistent. Namely, the 14-month-old boy was standing at rest, having just picked up a popular toy from a toy box, and he was facing two older children who were playing across the room. Suddenly, these two older children ran together fast towards the 14-month-old boy. As these two older boys approached this 14-month-old boy, still running fast, these older boys became entangled and they tripped and fell toward the 14-month-old boy. The 14-month-old boy was, in effect, gang-tackled by the two older boys, causing the 14-month-old boy to rotate backwards at a high rate of speed, pivoting about his feet, resulting in the back of his head violently impacting the bare, hardwood floor.

Impact Injury Biomechanics:

1. Analysis of all of the injuries sustained, and of the possible injury mechanisms responsible for each injury, led to the conclusion that one, single, violent, blunt blow, sustained by the back of the head of the 14-month-old boy, induced all of the injuries sustained. This injury biomechanics analysis included study of the pattern and extent of the skull fractures sustained and consideration of how this depressed skull fracture resulted in an increase in intracranial pressure sufficient to have induced hemorrhages in the region of the optic nerves and retinae.

2. Dynamic and impact biomechanical analyses were then performed to study (a) the kinematic consequences of collisions of the two older boys into the 14-month-old boy, along with (b) the magnitudes of the collision-induced increases in head-to-floor slam down velocities.

These engineering analyses demonstrated that the collision of the two older boys into the 14-month-old boy standing at rest could have increased the 14-month-old boy's head-to-floor slam down velocity to a level more than capable of producing the severe skull fractures and fatal brain injuries sustained. In addition, these analyses demonstrated how unlikely it would have been for simple fall, starting at rest from a standing height and not involving a collision, to have caused these catastrophic head injuries.

Recommendations:

In an interdisciplinary case such as this one, whether or not the death of this 14-month child was caused by homicide would be difficult for most medical examiners to judge absent feedback and support from a team member skilled in biomechanical engineering. When the quest for accurately determining injury causation involves consideration of complex medical and biomechanical engineering issues, forensic pathologists should seek support from skilled biomechanical engineering colleagues.

Head Impact Injury Biomechanics, Skull Fracture Mechanics, Occupant Kinematics

G71 The Enigma of SIDS: Variations in Diagnosis and Recommendations

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After attending this presentation, attendees will understand how SIDS is diagnosed differently by medical examiners and to discuss recommendations to enhance consistency in diagnosis and contribute to prevention efforts.

Consensus is needed on guidelines to diagnose SIDS and suffocation. These guidelines should be based on the definition of SIDS, autopsy data, death scene investigation, and pertinent medical and social history, as well as consistent decision making on whether these factors are positive or negative. The next phase of this effort will involve forensic pathologists, medical examiners and other interested parties forming a task force with the goal of developing a greater consensus regarding the diagnosis of SIDS. Forensic science should strive to produce the most accurate and truthful diagnosis of sudden unexpected infant deaths, both as a professional standard, and to benefit prevention. Since many prevention efforts are based on vital statistics data, the more accurate and consistent diagnosis of SIDS or other forms of sudden and unexpected deaths would serve to focus and enhance the reduction in preventable infant deaths.

Purpose: There is great debate about the diagnosis of SIDS in deference to other causes such as accidental asphyxia. In fact there is accumulating evidence that unsafe sleep environments are linked to many infant deaths although the diagnoses are controversial. Variations in diagnosis lead to inconsistency in vital statistics and confusion or misdirection of prevention efforts. The purpose of this session is 1) to present information on a study which investigated differences in the diagnosis of SIDS among medical examiners using case scenarios and 2) to use these study results as a starting point to discuss efforts and recommendations to increase consensus among forensic pathologists and medical examiners regarding the diagnosis of SIDS.

Methods: A mailed survey was obtained from Medical Examiners/Deputy Medical Examiners (ME) in Michigan. The survey included 28 case scenarios with varying diagnostic factors, questions about the diagnosis of SIDS, and demographics.

Results: A total of 53 surveys were returned for analysis representing a 59% return rate. Only 15% of MEs believe SIDS is a distinct

syndrome, 58% think SIDS is a catch-all diagnosis but includes actual SIDS cases, and 27% believe SIDS is a catch-all category and that SIDS does not exist. Among MEs, 21% say they would sometimes give SIDS as a comfort diagnosis so the parents would not feel guilty. In a case that classically meets the definition of SIDS, 80% called it SIDS, 11% indicated accidental asphyxia (AAX), and 9% would call it undetermined (UDTM). In a similar case with the only change being a 14-month-old baby, 32% of MEs would still call it SIDS, while 66% would call it UDTM. If a baby was found prone on a pillow, 17% call it SIDS and 73% AAX. When an infant was found alone on a waterbed or air mattress there was a fairly even split on SIDS vs. AAX. When bedsharing was involved, the diagnostic distribution was 42% SIDS, 39% AAX and 19% UDTM. As factors were added to cases which make suffocation more likely, AAX increased as a choice, but a substantial proportion of MEs continue to call these cases SIDS. When an intoxicated parent is bedsharing both AAX and homicidal asphyxia (HAX) increased as cause of death. (10% SIDS, 63% AAX, 8% HAX, 19% UDTM). Cases in which parents were sleeping with infant on couches elicited the highest rates of AAX (77-85%).

Conclusions: There is significant variation in the way that SIDS is diagnosed in Michigan. Even in cases that have accepted definitions of SIDS or AAX there are marked differences in diagnosis, in part based on beliefs of what SIDS actually is. This variance makes it difficult to use and interpret death certificate data concerning SIDS. These results will be used to stimulate discussions and recommendations toward a consensus on the diagnosis of infants suffering sudden and unexpected deaths.

This study was funded by a grant from First Candle (National SIDS Alliance).

Sudden Infant Deaths Syndrome, SIDS, Infant Mortality

G72 Investigations and Eye Findings in Crush and Other Accidental Traumas in Lethally Injured Infants and Children

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After attending this presentation, attendees will understand the extent of systemic and ocular findings in a group of injured children as well as the histories and investigations leading to the conclusion that the children were accidentally injured as a basis for comparison with their cases. Crush injuries of the head are a subset of accidental trauma but in this group they did not have extensive ocular injuries.

Observations have been the basis of the scientific study of phenomena for many years. Presentation of these observations allows others to consider and compare the material with personal experience and the literature, validate the observations, use them as a basis for making determinations in their own cases. Our "cases" impact the family members of that part of humanity which is affected by our determinations. The more scientific they are, the better our determinations should be for the forensic sciences and humanity.

Attendee can know the extent of systemic and ocular findings in a group of injured children as well as the histories and investigations leading to the conclusion that the children were accidentally injured. Attendee can be aware that crush injuries of the head may be a subset of accidental trauma with more extensive ocular injuries.

Concerns are sometimes raised because infant and child deaths are attributed to abusive injuries when explanations of caretakers are not accepted as sufficient to cause death. The following is a review of 35 cases in which the explanations of the events leading to the fatal injuries were regarded as adequate. It was concluded that the children were accidentally injured.

A prospective ocular and systemic study of infants and children was undertaken at the Southwestern Institute of Forensic Sciences between 1981 and 1989. The study group included 169 infants and children. Death was attributed to accidental injuries in 35 of the children.

Most of the accident deaths were attributed to non-abusive head injury, 18 cases. Six children were unrestrained passengers involved in motor vehicle collisions. The heads of two of these six were partially out of the vehicles during rollovers. Four other children were run over by motor vehicles, two were ejected from the vehicles prior to being run over. The other two were upright pedestrians. Four children fell: one fell from a second story window to concrete, another from an unknown height to a conglomerate patio. Two others were standing, on a washing machine and a bed above concrete floors, and fell onto their heads. One was ejected from a motorcycle. One child was being carried on a bicycle by an adult who fell on top of her when the bike hit an obstacle. A child's stroller rolled downhill and collided with a wall; a respiratory tract infection contributed to that death. The eighteenth child suffered a gunshot wound of the head and the ipsilateral eye was examined.

Analyzing the pattern of autopsy findings by the mechanism of injuries allows the identification of a subset of children with crush injuries of the head. Crush injuries were defined by the presence of extensive skull fractures and head deformity. Five of the six passengers had such injuries including the two with heads out of the vehicles during rollovers. All four of the children who were run over by vehicles had crush injuries. None of the other nine children had such extensive head injuries ©© one of the passengers in a motor vehicle collision, the four children with falls, the child ejected from the motorcycle, the child on the bicycle, the child in the stroller, and the child with the gunshot wound.

However, only four of the children with crush injuries had ocular hemorrhages. Retinal hemorrhages were seen near the optic disk in one of the two children whose heads were partially out of the vehicle when it rolled. Impact was a significant component of the injury mechanism in this child. More extensive retinal hemorrhages were found in three children. The hemorrhages included the superficial retina under the internal limiting membrane and the macula in two children who were run over at relatively low speeds and one of the unrestrained back seat passengers. Impact probably contributed to the injuries in the two children who were run over. Impact was a more significant component of the injury mechanism in the back seat passenger.

Although extensive skull fractures and head deformity was not seen with falls, two of the four had retinal hemorrhages — the two who fell the greatest distance. One of these two had hemorrhages at the ora serrata and under the internal limiting membrane as well as the disk and macula. The other's retinal hemorrhage were limited to the optic disk and macula. Similar findings were seen in one of the unrestrained passengers. The child who was ejected from the motorcycle and the child who fell from the bicycle both had retinal hemorrhages limited to the optic disk. All of these children had significant impact components in the mechanisms of injury

The other seventeen accidental deaths were attributed to less traumatic but equally lethal injuries. Nine children had asphyxial deaths: four positional, three overlays, and two aspirations. Eight children drowned: three were unattended in bathtubs, two were in pools, and one each into a bucket, a creek, and a live birth into a commode. Not surprisingly, none of these children had ocular injuries, subdural hemorrhages, or skull fractures.

Conclusions: Thorough investigation of history and scene circumstances coupled with a complete autopsy including ocular examination will allow identification of patterns of accidental injury. In this group approximately half of the deaths (eighteen) were the result of head injuries. A subset of more severe head injuries with multiple fractures and deformity were seen in nine of the children involved in motor vehicle collisions as passengers and as pedestrians in this series. Retinal hemorrhages were found in four of these children. Impact as well as crush mechanism was involved in the injuries. Five of the other nine head injured children also had retinal hemorrhages and all of these had significant impact injuries. In this group impact injuries were a confounding variable.

Head and ocular injuries were not found in the other seventeen deaths in this series. The presence of such injuries would be inconsistent with the explanations of the traumatic mechanisms and would have required additional explanations before the deaths could be regarded as accidental.

Retinal Hemorrhages, Accidental Head Injury, Accidental Injury

G73 Meningitis Mimicking Inflicted Abusive Head Trauma

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After attending this presentation, attendees will be reminded to consider other etiologies for markers of inflicted abusive head trauma which may prevent misdiagnoses of shaken baby syndrome.

The main goal impact of this presentation is to prevent misdiagnoses of inflicted abusive head trauma and the resulting consequences.

The current consensus regarding the triad of retinal hemorrhages, cerebral edema, and subarachnoid or subdural hemorrhage in non-ambulating infants is that it is virtually pathognomonic for inflicted abusive head trauma (i.e., shaken baby/shaken-impact syndrome - SBS). This case illustrates that while these findings are highly sensitive for SBS they are not 100% specific.

The local forensic pathologists were contacted by the pediatric intensivist to evaluate an eight-week-old male infant under treatment in the hospital's intensive care unit. The child had been admitted to the unit two days prior. The history given by the mother was that the child had a rectal temperature of 104° F at home, for which she gave him an ice bath. She then took him to the local health clinic. He was noted at the clinic desk to be "acutely ill." The mother was instructed to immediately take the baby to the hospital emergency room. She complied. Upon admission to the hospital the infant had a rectal temperature of 100.2° F and a heart rate of 240 beats per minute. Very little additional information is documented regarding the initial physical exam. The HEENT exam record consists of, "flat anterior fontanelle and a clear nose." Medical treatment focused on evaluating and treating the baby's rapid heart rate, and the child was "pan-cultured." Approximately 12 hours after admission the child's anterior fontanelle was noted to be bulging. A neurosurgical consult and a CT scan of the head were ordered. These revealed, "diffuse bilateral retinal hemorrhage, cerebral edema, and possible subarachnoid hemorrhage." The diagnosis of SBS was made. Local law enforcement and child protective services personnel were notified. Based upon the clinical diagnosis, the infant's older sibling (15 months) was removed from the custody of his parents.

The consulting forensic pathologists requested the results of all microbiology cultures, with particular attention to the spinal fluid cultures. They were advised that no lumbar puncture or spinal fluid culture had been performed upon admission, or at any time during the hospitalization. The tracheal aspirate culture was positive for *Streptococcus pneumoniae*. Throughout the child's hospitalization the mother maintained her position that she had not harmed her child. Regarding events leading up to her child's hospitalization, the mother specifically described the baby as having fever, jumping-like movements, "eyes rolling up into the head," and the presence of a hard red lump on the infant's head. The story did not change upon repeated interviews. The infant was pronounced brain dead on the fourth hospital day, and life support was withdrawn. The body was transported to the morgue. A complete autopsy was performed approximately 18 hours after death.

The autopsy revealed no external evidence of injury. All markings were a result of therapeutic intervention. The internal examination of the torso and neck was also negative for injuries. Examination of the head revealed a markedly swollen brain with herniation, very scant subdural and subarachnoid hemorrhage, and very extensive bilateral retinal hemorrhages. The meninges were remarkable for multifocal dull gray-green discoloration. The dura and overlying scalp around the anterior fontanelle grossly exhibited thickening and discoloration, suggestive of granulation

tissue/inflammation. The middle ears were opened revealing a cloudy green exudate on the left. Based on these findings, the case appeared to represent undiagnosed bacterial meningitis. A more definitive diagnosis required microscopic examination of the brain, meninges, and retinas. The "red lump" reported by the mother was a calcifying cephalohematoma of parietal skull. This was attributed to birth-related trauma. Upon these initial findings, the police and child protective services were notified, and the older sibling was returned to parental custody.

Thorough microscopic examination revealed severe acute meningitis with necrosis of the small to medium sized meningeal blood vessels. The inflammatory process completely encased the optic nerves. Microthrombi were noted in the blood vessels of the optic nerves and retinas. Sections of the eyes showed bilateral diffuse intraretinal hemorrhage. No optic nerve sheath hemorrhages were noted. Swabs of the middle ear fluid were remarkable for acute inflammation and cocciform bacterial organisms consistent with *Streptococcus pneumoniae*. The cause of death was ultimately attributed to acute bacterial meningitis.

Review of the literature reveals numerous papers on retinal hemorrhages, all of which state that the most common cause of retinal hemorrhages in infants is inflicted head trauma, particularly shaken baby syndrome. However, most papers also state that other rare causes, such as infection and bleeding disorders, must be ruled out. Only one case report was found documenting retinal hemorrhages in the setting of bacterial meningitis and without suspected abuse. The hemorrhage in this report was focal, and the patient recovered.¹ The meningitis did not result in massive cerebral edema and death, as was seen in this case.

This case should serve to remind the forensic pathologist and the clinician of the importance of investigating other potential causes of the "markers" of shaken baby syndrome, regardless of how unlikely they may be. The presenter will discuss possible explanations for misdiagnosis and recommendations for evaluating similar cases.

¹ Fraser SG, Horgan SE. Retinal hemorrhage in meningitis. Eye 1995;9:659-60.

Retinal Hemorrhage, Shaken Baby Syndrome, Meningitis

G74 Fatal Hyponatremia, Cerebral Edema and Seizures Associated With Bilateral Peripheral Retinal Hemorrhages in a 20-Month-Old Child Following Hypotonic Fluid Administration for Dehydration: Case Report with Critical Appraisal of the Current Literature

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After attending this presentation, attendees will understand that, based on the lack of evidence base within the current medical literature, peripheral retinal hemorrhages cannot be regarded as specific for non-accidental head injury in children.

The importance of critically reviewing the medical literature before ascertaining that certain ocular findings are specific for non-accidental head injury.

A 20-month-old child was parenterally rehydrated with 0.2% normal saline in 5% dextrose in water for mild dehydration from gastroenteritis. He received more than 750 mL of the hypotonic fluid intravenously during a four-hour period. He became severely hyponatremic and developed diffuse cerebral edema and seizures. Numerous bilateral intra-retinal hemorrhages extending to the periphery were noted and considered worrisome for nonaccidental head injury (NAHI) or Shaken Baby Syndrome (SBS). A forensic autopsy confirmed the intracerebral and intraocular findings and subsequent investigation by the medical

examiner, child protective services and law enforcement uncovered no evidence of child abuse. Retinal hemorrhages have been reported in cases of hyponatremia, cerebral edema and seizures although the pathogenesis has been disputed. No previous reported cases of retinal hemorrhages in infants or young children who died following intravenous hypotonic fluid administration were found following an electronic database search, although two articles described infants with nonfatal oral water intoxication who had retinal hemorrhages. The proximate cause of these ocular findings has been disputed. In one case the peripheral retinal hemorrhages, cerebral edema and seizures with hyponatremia were presumably due to Shaken Baby Syndrome, although the history of oral water intoxication could explain the infant's low serum sodium, cerebral edema and seizures. Subsequently, a Letter to the Editor described another infant with hyponatremia and seizures with posterior retinal hemorrhages due to water intoxication. The authors concluded that the infant had not been abused and questioned published studies of retinal hemorrhages and seizures pointing out that infants with hyponatremic seizures rarely receive an ophthalmologic examination. The initial authors responded that the distinguishing feature between the cases was the location of the retinal hemorrhages. They stated that localized posterior retinal hemorrhages could be attributed to unintentional head trauma and increased intracranial pressure, whereas peripheral and multilayered retinal hemorrhages are more often associated with abusive head trauma. Therefore, the background question became: Are peripheral retinal hemorrhages diagnostic of NAHI when observed in infants and young children? Using the National Institutes of Health National Library of Medicine MEDLINE (1966- 2002) electronic database a search was done on reported childhood deaths due to the administration of hypotonic fluids and articles discussing peripheral retinal hemorrhages and child abuse. One case-controlled study that exhibited selection bias discussed peripheral retinal hemorrhages and NAHI in children but none of the children in this study died from hyponatremia associated cerebral edema secondary to hypotonic fluid administration. The remaining articles consisted of case reports, non-comparative case series and unsystematic review articles. Based on the lack of objective scientific evidence, peripheral retinal hemorrhages cannot be regarded as diagnostic for NAHI or SBS.

Peripheral Retinal Hemorrhages, Hyponatremia, Shaken Baby Syndrome

G75 Delayed Jejunal Rupture in a Three-Year-Old Child After Minor Blunt Impact

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After attending this presentation, attendees will understand role of history, scene information, autopsy, and histologic examination in differentiating ischemic from traumatic lesions of the small bowel. Be aware of an infrequent cause of traumatic death in children (delayed jejunal rupture). Review what is known and what is controversial about aging lesions by histology. Be cognizant of the pitfalls and controversies in establishing accident versus homicide as manner in similar cases.

This presentation will impact the forensic community and/or humanity by reviewing an unusual cause of traumatic death in children. Invite the forensic community to consider a difficult question of manner of death in this case and similar cases, using the tools of scene investigation, autopsy findings, histology, and attempted dating of traumatic intra-abdominal lesions by histology.

Histologic examination of tissue from the intestinal wall, to determine whether ischemia or impact is the primary cause of necrosis, may allow differentiation between accidental death and child abuse. A healthy three-year-old girl arrived at an emergency department with a report of head injury. The child described to nurses and investigators how she tripped and fell down three concrete stairs while running after a ball. No significant head injury was found, and no evidence of abuse was detected at that time. Three days later, the child complained of gradually increasing nausea and abdominal pain, and died suddenly. Autopsy revealed ischemic small bowel with perforation. Microscopic findings showed inflammation with both fresh and remote hemorrhage. Possible etiologies included three-day-old child abuse with blunt impact to abdomen, fresh child abuse with blunt impact to abdomen, and delayed jejunal rupture due to ischemia after minor blunt impact to abdomen. The characteristics of ischemic versus traumatic lesions are discussed. Controversies in determining aging of lesions are reviewed, along with the issues for the examining pathologist.

Delayed Jejunal Rupture, Histologic Dating of Lesions, Forensic Pathology

G76 Virulence Factors in Neisserial Meningococcemia

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Attendees will review new research into factors that make neisserial meningitis fatal for one person, while subclinical for another. Virulence factors include microbial adaptations, such as adhesive pili, lipopolysaccharides, and opacity proteins (Opa); host factors include toll-like receptors, cytokines, mannose-binding proteins, and immunoglobulin G receptors.

All of pathologists deal with the impact of cases of fulminant neisserial meningitis on communities, but rarely do is there an opportunity to review the science which lies behind the current understanding of what makes one victim die, while another survives. This "snapshot" overview of what is understood about the genetics behind host and microbe virulence factors will update the medical community, and will allow physicians to go on following the science as results continue to come in, and perhaps point the way for tests in the future on meningitis cases.

A 13-year-old boy underwent a rapid progression, over a period of hours, from normal health to septic shock and death, while family members remained healthy and free of disease. At autopsy, despite grossly clear meninges, evidence of Waterhouse-Friderichsen syndrome led to the suspicion of meningitis. Microbial culture determined the agent to be *Neisseria meningitidis*. This child's extreme susceptibility to the devastating effects of neisserial infection, while his family remained well, was likely due to the interplay of microbial virulence factors, with newly understood host factors. Newly understood microbial factors, recently described by functional genomics and microbiology research, include genes that play essential roles in the pathogenesis of meningococcemia. These are neisserial genes involved with quorum sensing, and with variation of surface antigens, such as adhesive pili, lipopolysaccharides, and opacity proteins (Opas). Regulation of expression of these genes is likely to underlie incomplete virulence among close patient contacts. However, the development of sepsis rather than an innocuous commensal relationship is not only a function of the microbe, but also of increased susceptibility of the host. A variety of gene products implicated in a diminished immune response to *Neisseria meningitidis*

include genetic polymorphisms in toll-like receptors, cytokines, mannose-binding proteins, and immunoglobulin G receptors on neutrophils, monocytes, and macrophages. This affords us an opportunity to review the recent research into the critical determinants of meningococcemia, from the aspect of both host and microbe.

Neisserial Meningitis, Virulence Factors, Host

G77 SARS, Monkeypox, West Nile, Dengue, and Plague: Pitfalls of Globalization

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After attending this presentation, attendees will explore the ramifications of political, social, and economic forces that impact mortality, morbidity, and public health issues. They will learn about the global mechanisms that foster aberrations in traditional biological and scientific relationships, and how to utilize the knowledge gained to create solutions.

Participants will consider the challenges and positive implications of unexpected phenomena. The development of new methodologies and technologies, and the applications of these unexpected experiences offer the potential for predictive modeling processes to expedite future valid solutions.

Forensic specialists and experts must be well grounded in factual elements. For truth to prevail forensic scientists must bring to light the crucial and all related ancillary facts. These must include the limitations of the science employed and the extent to which the opinions generated represent subjectivity, causality, and validity.

Over the past few decades and especially in the last few years changing patterns relating to human infectious diseases have emerged. For example, with the encroachment of human living environments especially in the western United States, into traditional animal habitats, the Hanta viruses have crossed over from being infections solely carried by the deer mouse, to ones infecting humans. Lyme disease (named in 1977) has emerged and has become embedded in a geographic distribution (the northeast, mid-Atlantic, upper north-central regions, and northwestern California) with progressive infection of humans manifesting an acute and/or chronic form of the disease. This is an infectious disease transmitted by an arthropod (the deer tick) and causes more than 16,000 cases in the United States each year. An effective vaccine has been developed and produced, but has been abandoned. In addition, the re-emergence of known but thought to be controlled infectious diseases such as Smallpox and Anthrax has occurred, including the potential use of these biological agents as weapons of terrorism. Smallpox vaccine exists in sufficient quantities to protect all 280 million United States citizens. Phase I of a stepwise program that would initially vaccinate 500,000 healthcare workers has been placed on hold. A program which protects most of the U.S. population would render the Smallpox virus ineffective as a terrorism weapon and truly be the application of prevention.

The Ebola virus has caused disease periodically since 1976 when it was initially recognized in Africa. It produces a severe, acute disease in humans and non-human primates with a high death rate. The origin and natural reservoir of the virus remains unknown but is suspected to be animal-borne (zoonotic). Death occurs due to a hemorrhagic fever. Dengue fever is caused by four closely related, but antigenically distinct virus serotypes. Infection with one of the serotypes does not render cross-protective immunity. However, until the late 20th century each of the serotypes remained primarily in its endemic region. The introduction of additional serotypes and mosquito vectors into various regions has resulted in the human population now being at risk for two or more Dengue infections. Dengue has emerged as a major public health problem in the region consisting of the Americas. In 1997 it was determined that the geographic distribution of the mosquito vector has pro-

gressively widened. Dengue is presently the most important mosquito-borne viral disease affecting humans, with a case-fatality rate of 5%.

A number of human diseases are spread by mosquito vectors. In addition to Dengue, Malaria, Yellow fever, West Nile virus, and filariasis are included. Some mosquitoes are great travelers. However, much depends on the facilities for travel. The mosquito is, in fact, a hardy and enterprising colonist, ready to exploit any and every chance. The advent of the airplane in the 20th century provided the mosquito, including disease-bearing members of its family, with the opportunity to spread to the far reaches of the world. If the mosquito cannot get there as an adult, it sends an egg or a larva as a substitute.

Though West Nile virus was first found in Uganda in 1937, its progression in the United States, identified first in New York in 1999, has generated great interest and concern. In that year only four states were affected, with 62 cases and seven deaths. By 2002, West Nile was present in 40 states, resulting in 4156 cases and 284 deaths. West Nile has proven to be extremely aggressive and versatile and can affect more than 130 species of birds, and is carried by at least 36 types of mosquitoes. No medical treatment or vaccine presently exists. The rapid expansion of this disease in only three years raises significant questions and serious problems to be evaluated.

This past year, 2002-2003, brought the emergence of SARS (Severe Acute Respiratory Syndrome) caused by a corona virus and spread human-to-human via droplet infection. The world outbreak began in Guangdong Province of mainland China in November 2002. The four month silence about the existence of the epidemic by the Chinese government until February 2003 played a significant role in the uncontrolled spread of the disease. Open communication and cooperation with healthcare entities like the World Health Organization (WHO) would have proven successful in alleviating the ensuing consequences. Healthcare workers played a significant role in the spread of SARS throughout the world, and closing healthcare facilities helped bring the epidemic under control. SARS infected 8439 people in 30 countries on five continents with a death rate of 10% (812 people). No vaccine or specific treatment presently exists. The disease has primarily been controlled by isolating patients and quarantining those in close contact with them. Re-training of hospital doctors and healthcare workers in infection control measures (proper use of gloves, masks, face shields, barrier techniques, strict isolation) was necessary because hospital workers were exposing others. SARS may prove to be a seasonal disease that returns in the winter each year. There is a need to develop predictive models in preparation for its return should a reservoir exist as many experts believe. The application of techniques like forensic patterns would be most helpful. No rapid laboratory identification testing presently exists to help in the early identification of SARS. All present approaches are focused primarily on response while they should be equally focused on prevention. The SARS epidemic, its rapid progression and world-wide public health and economic impact, provide a unique opportunity to use the SARS experiences in developing models for the control of future disease epidemics, and even terrorism planning.

Globalization, Predictive Models, Forensic Patterns

G78 Pure Group A Beta Streptococcal Peritonitis in a Child With Inflammatory Bowel Disease

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After attending this presentation, attendees will be able to discuss the rare phenomenon of pure Group A Beta Streptococcal peritonitis, and to describe the possible relationship between this death, previous colonic biopsy, and childhood inflammatory bowel disease. Current surgical practice regarding colonoscopic perforation will be described.

The forensic community will be more familiar with the rare occurrence of pure Beta Streptococcus peritonitis, and of current practice related to bowel perforation during colonoscopy.

A seven-year-old child with a history of ulcerative colitis presented to the emergency department with increased abdominal pain and collapsed, expiring after prolonged resuscitative efforts. He underwent colonoscopy with biopsy 4 days prior to death. Peritonitis was diagnosed in the Emergency Department, and microbiologic culture subsequently yielded a pure culture of Group A, Beta Hemolytic Streptococcus.

Autopsy revealed peritonitis resulting from a perforation of the descending colon. Diffuse erythematous skin discoloration, typical of streptococcal infection, was observed. Changes of ulcerative colitis extended from the midtransverse colon to the anocutaneous line. Original biopsy slides were reviewed and were shallow mucosal specimens, without full-thickness extension.

Pure Group A, Beta Streptococcal peritonitis has rarely been reported, and has been described only in cases of primary peritonitis. In streptococcal primary peritonitis, toxic shock syndrome often accompanies the abdominal findings. Adults who present with streptococcal primary peritonitis often have chronic ascites, nephrotic syndrome, or immunosuppression.

The incidence of perforation from diagnostic colonoscopy ranges from 0.2 to 0.8%. Non-operative management in cases of known perforation is acceptable in some circumstances.

Perforation occurs in less than 5% of cases of childhood ulcerative colitis. Colonic perforation in ulcerative colitis usually occurs in association with toxic megacolon or severe fulminant disease.

Beta Streptococcal Peritonitis

G79 Acute Dissection of the Left Subclavian Artery in a Patient With Ehlers-Danlos Syndrome

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After attending this presentation, attendees will have reviewed of pathogenesis, complications, and the methods for the diagnosis of EDS as a cause of sudden death.

The presentation will help one recognize this unusual cause of internal hemorrhage, and will emphasize the need for communication with families about the genetic implications of EDS.

This presentation consists of a case study of a female who died from complications of Ehlers-Danlos Syndrome Type IV and includes a discussion of the pathogenesis, complications and diagnostic workup of Ehlers-Danlos syndrome with emphasis on EDS Type IV, the vascular type.

EDS is a heterogeneous group of connective tissue disorders characterized by the inability to produce sufficient amounts of collagen or by a defect in the structure of collagen. At least 10 variants of EDS have variable modes of inheritance. This paper reviews the syndrome as a whole but will emphasize the vascular type, or EDS Type IV. Affected patients usually have hyperextensible skin and hypermobile joints, hence the designation "rubber man." Patients have a predisposition for joint dislocations and fragility of the skin and soft tissues. The most serious complications include rupture of a viscous, or vascular rupture or dissection. Death may result from internal hemorrhage. Diagnosis is based upon physical and laboratory examination of a living patient or autopsy findings. The specific collagen defect can be elucidated through electrophoresis of collagen products produced by a fibroblast culture of the patient's skin, soft tissue or organs. DNA molecular studies of the fibroblast culture pinpoint the gene locus mutation.

A 33-year-old white female was admitted in asystole to an emergency department after awaking suddenly during the night stating that

she "was passing out." Despite ACLS protocol she could not be resuscitated. She had been admitted to the hospital earlier that week with headache and gastrointestinal symptoms including nausea, vomiting and abdominal pain. Endoscopy revealed gastritis, chronic enteritis of the duodenum, and the colon grossly was significant for a small cluster of dark red polyps clinically suspicious for juvenile polyps or hamartoma. She was also found to have a microcytic hypochromic anemia. Treatment included red blood transfusion. Preliminary autopsy findings included thin, transparent skin of the trunk and extremities revealing the subcutaneous vasculature. Internal findings included unusual friability of vasculature, soft tissue, and viscera. The organs were extremely soft, and the skin tore upon restoration of the body after autopsy. The embalmers reported severe friability of the vasculature and difficulty in the embalming procedure. Grossly there was a dissection of the left subclavian artery with adventitial hemorrhage, which extended from its origin at the aorta to 10 cm distal in the upper arm. Significant sequelae included a left hemothorax of 1,050 ml and visceral pallor. Microscopic sections of the vessels revealed a dissection of the outer third of the muscle wall of the left subclavian artery and the left renal artery. Thrombus and rupture of the vascular wall involved the mesenteric arteries of the transverse colon with subsequent segmental early necrosis of the colon. Samples of lung, skin and kidney underwent fibroblast culture. Electrophoretic mobilities of collagen produced by cultured fibroblasts revealed diminished type III procollagen and intracellular storage of abnormal type III procollagen. cDNA responsible for encoding pro alpha 1 (III) chains of the type III procollagen was synthesized from RNA isolated from the patient's fibroblast culture. Normal cDNA and an abnormal cDNA that demonstrated a mutation of the gene COL3A1 were present. The mutation was a change in the second nucleotide of intron 14 (IVS14 + 2T>A). There was no family history of adverse vascular events. The final diagnosis in this case is left hemothorax due to dissection with rupture of the left subclavian artery due to Ehler's Danlos syndrome type IV.

Ehler's Danlos syndrome is an entity to be included in the differential diagnosis of sudden death in a patient with internal hemorrhage cause by spontaneous vascular rupture or dissection. The implications to the patient's family are serious, and genetic counseling follow up is required.

Ehlers-Danlos Syndrome, Arterial Dissection, Hemothorax

G80 A Case of Sudden Death in a 3-Year-Old Infant With Prader Willi Syndrome

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A case of sudden death of a 3-year-old infant affected by Prader Willi Syndrome is presented. The aim of the paper is to analyze the macro-microscopic findings in Prader Willi Syndrome and to focalize the forensic implication in sudden death cases.

To the best of our knowledge, this is a rare case of sudden cardiac death in infant with Prader Willi Syndrome. This datum is confirmed by means of histological study of cardiac tissues. It would be an important contribute to the scientific community for the diagnosis of the cause of death in Prader Willi Syndrome.

The Prader Willi Syndrome has a variable prevalence of 1:10000 – 25000.

The syndrome is a rare genetic disorder caused by a chromosomal aberration. Most common a deletion on chromosome 15q11-13 in the portion inherited from the father, less frequently the child has two chromosomes 15 from the mother and none from the father, rarely there is an

imprinting mutation on chromosome 15q11-q13. The Prader Willi Syndrome is characterized from a hypothalamic dysfunction that leads to hyperphagia and obesity and has secondary consequences of diabetes, heart disease, stroke and sleep apnea. It is also characterized by severe muscular hypotonia, short stature, cryptorchidism, learning disabilities, mental retardation.

We present a sudden death case in a 3 years old young male, affected by Prader Willi Syndrome diagnosed by means of DNA methylation. The infant was referred apparently unconsciousness by his mother to the Emergency Area. Pulse was absent, he was breathless and in fixed mydriasis. The cardiopulmonary resuscitation was unsuccessful. In the history, mother referred that her son suddenly collapsed while he was on bed.

The external examination was performed showing an uninhabited scrotum, a severe hypo tonic muscular body mass and an excessive accumulation of fat. At the post mortem examination the skull cup was uninjured, the brain was congested and edematous with convolutions reduced (microgyria) in correspondence of parietal and occipital lobes, but normal in size, volume and weight. It was fixed in formalin and later it was sectioned with coronal cuts according to the Pitres technique, showing hypoplasia of olive of medulla oblongata and haemorrhage on periventricular surface. Cervical and thoracic organs were removed "en block" according to the Ghon's technique, appeared edematous and congested but anatomically normal; tracheobronchial tree and lungs, were unremarkable except for white fluid in upper respiratory tract. Heart was fixed in formalin and a dissected according to "Four – Chamber" method was completed. Cardiac size was normal, with conical shape, the color of fresh subepicardial myocardium was reddish-brownish. Macroscopic study (cut in cross-section 3 mm intervals) of coronary arteries was unremarkable. Left ventricular thickness, measured 2 cm below mitral anulus, was cm 1; ventricular septum 1.2 cm; right ventricular thickness 0.4 cm. Histological cardiac findings were represented by spotty area of fibrosis; myocells showed eosinophilic cross-bands consisting of segments of hyper contracted or coagulated sarcomeres, to a total disruption of myofibrils and cells with granular aspect. In particular, the contraction band necrosis were variously distributed in multiple foci, formed by few myocells. Sarcomeres appear shorter than their normal length and this finding was associated with marked thickening of the Z-lines. Granular destruction of myofibrils were also associated with a paradiscal lesion (paradiscal contraction band) without rhesis of the myofibrillar apparatus. Adjacent normal myocells show a typical "wavy" disposition, possibly induced by the hyper contracted myocells. Myocardial fibers appear also stretched and broken. (A quantitative morphometric analysis has been conducted). In the lung mild pulmonary oedema was observed; a limited bronchial phlogistic infiltration, and large areas of atelectasia were also observed.

The histological findings lead to the definition of a cardiac death with a typical picture of contraction band necrosis (CBN). The cardiac findings should be judged sufficient to explain the cause of death. Pulmonary hypoxic alteration is frequently reported as primary cause of death in PWS cases. The chronic hypoxic stimuli should trigger a fatal cardiac arrhythmia, as demonstrated by typical myocardial damage (Contraction Band Necrosis).

In conclusion, this case contributes to a better definition of morphological findings in sudden death related to Prader Willi Syndrome.

Prader Willi Syndrome, Sudden Cardiac Death, Histological Findings

G81 Pediatric Asthma Mortality in the Cook County Medical Examiner's Office, 1 to 14 Years: 1998 - 2002

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After attending this presentation, attendees will understand trends and patterns of pediatric asthma death and how to diagnose pediatric asthma at an early age.

The management of pediatric asthma should take optimal treatment with current therapies and continued public education for available care. Asthma mortality can be reversed.

The purpose of this presentation is to provide pediatric asthma death data between 1 and 14 years of age in the Cook County Medical Examiner's cases. This report has the following goals: 1. To describe trends and patterns of pediatric asthma death. 2. To identify the prevalence of risk factors. 3. To understand how to diagnose of the condition in children younger than 5 years of age. We examined case records of the Cook County Medical Examiner's Office (CCMEO) over the five year period from January 1, 1998 through December 31, 2002. The number of deaths investigated by CCMEO between 1 to 14 years of age totaled 42 cases in the five year period. Twenty-two cases involved males and twenty involved females. Blacks were predominate in 79% (33/42) of the cases. The highest incident occurred at the age of 10. This report highlights pediatric asthma mortality in an early age. Three cases involved under 2 years of age. Asthma is a chronic inflammatory disease of the airways clinically characterized by recurrent episodes of wheezing, breathlessness, and chest tightness. It is associated with variable airflow limitation that is at least partly reversible, either spontaneously or with treatment. In recent years, the prevalence and severity of asthma is noted to be increasing. In the United States, current estimates indicate that the number of children with asthma has increased by about 100% in the past 20 years. Between 1980 and 1995, the number of U.S. children with asthma rose from 2.3 million to 5.5 million, and this rise now seems continuing. The number of deaths from asthma increased gradually during 1980 to 1995, from 2891 to 5637 in all ages and from 94 to 185 in ages 0 to 14. Although without certainty, data for 1996-1998 indicate that mortality rates are starting to plateau or decrease. Asthma is a worldwide problem. The prevalence of asthma in adults is between 5% and 10% in the industrialized countries, and about 10% of these patients have a severe disease that is not optimally treated with currently available therapies. One-third of asthmatics are pediatric asthma. Asthma runs in families and has heritability. The hallmark in its pathogenesis is the development of chronic airway inflammation leading to bronchial hyper-responsiveness and airway remodeling. Exposure to inhalant allergen results in inflammatory mediators. The principal effector cells are eosinophils, mast cells and others. Diagnosis of pediatric asthma relies on a combination of meticulous history and the objective evidence of airway liability.

Pediatric Asthma, Mortality, Diagnosis

G82 Fatal Accidental Intravascular Injection of Air in Infants

Angela R. Wetherton, MD and Tracey S. Corey, MD, Office of the Chief Medical Examiner, 810 Barret Avenue, Louisville, KY 40204*

After attending this presentation, attendees will have reviewed cases of fatal accidental intravascular injection of air in infants. The importance of a thorough scene investigation, review of medical records, and complete postmortem examination in sudden death will be highlighted – even those occurring in the hospital.

This presentation will remind the forensic pathologist to consider this type of event in sudden death of hospitalized infants.

Air embolism may be difficult to diagnose in any age group. A review of the literature indicates that air embolism in infants may occur as a complication of ventilator therapy in hyaline membrane disease, during neurosurgical procedures, and as a complication of nasal continuous positive airway pressure (CPAP). To our knowledge, there are no reported cases of fatal accidental intravascular injection of air in infants. We report three such cases.

Case 1: A 29-week estimated gestational age baby boy was admitted to the neonatal intensive care unit (NICU) with a diagnosis of prematurity. At eleven hours of age he suffered a cardiac arrest. A chest radiograph during the unsuccessful resuscitation effort was suggestive of intracardiac and portal air. The nurse stated that she had mistakenly injected 10 ml of air into the arterial line as she attempted to “clear” the nasogastric gavage tube. A postmortem examination revealed intracardiac and intravascular air.

Case 2: A 30-day-old, former premature infant boy was admitted for observation for difficulty breathing. Shortly after the placement of an IV line, he developed facial cyanosis followed by respiratory arrest and a full code, from which he could not be resuscitated. Postmortem examination revealed no cause of death. Following up on information obtained through unsolicited telephone calls to the OCME, additional historical information obtained via deposition indicated that the intravenous (IV) line tubing had not been flushed prior to initiating the IV line. An “air bubble” was subsequently noted in the tubing, and the tubing was flushed. Immediately after re-initiation of IV fluids through the flushed line, the baby decompensated and died. The autopsy findings, historical information, and temporal sequence of events were consistent with death arising from an air embolus introduced through the IV tubing.

Case 3: A 31 week gestational age infant boy was admitted to the NICU for prematurity. At 43 days of age, in a time sequence shortly after receiving a “routine” replacement transfusion of red blood cells and a scheduled gavage feeding, the baby suffered an acute decompensation, with bradycardia and abdominal distension. Chest radiographs performed during the code revealed massive intracardiac air. An autopsy provided no significant, potentially lethal, pathologic process. The clinical presentation, radiographic findings, and pathologic findings were consistent with an exogenous source of air being introduced into the vascular system. The exact source of the exogenous air has not been clearly elucidated to date.

Air embolism presents a diagnostic challenge in adults, and is even more difficult to diagnose in infants. A thorough review of case information including specific nursing activities around the time of decompensation may suggest air embolism as a possibility. Review of radiographs taken during resuscitation may document the air embolus. Extensive follow-up may elucidate possible sources of exogenous air. These cases highlight the importance of a thorough scene investigation, review of medical records, and complete postmortem examination in sudden death – even those occurring in the hospital.

Air Embolus, Infants, Accident

G83 Lucid Interval Revisited: Delayed Onset of Unconsciousness in an Impacted Child

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After attending this presentation, attendees will understand the timing of inflicted childhood head trauma, depending on the mechanisms, and clarification and definition of the term “lucid interval.”

The impact of the mechanisms of injury, interplay of the primary and secondary cerebral injury and age of the injured child on the timing of injuries.

The timing of injuries and existence of a lucid interval in non-accidental head trauma are among the most controversial issues in child abuse investigation. These issues are of paramount importance when it comes to prosecuting certain individuals who cared for the child. The current, widely held belief is that if the injured child becomes unresponsive while cared for by a certain individual then that particular caretaker must invariably be the perpetrator. This tenet, although recently challenged, is still being equally applied to impacted and “shaken baby” cases. In the present case report we discuss and correlate investigative information and court testimonies with autopsy findings in an impacted five-week-old infant. Our emphasis is on the importance of distinguishing different mechanisms of injury as well as the significance of primary and secondary cerebral injury, which have considerable impact on the clinical presentation and pathological findings in child abuse cases.

Non-Accidental Head Trauma, Craniocerebral Injuries, Subdural Hemorrhage

Pathology/ Biology

G1 Investigation of Infant Fatalities in Maryland (1990-1999)

Ling Li, MD, and David R. Fowler, MD, Office of The Chief Medical Examiner, State of Maryland, Baltimore, MD; Liang Liu, MD, Tongji, Medical University, Wuhan, China; and Mary G. Ripple, MD, Zoe Lambros, RN, JD, Havre de Grace, MD, and John E. Smialek, MD, Office of The Chief Medical Examiner, State of Maryland, Baltimore, MD*

The goals of this presentation are to learn the value of the infant death scene investigation and to identify certain epidemiological characteristics of Sudden Infant Death Syndrome (SIDS).

From 1990 to 1999, the Office of the Chief Medical Examiner (OCME) investigated a total of 1,510 sudden infant deaths. SIDS was the leading cause of death in this infant population (51%). Since 1994, the SIDS rate in Maryland has dropped significantly. However, the number of infants that died of accidental or non-accidental injuries remained consistent during the same time period.

Sleeping locations and positions of all the infants were documented in the investigations. A total of 342 infants were found sleeping in bed with an adult or adults (bed-sharing) at the time of death. Of the 342 bed-sharing infants, 265 (77%) died of SIDS, 45 (13%) died of natural diseases, and 11 (3%) died of asphyxia due to overlay. There were 21 bed-sharing infants whose cause and/or manner of death could not be determined. Of the 778 SIDS infants, 467 (61%) were found unresponsive on their stomach, 126 (16%) on their side, and 70 (9%) on their back. More than 38% SIDS infants who were placed to sleep on their side were found on their stomach. Since 1997, the proportion of prone sleeping SIDS has reduced from approximately average 60% prior to 1997 to only 25% in 1999.

During the past 10 years, 27 infants died of positional/compressional asphyxia due to unsafe sleeping environments, such as defective crib; defective side rails on crib/bed; mattresses that were too small for crib/bed, allowing space between mattress and the head or foot boards, or space between the mattress and the wall. All the situations allow the infants to slip down and become wedged. Eleven infants were suffocated by entanglement in bedding materials, such as plastic covers, quilts, blankets, and pillowcases. Since the risks for the accidental suffocation can be modified, it is very important for the investigators to carefully examine the scene and personally interview the individuals who were caring for the infant and who discovered the child. Such efforts could prevent potential dangerous sleeping environments and save lives.

This report focuses on the importance of infant death scene investigation in determination of the cause and manner of sudden infant deaths. Certain characteristics of SIDS victims are also presented.

Sudden Infant Death, Bed-sharing/Sleeping Position, Death Scene Investigation

G2 Sudden Infant Death Syndrome in North Carolina From 1999-2000: The Prevalence of Risk Factors and Its Relation to 2000 Census Data on a County by County Basis

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The goals of this presentation are to demonstrate the prevalence of risk factors for Sudden Infant Death Syndrome (SIDS) in North Carolina as related to type of sleeping surface, sleeping position, and co-sleeping and to show the relationship between the SIDS mortality rate per county and the 2000 census demographic data for each county.

Hypothesis: Reported risk factors for SIDS with regards to sleeping surface, sleeping position, and co-sleeping are highly prevalent in the population of SIDS deaths studied. Demographic data as presented in the 2000 census is significantly related to county SIDS mortality rates.

Methods: The North Carolina Office of the Chief Medical Examiner's autopsy and investigative records were retrospectively reviewed for all infants aged 0-1 years who died during 1999 and 2000 in which the cause of death was SIDS or undetermined. Demographic data with regards to age, sex, and county of death were tabulated. The place where the infant was sleeping, the infant's sleeping position, and the occurrence of co-sleeping were recorded when the data was available. The anatomic diagnoses on the autopsy reports were tabulated for all of the deaths. The 2000 census data for North Carolina counties was used to determine the number of 0-1 year old infants in each county so that population at risk for SIDS could be determined. State and county SIDS mortality rates for the population at risk were then calculated. The county death rates were then compared to county demographic data as reported by the 2000 census by a general linear model using a Poisson link function to see which data significantly correlated ($p < 0.05$). The demographic data that was analyzed for each county included: birth rate; death rate; ethnicity; household, family, and per capita income; families, children, and persons below poverty; families with children under 16 with both parents in the workforce; female labor force participation rate; completion of high school or bachelors degree; persons who lived outside the U.S. 5 years ago or were born outside the U.S.; wood as principal heating fuel; and lacking complete plumbing.

Results: The authors examined 238 deaths. Of these, 131 (55.0%) were male and 107 (45.0%) were female. The ethnicity of the infants was 117 (49.2%) white, 104 (43.7%) black, 13 (5.5%) Hispanic, and 4 (1.7%) other. The ages ranged from 3 – 338 days with an average of 100 days. The causes of death were reported as 190 (79.8%) SIDS, 22 (9.2%) asphyxia, 7 (2.9%) other, and 19 (8.0%) undetermined. The manner of death was determined to be natural in 197 (82.8%), accidental in 24 (10.1%), and undetermined in 17 (7.1%). Prior to their deaths, the infants were placed in the following locations: adult mattress 68 (28.6%), crib/bassinet 51 (21.4%), couch/sofa 22 (9.2%), water bed 3 (1.3%), chair 1 (0.4%), playpen 1 (0.4%), other 15 (6.3%), and unknown 77 (32.4%). The position that the infants were in when found was: prone 85 (35.6%), supine 36 (15.1%), side 12 (5.0%), other 2 (0.8%), and unknown 103 (43.3%). Co-sleeping was present in 105 cases (44.7%), absent in 75 (31.9%), and no data were available in 55 (23.4%). If co-sleeping did occur, the number of adults and/or siblings sleeping in

bed with the infant was 1 in 52 cases (49.5%), 2 in 48 cases (45.7%), and 3 in 4 cases (3.8%), and 5 in 1 case (1.0%). The mother was the most common person in bed with the infant as found in 89 cases (84.8%). Co-sleepers also included: the father in 48 (45.7%), siblings in 18 (17.1%), and others in 4 (3.8%).

Risk factors for SIDS have been reported elsewhere to include not sleeping in a crib, prone sleeping position, and co-sleeping. These risk factors were examined in the North Carolina infants by examining the 102 SIDS deaths in which data was available for all three. Of these 102, 67 (65.7%) were not in a crib, 63 (61.8%) were prone, and 48 (47.1%) were co-sleeping. However, 94 (92.2%) of these 102 had at least one of the three risk factors present (i.e., were prone or co-sleeping or not in a crib). Only 6 (5.9%) deaths were recorded for infants sleeping supine and alone in a crib. Only 2 (2.0%) deaths were noted for infants sleeping on their side and alone in a crib. Thus, the vast majority of SIDS deaths occurred in infants exposed to a known risk factor with regard to sleeping surface, position, or co-sleeping.

The following anatomic diagnoses were reported in the infant's autopsy reports: pulmonary congestion/edema/hemorrhage 107 (45.0%), mediastinal petechiae 102 (42.9%), pulmonary inflammation 22 (9.2%) (includes pneumonia, bronchitis, bronchiolitis, and interstitial inflammation), visceral congestion 22 (9.2%), heart malformations 17 (7.1%), liver pathology 13 (5.5%) (includes fatty change, hepatitis, and necrosis), acute/chronic tracheitis 9 (3.8%), neuropathology 7 (2.9%) (includes encephalopathy, edema, subdural hemorrhage, and gliosis), and aspiration 6 (2.5%).

The SIDS mortality rate in North Carolina was 1.0 deaths per 1000 infants per year; the rate for counties varied from 0 – 5.9 deaths per 1000 per year. The following county demographic factors were found to be significantly related to SIDS: death rate ($p=0.007$), percent of families with children under 16 with both parents in the workforce ($p=0.03$), and percent Native Americans ($p=0.05$); birth rate had a borderline significance ($p=0.07$). A general linear model with Poisson link function based on these 4 pieces of data explained 68% of the variance in the county SIDS mortality rate data. None of the other demographic data was found to be significantly related to county SIDS mortality rates.

Conclusions: This study has found that of the 238 SIDS deaths in the state of North Carolina during the years 1999 and 2000, 94 (92.2%) were exposed to a known risk factor (i.e., not sleeping in a crib, sleeping in the prone position, or co-sleeping). Only 6 (5.9%) deaths were reported for infants without a risk factor with regards to bed, position, or co-sleeping. The mortality rate for SIDS in North Carolina was 1.0 deaths per 1000 infants per year with county mortality rates that varied from 0 – 5.9 deaths per 1000 per year. The county SIDS mortality rate was significantly related to the following county demographic data as reported in the 2000 census: death rate ($p=0.007$), percent of families with children under 16 with both parents in the workforce ($p=0.03$), and percent Native Americans ($p=0.05$); birth rate had a borderline significance ($p=0.07$). The most common anatomic diagnoses found on postmortem exam of the infants were pulmonary congestion/edema/hemorrhage and mediastinal petechiae.

Sudden Infant Death Syndrome, North Carolina, 2000 Census

G3 Epidemiological Study of SIDS in an Apulian Population

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This work investigates the trend of sudden infant death syndrome (SIDS) in the period from 1970 to 1999, as shown in the case series documented by the Legal Medicine Section of the Department of Internal Medicine and Public Medicine (DIMIMP) of Bari University Hospital. The goal of the study was to assess whether the epidemiological data on SIDS have changed over time and how data compare with those in the literature.

In recent years the number of cases of SIDS seems to have dropped, but although this positive result can be attributed to the efforts of the scientific community in terms of the progress made in pediatric medicine and neonatal care, no etiopathogenetic hypotheses have yet been formulated that can individuate all the causes of the syndrome. In 1997 the death rate in the industrialized world ranged from 0.17 in Holland to 1.12 in Australia. Despite the low incidence of SIDS, it is a real social problem because no precise cause of the death can be referred. The parents and family are unable to accept the diagnosis of "unexplained" death of the infant and tend to impute responsibility to third parties, especially the doctors. The main difficulty in nosographic classification of SIDS is due to its peculiar diagnosis by exclusion, defined by Marie-Dapena and Marion Willinger as "Sudden death in infancy unexplained after review of the clinical history, examination of the circumstances of death and postmortem examination".

The present work analyses the records of autopsy of infants who died between 1970 and 1999, reviewed by the Legal Medicine Section. After excluding all cases in which the cause of death was identified (ascertained responsibility of medical staff, maltreatment, homicide, congenital anomalies, infectious diseases, etc.), a total of 63 cases of SIDS (31 M, 32 F) were found. In these, autopsy and histological examinations had not revealed any organ disease such as to cause death but only aspecific signs, that could have been correlated to the final outcome or were chance findings, such as: acute polyvisceral stasis (45%), pulmonary congestion (30%), petechiae at the level of the serosa (26%), pulmonary edema (25%), cerebral edema (20%), hypertrophy of the thymus (10%).

The distribution of the 63 cases of SIDS by calendar month showed that the highest number of deaths (43) occurred in the months of February, March, April, and December, although there was no significant relationship with seasonal affections of viral or influenza type. Distribution by age demonstrated that 51 deaths occurred in the first six months of life and only 12 from the sixth to the twelfth. Analysis of the national trend of infant mortality in the same period identified two different periods: from 1970–1980 the infant mortality rate in Italy ranged from 19 to 36.3% and 51 of the deaths in the authors' sample occurred, featuring peaks of 9 deaths in the years 1970 and 1973. From 1981 to 1999, instead, the infant mortality rate in Italy ranged from 7 to 18 and 12 SIDS occurred in this sample.

The population was therefore subdivided into 2 groups for statistical analysis: SIDS between 1970 and 1980, and SIDS between 1981 and 1999. The χ^2 test showed that there was no statistically significant difference in age distribution between the two groups ($p=0.43$; $\chi^2 10.08$), nor in distribution by calendar month ($p=0.76$; $\chi^2 6.25$). The results confirm the hypothesis that SIDS is a multifactorial affliction. They also confirm that study of this syndrome is conditioned by circumstantial factors, such as a progressive reduction of autopsy orders for suspected SIDS.

SIDS, Autopsy, Postmortem Examination

G4 A Five Year Retrospective Study of Unnatural Deaths in Children 12 Years and Younger in Singapore From 1997-2001

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The goals of this presentation are to identify the recent 5 year trend of unnatural deaths in children aged 12 years and below, in Singapore, so that greater awareness can be directed at preventing such deaths. The outcome is the identification of significant characteristics in the major subgroups of unnatural deaths.

The Death Investigation system in Singapore is a Coroner's system where all sudden unnatural and violent deaths are reportable to the Coroner. Annually, some 3300 Coroner's cases are reported and of which 2000-2200 cases are autopsied. All unnatural deaths are autopsied. The Centre of Forensic Medicine of the Health Sciences Authority carries out all forensic autopsies centrally for all of Singapore.

A previous study of accidents and poisoning in children in Singapore from 1979-1984 by the late Professor T.C. Chao revealed the three leading causes as road-traffic accidents (28.3%), drowning (26.75%), and falls/falls from height (25.10%). Since then, Singapore has undergone tremendous social and technological change. Economic development has seen Singapore moving into the ranks of developed countries. The population has also increased to 4 million with the influx of foreign talent.

Over the 5-year period of 1997-2001 under study, there were a total of 139 unnatural deaths in children aged 12 and below (average of 27.8 cases per year, or an incidence of 3.17 per 10,000 population). This marks a substantial fall in the absolute number of fatalities even when compared against the narrower scope of the previous study which covered only accidental deaths. Presently, the 4 leading manners of death are: Fall from Height (25.9%), Drowning (18.7%), Road Traffic Accidents (17.3%), and Homicide/Non-accidental Injuries (NAI) (13.7%). The age distribution is 40.3% (birth to 3 year olds), 20.1% (4 to 6 year olds), 13.7% (7 to 9 year olds), 25.9% (10 to 12 year olds). Overall gender Ratio is M: F 2.2 to 1.

Some Interesting Findings:

1. The vast majority of fall from Height took place at high-rise residential buildings. Of particular interest is the appearance of childhood suicides in this group.
2. The pattern of drownings has shifted from the younger age group to the older age group. Drowning is in the majority now occurring outdoors.
3. As for Road Traffic Accidents, childhood fatalities now accounted for 2.27% all RTA fatalities over the same period, the group being almost evenly divided between pedestrians and vehicular passengers.
4. The appearance of Homicides/NAI within the top 4 leading causes of unnatural deaths.
5. Asphyxia due to Foreign Body has largely disappeared.

The presentation will provide further study of the leading causes and compare the results of the previous study and the present one. It will also offer possible reasons to explain the differences.

Unnatural Childhood Deaths, Childhood Suicides, Accidental Deaths

G5 Bone Scintigraphy and Battered Children: Limit and Indication About a Case Report

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The goals of this presentation are to clarify the place of bone scintigraphy in the diagnosis of child abuse.

The diagnosis of battered child is difficult to make in certain cases. Because this diagnosis can have legal and administrative implications, a reliable diagnosis is crucial. A false-positive diagnosis of ill treatment could have as serious consequences as a false negative diagnosis. Bone scintigraphy may reveal some bone lesions which are undetected on standard radiography. Conversely, images on bone scintigraphy are not specific to non-accidental injury syndrome. The authors present the case of a young child who had an abnormal image on bone scintigraphy. Based exclusively upon these results, the pediatrician notified the authorities. The resulting inquiry revealed that the image was due to accidental muscular lesions and not to inflicted skeletal trauma.

Most traumatic injuries are identifiable by routine radiography which is highly sensitive, particularly in the detection of skull fractures and subtle metaphyseal injury. False negatives may occur however. The superior sensitivity of bone scintigraphy is most evident in the assessment of rib fractures, acute non-displaced long bone fractures, and subperiosteal hemorrhage. This exam also lacks specificity and should not be performed individually as it may lead to mistakes as in the presented case. In addition, bone scintigraphy is not ideal for certain body areas principally the cranium, and there is no broad consensus on indications for bone scintigraphy. Literature review indicates that certain authors suggest the use of radiological surveys before the age of 2, and after the age of 2 only perform bone scintigraphy. If images are noted on scintigraphy, examination is completed with focus radiography. Other authors suggest that both exams be carried out systematically, while still others suggest bone scintigraphy after the age of 1 with radiological survey or a scintigraphy recommended.

Faced with the absence of consensus, the authors have proposed a multicenter (5 hospital) study to clarify the role of radiographic skeletal survey versus scintigraphy in the diagnosis of child abuse. A concordance study is used between the diagnosis of child abuse based upon clinical features and skeletal survey either with clinical features or bone scintigraphy. Bone scintigraphy and radiographic skeletal surveys are performed on all children within the first 48 hours of hospitalization if possible based upon strict protocols which are followed in all centers. Independent examinations will be carried out and the findings correlated. Because the pediatrician and the medical examiner need precise diagnostic tools for the diagnosis of battered child syndrome, the final stage of the project is to quickly improve recognition of child abuse by reliable methods to limit the number of complementary examinations and irradiation.

Battered Children, Bone Scintigraphy, Skeletal Survey

G6 Fatal Capnocytophaga Infection Associated With Splenectomy

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The goal of this presentation is to correctly diagnose fatal sepsis due to Capnocytophaga in those at risk. This poster will address the source, site of colonization, and laboratory growth characteristics of Capnocytophaga. A clinical case study will be summarized.

Capnocytophaga can cause rapidly progressive sepsis leading to adult respiratory distress syndrome (ARDS), disseminated intravascular

coagulation(DIC), and death in splenectomized individuals. The forensic pathologist should be aware of the characteristic features and clinical presentations of *Capnocytophaga* infections in order to make this diagnosis.

This case study involves a 44-year-old male who was taken to the emergency room complaining of "not feeling well" for several days. On admission, he was hypotensive and febrile. He was placed on oxygen, but became progressively worse over a four-hour period. His X-Ray was clear on admission, but four hours later showed changes consistent with ARDS. The differential diagnoses included hantavirus, plague, and tularemia. A Wright stain of the peripheral blood smear revealed rod-shaped intracellular bacterial forms within polymorphonuclear cells. He developed DIC, and died. His medical history included a past motorcycle accident, which resulted in rib fractures, pleural adhesion, and a splenectomy for a lacerated spleen. Socially, he lived in a trailer and spent time outside collecting scrap metal to sell. He hunted squirrels and rabbits, and was recently given a German Shepherd puppy. Several cuts and scratches were observed on his forearms and hands.

Autopsy revealed congested lungs, weighing over 1000 grams each, bilateral pleural effusions, hemorrhagic skin lesions, lymphadenopathy, and status-post splenectomy. At the time of autopsy, cultures were obtained. The slow growing organism *Capnocytophaga* was considered in the differential diagnoses and chocolate agar cultures proved positive.

Canine *Capnocytophaga* is found in normal flora within the oral cavity of healthy dogs and cats. *C. canimorsus* and *C. cynodegmi* can cause localized wound infections and/or systemic infections in people who have been bitten, licked, scratched, or merely exposed to cats or dogs. The cuts and scratches on the decedent's arms may have been the exposure site for the zoonotic infection. Those at highest risk are generally individuals with an underlying disease or condition predisposing them to infection with this organism. Risk factors commonly include previous splenectomy and alcohol abusers, and less commonly chronic obstructive pulmonary disease, pulmonary fibrosis, Hodgkin's disease, hairy cell leukemia, Waldensrom's macroglobulinemia, malabsorption syndrome, renal disease, and steroid use (systemic or topical). Because the association with asplenia is frequent, it suggests that the reticuloendothelial system plays an important role in containing the infection. Illness can range from self-limited disease to severe infection characterized by DIC and death. Some of the major clinical features have included cellulitis, meningitis, fulminant bacteremia with septic shock, renal failure, hemorrhagic skin lesions reminiscent of menigococcal disease, pneumonitis with empyema, and bacterial endocarditis. The clinical picture can look identical to menigococcal disease with Waterhouse-Friderichsen syndrome, DIC, purpura fulminans, and symmetrical peripheral gangrene. *Capnocytophaga* has previously been misdiagnosed as plague.

The diagnosis of *Capnocytophaga* is made by culture. *Capnocytophaga* is a fastidious gram-negative bacillus that grows slowly on blood or chocolate agar, leaving a yellow pigment. Because it grows slowly and will not grow on MacConkey's agar, it is advisable to inform the lab that this diagnosis is being considered. *Capnocytophaga* has gliding motility, requires carbon dioxide under either anaerobic or aerobic conditions, and ferments glucose.

In summary, it is important for the forensic pathologist to be aware of *Capnocytophaga* as an organism resulting in overwhelming sepsis and death in splenectomized individuals. A thorough social, medical, and surgical history, clinical presentation, and cultures are important in making the diagnosis of *Capnocytophaga* infections.

Capnocytophaga, Sepsis, Zoonotic

G7 Look Until You See: An Unexpected Delayed Death Following a Motor Vehicle Accident

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By attending this presentation, the participant should expect to gain a renewed appreciation for the fact that small and seemingly unrelated phenomena can coalesce to produce a significant outcome. This poster has three objectives: to highlight the importance of a thorough review of all available resources from the events surrounding an accident and subsequent death; to reinforce the importance of approaching the complete autopsy without bias to avoid missing important details; and, to provide a brief review of the literature pertaining to splenic injury in motor vehicle accidents.

Although deaths due to motor vehicle accidents are commonplace in today's mobile society, this case report emphasizes several important points. Careful attention must be given to multiple aspects of an individual's life when conducting a medico-legal death investigation. Coupling information from the accident scene with the antemortem medical encounter and the medical history was essential, in conjunction with a complete autopsy, to arrive at an understanding of all the contributing factors in this initially surprising cause of death.

A 37-year-old white female sustained apparently minor injuries in a single vehicle accident in which she was the belted driver. At the emergency room of a rural hospital, she complained only of a headache and some lower back pain. The physical exam noted a frontal contusion and specified that the abdomen was soft and non-tender. All imaging studies obtained (plain film only) were negative, and the only significant lab test revealed thrombocytopenia. The patient was discharged home, reportedly feeling fine, at 2000 that evening. She woke up at around 0230 with nausea and vomiting but returned to bed with no further complaints. Her parents found her cold and without vital signs at 0630.

Postmortem external exam revealed the previously noted frontal contusion and a newly prominent periorbital ecchymosis. A few scattered contusions were also noted on the extremities. Notably absent were any abdominal contusions. The internal exam began with the unexpected discovery of free blood trickling from the abdominal cavity. The hemoperitoneum was significant, with slightly over 1000cc of free blood recovered from the abdomen. Further exploration of the organs *in situ* demonstrated a pale, nodular liver and a grossly enlarged spleen with a large subcapsular hematoma. Examination and dissection of the spleen revealed a rent in the capsule in addition to the Grade III laceration in the body of the organ. The exam of the head revealed a subgaleal hematoma but was negative for any deeper trauma including epidural, subdural, or subarachnoid bleeding and parenchymal contusions.

The deceased in this case was the unfortunate victim of synergistic activity between her disease processes and the injuries she sustained in the accident. The overtly cirrhotic liver was the result of her known history of chronic ethanolism and her questionable history of viral hepatitides. The cirrhosis, in its obviously advanced stage, had caused a significant degree of splenomegaly. This splenomegaly in turn was likely responsible for the thrombocytopenia indicated by the lab results at the emergency room.

The blunt injury to the abdomen sustained in this apparently minor car accident was sufficient, partly due to the massively engorged state of the spleen, to cause a Grade III splenic laceration. The injury to the parenchyma of the spleen continued to bleed into the subcapsular space. Because of the thrombocytopenia, likely caused by the hypersplenic state resulting from the cirrhosis, the victim was apparently unable to achieve sufficient hemostasis. The subcapsular hematoma continued to

expand and eventually ruptured the capsule, perhaps by simply extending an existing defect sustained in the initial impact injury. This resulted in the generous hemoperitoneum and subsequent death of the victim. The automobile accident in this case would have caused minor to moderate injury in an otherwise healthy person. However in this victim, the diseased organ systems in conjunction with the mechanism of injury resulted in the lethal outcome.

*The views expressed in this abstract are those of the authors and do not reflect the official policy or position of the Department of the Army, Department of Defense, or the U.S. Government.

Motor Vehicle Accident, Blunt Abdominal Trauma, Splenic Laceration

G8 Basketball-Related Sudden Deaths in Young Adults: A Medical Examiner Study

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The goal of this presentation is to examine the cause of sudden deaths in non-professional adult athletes playing basketball.

Twenty-three cases were reviewed of sudden cardiac death of young adults who were playing or had just stopped playing basketball at the time they expired. The time period of this study was four years, 1997 to 2000. All 23 cases underwent complete autopsy and toxicologic examination at the Office of the Chief Medical Examiner (OCME) for the State of Maryland. Of all the sports-related sudden deaths examined at this office during this time period, basketball was the sport associated with most sudden deaths. This particular type of exercise may be unusually stressful for certain people. This presentation will examine why, as well as look for the anatomic basis for the sudden deaths in this population of non-professional athletes who were relatively young adults and physically active. Of the 23 cases, all were male; the average age was 30 years. The authors found that most showed evidence of at least one significant heart condition, unknown prior to autopsy. The most frequent abnormality was atherosclerotic cardiovascular disease (almost one third of the cases). Less common findings included: congenital heart disease, left ventricular hypertrophy, right ventricular dysplasia, and myocardial scarring. Of note, several deaths occurred in those who were overweight; there also appeared to be an association between the amount of obesity and left ventricular hypertrophy observed in some.

In conclusion, in the authors' population of non-professional adult athletes dying of sudden death while playing basketball, the most common cause of death was atherosclerotic cardiovascular disease.

Sudden Death, Basketball, Autopsy

G9 The Significance of Tattoos in Forensic Autopsy

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The attendees will learn the profile of tattoos in forensic autopsies in Istanbul, Turkey, and the importance of tattoos.

The oldest tattoos have been found on Egyptian mummies with tattoos of various body parts reflecting the profession, life style, psychological state and habits of the tattooed in the past. In recent years, tattooing has become fashionable among youngsters and revision of the significance of tattooing may be required, though tattooing still remains

an important indicator of the particular peer group tendencies, life style, and personality traits.

In this study, the forensic autopsy records of the State Institute of Forensic Medicine, Ministry of Justice of Turkey were reviewed for 4 years (1998-2002) and those with tattoos were further evaluated. Data regarding the personal information, the cause and origin of death, tattoos, self destructive and figurative scars, and their locations and features were recorded in detail. The data were then analyzed and discussed within the scope of the literature.

Of the 10,966 forensic autopsies in that 4-year interval, 269 (2.4%) had tattoos. 10.4% were female and 89.6% were male. In both sexes, 25.3% were in the 21-25 year age group, 39.4% had self-destructive scars, and 1.8% had figurative scars. The frequencies of cause of death in descending order were as follow: 14.9% drug intoxication, 13.4% gunshot wounds, 13.4% stabbing, and 7% methanol intoxication.

Tattoos, Death, Turkey

G10 Epilepsy—A Major But Disregarded Health Problem

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Myocardial fibrosis might be the organic substrate for malignant arrhythmia in patients with epilepsy, which can lead to sudden death either due to natural causes or due to traffic accidents.

It seems to be the general opinion that epilepsy is of no risk to traffic and there is a tendency all over the world to be less restrictive to provide a driver's license to patients with epilepsy. A study from Denmark, the Accident analysis group, Odense, has shown that epileptics have a seven times increased risk to be involved in traffic accidents compared to controls.

Moreover, epidemiological studies have established sudden unexpected death (SUDEP) to be the most important cause of epilepsy-related death as a direct consequence of seizure activity. Postmortem reports have shown patchy subendocardial fibrosis in the otherwise normal hearts of these epileptic patients, although these findings are controversial. However, it is well known that such small areas of myocardial fibrosis may serve as a potential substrate for malignant arrhythmia causing sudden death.

The following two cases illustrate this issue and should encourage researchers and the public to focus on the problem.

A 33-year-old truck driver drove for no apparent reasons in low speed off the road and into a train wagon. The front of the truck was crashed and he was found wedged in behind the steering wheel. The cause of death was bleeding due to lesion of the left axillary artery. He was known to suffer from epilepsy since the age of 17, was seen at the neurological department twice a year, and was on antiepileptic treatment. He had earlier been disqualified from driving for one year due to a solo accident and later on for 3 month due to an epileptic fit.

An otherwise 23-year-old healthy woman with drug refractory epilepsy was found dead in her bed. The cause of death was an epileptic fit based on findings at the scene, autopsy, microscopy including neuropathological examination and toxicology. Especially, microscopy of the myocardium including the conduction system showed focal myocardial fibrosis of the endocardium located to the posterior papillary muscle.

Conclusion: focal myocardial fibrosis can be the organic substrate for malignant arrhythmia triggered by an epileptic seizure which cannot

be avoided by antiepileptic treatment and which has to be taken into consideration when authorizing an epileptic driver with a driver's license.

An ongoing not yet published prospective case-control study from the authors' group has shown epileptics to have focal myocardial fibrosis.

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Epilepsy, Myocardial Fibrosis, Traffic Accident

G11 Death at Dinner: Foreign Body Asphyxiation – An Unknown Cause of Death in the Elderly?

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Food asphyxiation is a common problem whenever and wherever people eat. Knowledge of predisposing factors might help to prevent asphyxial deaths.

The authors reviewed 42,745 consecutive autopsies done during an 18-year period (1984 to 2001) at the Institute of Forensic Medicine, Vienna. Demographic features and predisposing factors were determined for the 232/42,745 (0.5%) cases of fatal foreign body asphyxiation.

There was a predominance of men (134 men, 98 women); the overall male-to-female ratio was 1.4:1. 105/232 persons (44 males, 61 females) were aged 65 years or older. 69% of the fatal incidents occurred in private homes, about 15% in a restaurant. The remainder died in nursing institutions (9.5%), public areas (5%), or in hospitals (1.5%).

On 137/232 (59%) occasions observers were present at the time of the incident and subsequently called the Emergency Service. In 125 (91%) cases, neither the observing laymen nor the majority of the emergency medical technicians and physicians who would have been able to intervene recognized the definite diagnosis. Only 12 cases, most of all victims younger than 65 years, have been correctly identified during cardiopulmonary resuscitation. Misdiagnoses were cardiovascular failure (59%), intoxication from medication, drugs or alcohol (26%), and epileptic seizures (10%).

By medical history 21% were considered to be chronic drinkers. Blood alcohol concentration was determinate in all of the 232 cases. 44% of the victims were sober at the time of death. The other deceased (56%) had blood alcohol levels ranging from 0.05 % to 4.35 %. In another 39 (17%) corpses, findings from toxicological analysis were positive for sedative and/or hypnotic drugs.

Only 22 (9%) victims had intact dentition. 29% had partial or complete dentures, 25% were edentulous, and 37% had defective or partial dentition without dental prostheses at the time of death.

The food most often choked upon was either a segment of unchewed meat (48%) or a large piece of sausage (20%). A bolus consisting of bread, cheese, egg, cookies or pastries was found in 14%, while fruit or vegetables accounted for another 7%.

In 71% the obstructing foodstuff or other foreign objects were located in the supraglottic region or within the glottis itself, presumably in reach of fingers. In the other cases (29%) the bolus was lodged in the infraglottic area.

Concomitant with the advanced age groups is the problem of inadequate dentition. Whereas meat and sausages were the obstructing food in all cases of the people with intact or defective dentition - soft, friable, or loosely textured foods were found predominately in the edentulous, elderly victims. Future improvements in rescue techniques should take this into consideration.

Such fatal accidents could have been prevented easily. Effective prevention depends on understanding of the nature and frequency of the accidental asphyxial deaths, the facts that led to their occurrence, and a high degree of suspicion.

Foreign Body Asphyxiation, Elderly, Autopsy

G12 Death During EMS Transportation

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The goal of this presentation is to study the cause and manner of death and other important epidemiological data of those individuals who die in an ambulance car during EMS transportation.

Materials and Methods: Retrospective analysis was made of 1,001 ambulance reports and autopsy records of deaths during EMS transportation between 1996 and 2001. According to local regulations, everyone who passes away while being in an ambulance car, after a 911 call, should undergo forensic autopsy evaluation. Statistical calculations were done from many points of view.

Results and discussion: Averagely 62% of the deceased were male, 38% were female (average m/f ratio was 1.58, but it was 2.18 in accidental deaths, and 1.29 in suicides). Natural cause of death was listed in 81.2% of the males (out of this was 71% cardiovascular mortality). Breaking down to age categories, natural cause of death was present in only 19 % in the age group between 21-30 y. and it was in 94% in the older age group (over 71 years of age). In females, the natural cause of death represented 82.2% and out of this cases 78% were cardiovascular origin, with scatter similar to males.

Upon further investigation natural causes of death, particularly cardiovascular deaths (pre-hospital cardiac arrest), it was obvious, that the majority of these events happened at home. Analysis will be given on other scenes of occurrence in different age categories by gender. Pathologic condition of the hearts was analyzed, regarding weight of the heart (left ventricular hypertrophy), myocardium (recent and old myocardial infarction), coronary arteries (AS, plaque rupture, etc.) and pulmonary arteries. Also compared were the accuracy of diagnoses made by ambulance personnel and diagnoses made after forensic autopsy.

Accidental cause of death was listed in 10.3% of males and 7.5% of females, with somewhat different age distribution curves. Major injuries will be detailed and the usefulness of resuscitation on moribund trauma patients while being in an ambulance car.

Suicide cases died during transportation represented 3.7% of all male cases and 4.6% of all female cases. Important details will be provided on the methods of suicides most likely lead to fatal outcome in such a short transportation time.

Homicidal victims were only 4.8% of all transported male patients and 5.7% of all female patients. Again, the method of homicides and the associated serious injuries will be presented.

Data will be presented on what part of the transportation process during which the patient was declared dead (before leaving the scene, first or second part of the transportation, dead-on-arrival/DOA). Also an important factor determining survival is the ambulance response time, how fast the ambulance crew can reach the patient and how they can follow the chain-of-survival concept. These particular issues will also be discussed.

Death in Ambulance Car, EMS Transportation, Out-of-Hospital Cardiac Arrest

G13 Sudden Asphyxial Death Due to Regurgitation of a Pedunculated Esophageal Lipoma: A Case Report and Review of the Literature

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The goals of this paper are to present an unusual case of sudden death due to asphyxia by regurgitation of a pedunculated esophageal lipoma is presented, and a review of relevant literature is performed.

Of all esophageal neoplasms, 20% are benign. Benign esophageal tumors include leiomyomas, which are the most common, as well as fibromas, hemangiomas, and lipomas. Lipomas are extremely uncommon, representing approximately 4% of benign esophageal tumors. They usually present in the elderly and more commonly in men, although no other definitive risk factors have been identified. Most arise in the submucosa, and may be sessile or pedunculated. When pedunculated, the most common symptom is dysphagia, followed by a sense of fullness in the throat or respiratory symptoms such as wheezing or recurrent respiratory infections. However, the first sign may be regurgitation of a mass into the mouth following coughing, eructation or vomiting. In rare patients, the mass obstructs the oropharynx, leading to asphyxia. To date, less than ten asphyxial deaths due to regurgitation of a pedunculated esophageal tumor have been reported in the literature.

The authors present a case of a 44-year-old man with a history of seizures that suddenly collapsed after a witnessed seizure. Upon arrival at the emergency room, he was apneic. The anesthesiologist identified food and gum in the mouth, which were cleared, and a white mass was identified in the pharynx. When oral intubation was impossible, a tracheostomy was performed for airway control. Unfortunately, resuscitation efforts were unsuccessful and the patient was transferred to the medical examiner's office for examination.

At the time of autopsy, a pedunculated esophageal mass was present obstructing the oropharynx. The mass was consistent with a lipoma on gross and microscopic examination. Additional significant autopsy findings included two small cavitary lesions in the left temporal and occipital lobes of the brain, which were most likely responsible for his seizure disorder.

Although rare, pedunculated esophageal tumors are important entities to consider in patients with complaints of dysphagia or vague respiratory complaints, especially in otherwise healthy individuals. When undiagnosed, the presenting symptom may be sudden unexpected death as in this case.

Sudden Death, Asphyxia, Pedunculated Esophageal Lipoma

G14 First Report of Fatal Outcome by Accidental Intrathecal Injection of Vindesine

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The goal of this presentation is to describe the first case of fatal accidental intrathecal injection of vindesine.

Patients who are treated for cancer are exposed to risks including mistaken doses or routes of administration of toxic agents. The authors describe a case of the accidental intrathecal administration of vindesine which resulted in a fatal outcome. Pathologic findings of the central nervous system are reported and compared to the literature. Medical responsibility is also examined.

History: This 25-year-old woman had stage III non-Hodgkins lymphoma with clinical manifestations including asthenia. Lymphomatous cells were present in the cerebrospinal fluid (CSF), but neurologic function was reportedly good. Therapy included systemic vindesine and intrathecal administration of methotrexate and methylprednisolone. Vindesine, which should only be injected intravenously, was accidentally injected intrathecally. Prior to removal of the needle, a first washing of the CSF was performed. The woman was then transferred to the neurosurgical department to drain and wash the CSF. Her clinical course was slowly progressive over 6 weeks resulting in death. On the first week she suffered from leg pain with decrease in motor activity, and distal paresthesia and sensory loss occurred. On the second week, lower extremity paralysis occurred followed by upper extremity paralysis. Ascending sensory and motor dysfunction were observed. Her consciousness level began to decline and confusion progressed to lethargy. On the fourth week she was comatose and respiratory arrest occurred 2 weeks later; she died 6 weeks after the intrathecal injection of the vindesine. An autopsy was performed and included spinal cord examination by a pathologist.

Autopsy and Discussion: Autopsy was performed 2 days after death. The terminal event was pulmonary edema. Two fibrotic masses filling the upper mediastinum and infiltrated by lymphocytes were thought to represent residual tumor. The brain weighed 1250 g and was edematous. The microscopic findings in the spinal cord will be described.

Vindesine, a widely used anti-tumor agent, binds tightly to microtubules including mitotic spindle cell tubules and neurotubules. Experimental intrathecal administration of vincristine or vinblastine produces striking neuronal changes, creating vast aggregates of neurofilaments and crystalline masses possibly composed of neurotubules with the crystals appearing within 30 minutes of direct exposure but disappearing by 8 days. Neurotoxicity of vindesine has the same physiopathology. Some cases of accidental injection of vincristine have been reported. No case involving vindesine has been previously reported. The clinical, autopsy, and microscopic findings in this case are compared with others.

There is no recognized antidote to vindesine neurotoxicity leaving the clinician few therapeutic options. Immediate attempts to remove the toxin seem the most rational approach at present but limited experience in these cases indicates that piecemeal CSF drainage or exchange is not significant in preventing vindesine effects. In this new case, fatal ascending clinical progression could not be avoided.

Vindesine, Intrathecal, Death

G15 The Importance of an Interdisciplinary Review Process in the World Trade Center Mass Disaster Investigation

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Upon completion of this presentation, attendees will be informed about potential problems associated with the recovery and identification of human remains after a mass disaster and illustrate the value of cooperative effort between medical examiners, anthropologists, DNA specialists and other experts.

In the wake of the events of the September 11, 2001, terrorist attacks on the World Trade Center, the Office of Chief Medical Examiner, New York was faced with the daunting task of identifying the nearly 3000 victims of the attacks. For over 10 months, a constant and heavy flow of remains was delivered to the OCME with which the pathologists, anthropologists, DNA experts, dentists, investigators, and numerous other members of the OCME staff were forced to deal in a rapid fashion. During the triage process, in the interest of avoiding the potential complications of commingling the OCME pathologists and anthropologist were supposed to consider only those remains that were connected by tissue (bone, skin, muscle, etc) to be definitively the remains of a single individual and assign a single identifying case number. Due to the long shifts and large number of remains that needed to be processed this was not always the case as was discovered after the first identifications had been made and from commingled DNA results.

It could not be assumed, for example that the remains delivered in a single body bag were those of a single individual. Even remains delivered within clothing might not belong to a single individual given the number of factors that may have influenced their deposition especially later in the recovery process. Initially, during the triage process of sample collection, little effort was made to use traditional anthropological methods for sex, age, and ancestry determination. In addition, there was also a need for more detailed descriptions of the remains because victims' families were interested in receiving this information.

Hence, on May 28th, the Anthropology Verification Project was initiated. Without the same time constraints endured by the OCME pathologists, a team of anthropologists reopened each of the more than 19,000 logged in sets of remains to verify the existing descriptions and look for inconsistencies and commingling. During the verification process, the anthropologists encountered extreme levels of fragmentation, variable decomposition, varied stages of mummification and skeletonization, and the effects of prolonged exposure to fire, all of which complicate the effects of commingling. In addition to the verification of the existing file material, the anthropologists were also able to add detail to the descriptions with regard to skeletal tissue, which was often more easily recognizable than the soft tissue remains. These descriptions can be revisited in the event that DNA matches are made for individual remains. It can be insured for instance using DNA that there are no duplicated body parts sharing the same case number. Non-human remains recovered from the site were separated from the remains of victims of the attack.

DNA typing confirmed the value of this effort. All cases in which the Anthropology Verification Project decided to assign additional identifying numbers were retested and in each case at least one of the fragmented remains was determined to be from a second individual. This process not only eliminates wrong associations but might also allow for additional identifications that otherwise might have gone undetected.

Mass Disaster, Anthropological Review, DNA Typing

G16 Media Relations and the Identification of the September 11 Pentagon Terrorist Attack Victims: The Perspective of the Office of the Armed Forces Medical Examiner

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The goals of this presentation are to review challenges faced by the Armed Forces Medical Examiners in effectively responding to the international news media following the September 11 Pentagon terrorist attack; and to provide guidance to medical examiner offices when dealing with intensive media interest following mass fatality incidents.

The September 11 terrorist attack at the Pentagon posed new challenges to the Office of the Armed Forces Medical Examiner (OAFME) in responding to intensive, international media interest. This response included extensive message development coordination between OAFME's spokesperson and other Department of Defense officials; creation of a "virtual" Joint Information Center (JIC) to communicate findings; and detailed attention towards delivering the appropriate message on the status of identifications while remaining sensitive to the needs of the victims' families.

In the chaotic hours immediately following the attack, the OAFME spokesperson notified DoD public affairs officials of his availability to respond to media inquiries; provided 24-hour pager/home telephone information; and prepared background papers about OAFME's role in the investigation. This information proved essential in helping to refer media inquiries rapidly to OAFME for reply.

The spokesperson completed this preparatory phase with jurisdictional issues over custody of the remains still unresolved between OAFME and the Office of the Chief Medical Examiner of Virginia in the first 24 hours following the attack. Media inquiries began in earnest on September 12, when a reporter from The Washington Post called seeking an explanation and clarification of the situation. The resulting September 13 article ("Recovery Continues and Scientists Wait for Bodies") portrayed OAFME as prepared to act, but by that time the victim identification operation had commenced in Dover.

Communications with the media commenced in earnest two days after the attack. The JIC enabled OAFME to exchange information and coordinate appropriate responses with Dover AFB and DoD officials. U.S. Air Force casualty affairs officials held a short briefing when the remains arrived at the mortuary; however, OAFME officials did not participate, and at no point during the operation did OAFME conduct a press briefing. Instead, OAFME's spokesperson represented the chief medical examiner to the media and provided timely and accurate commentary over the next two weeks regarding the status of the operation. He referred journalists to former OAFME chiefs for expert analysis, and focused media attention on the work being conducted at the Armed Forces DNA Identification Laboratory (AFDIL).

Over the next two weeks approximately two dozen international print and electronic media representatives conducted interviews with the OAFME spokesperson or AFDIL staff, including CNN, National Public Radio, The News Hour with Jim Lehrer, the Associated Press and The Times of London. AFDIL staff also received positive coverage for their work providing DNA identifications of the United Airlines Flight 93 crash victims in Somerset County, Pa. DoD officials provided daily updates regarding the number of identified victims and the return of remains to family members.

From late September until early November 2001, media interest lessened and focused almost entirely on the identification and disposition of the terrorists' remains. At the close of the investigation in November 2001, OAFME's spokesperson participated in a joint DoD

planning session for release of information to the families. He also developed background papers for DoD officials on the complexity of the identification process and served as a contact point for questions from next-of-kin and interested media. DoD did not formally release information about the close of the investigation; however, The Washington Post on November 21 covered the story under the headline "Remains Unidentified for 5 Pentagon Victims; Bodies Were Too Badly Burned, Officials Say."

In conclusion, OAFME achieved generally positive and timely coverage for its work following the attacks. Multiple requests for information were handled simultaneously, and AFIP experts were utilized for comment as needed. Future OAFME communications following mass casualty incidents could benefit from the posting of background information on the AFIP website, and from an initial press briefing by OAFME personnel, subject to DoD guidance and approval. OAFME experience in this and other mass fatality incidents reflects the importance of appointing a single spokesperson, developing and releasing messages in a joint setting with other investigating agencies, and utilizing selected experts for public commentary as needed.

Armed Forces Medical Examiner, Media Relations, Pentagon 9-11 Identification

G17 Victim Identification Following the Crash of United Airlines Flight 93

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This presentation examines the overall victim identification forensic response to the crash of United Airlines Flight 93 on September 11, 2001. The various stages of the response will be examined, and the unique issues of this event will be discussed. Final figures on the methods of victim identification will be presented.

The last of the four terrorist attacks on September 11, 2001, was the crash of United Airlines Flight 93 (UA93). The Boeing 757, carrying 44 passengers and crew, was en route from Newark, New Jersey, to San Francisco when the plane was overtaken by four hijackers and turned back towards the Washington, DC, area. At about 10:10 am, the aircraft crashed into an abandoned strip mine near the town of Shanksville, PA. According to media accounts based on cell phone calls, several passengers attempted to take control of the cockpit shortly before the crash.

The Somerset County coroner and law enforcement and fire/rescue personnel were the first to the crash scene. It became evident to the coroner that outside support would be needed to help identify the remains. State volunteer response teams, including the Pennsylvania Dental ID Team (PADIT) and the Pennsylvania Funeral Director's Association, assisted the coroner in selecting and organizing a morgue site. The Federal Bureau of Investigation took control of the crash scene because of the criminal nature of the event. Initial confusion regarding the proper procedure of the deployment of the U.S. Department of Health and Human Service's Disaster Mortuary Operational Response Team (DMORT) delayed arrival of the team. Attempts to have the site declared a federal disaster through the state proved unsuccessful and the crash did not fall under the Aviation Disaster Family Assistance Act.

Ultimately, DMORT responded under a memorandum of understanding with the FBI. A team of nearly 60 DMORT members, comprised largely of the Region III team and augmented by members from other DMORT regions, was on site for two weeks. DMORT operation focused on victim identification and the family assistance center.

This response featured several firsts for DMORT, of note because of their importance for future responses. These included the first use of a contract morgue, the deployment of the DMORT DNA team, the establishment of protocols documenting the operation of each morgue section, the response of the DMORT Family Assistance Center team, the collection of family blood reference samples, and the inclusion of a formal remains triage station.

Typically, DMORT relies on the Portable Morgue Unit (DPMU) to supply and equip the team for victim identification operations. However, the DPMU was deployed to the World Trade Center disaster, so equipment and supplies for the UA93 response was pieced together from a variety of sources. A majority of the materials for the morgue were obtained under a contract with Kenyon International Services. Kenyon maintains a mobile morgue that is a scaled down version of the DPMU. Kenyon transported the mobile morgue to Somerset and provided staff for resupply and equipment purchasing. The local hospital and area funeral homes also provided morgue materials. Other pieces of specialized equipment were obtained elsewhere from local universities and hospitals.

This activation marked the first response of the DMORT DNA team. This three-person team (consisting of a team leader/pathologist, an anthropologist, and a dentist) provides reliability in the collection of DNA specimens. Because the Armed Forces DNA Identification Laboratory (AFDIL) conducts most of the DNA identification work during a DMORT response, the team was trained by AFDIL earlier in 2001. Initial assessments of the UA 93 crash scene revealed highly fragmented remains, indicating that DNA would play an important role in ensuring positive identifications. The delay in the DMORT response allowed the DMORT team commander to meet with AFDIL staff to address DNA requirements were met before starting the operation in Somerset. During the morgue operation, DMORT DNA team personnel worked closely with AFDIL staff during the collection of DNA samples.

The DMORT Family Assistance Center (FAC) team, who had completed training a few days before September 11, had their charter deployments in Somerset and New York. The UA 93 FAC team worked out of the Seven Springs Mountain resort (nearly 25 miles from the morgue site), the location of the family center selected by United Airlines. The FAC team worked closely with the airline, the Red Cross, and the National Transportation Safety Board to collect victim information. The national travel restrictions in the weeks following the crash posed some problems in obtaining records, and some families chose not to travel to the assistance center. To assist the FAC team, the U.S. Department of Health and Human Services deployed a Disaster Medical Assistance Team nurse to collect family blood and direct reference samples for DNA analysis.

Given some of the concerns involving the numbering and processing of fragmented remains at previous responses, a triage station was established. Staffed by a pathologist, two anthropologists, and a dentist, the triage team sorted through the remains, first separating personal effects from remains. Once the personal effects were transferred to the FBI, the remains were examined to ascertain their potential for identification. Potentially identifiable remains, those with dental remains, friction ridge patterns, unique characteristics, or potentially usable for DNA analysis, were assigned a sequential number, a file was created, and the specimen was sent through the morgue. Non-identifiable remains (small pieces of fatty tissue, burned tissues, and other small fragments that would be unsafe for DNA collection) were placed in containers, weighed daily, and stored separately from the numbered remains. The triage process helped to focus work on remains that would most likely lead to identification, eliminated unidentifiable remains from

the morgue flow, reduced unnecessary paperwork, and allowed the numbering process to remain simple and easily understandable.

The nature of the crash required creating written protocols for each morgue station. Team members at each morgue station submitted the protocol to the morgue manager, who then provided them to the FBI for review. These protocols were compiled, producing a document describing the particulars of the United 93 morgue operation.

The DMORT response concluded on September 25. The final numbers for victim identification indicate that DNA was the primary tool for identification. There were nearly 1500 fragments of human remains collected during the initial response and subsequent recoveries. Of these, 592 specimens were taken for DNA analysis, and 546 yielded profiles adequate for identification. From these remains, forty positive DNA identifications were completed, and four additional unique DNA profiles were isolated (probably representing the four terrorists). Fourteen positive identifications were made using traditional methods: five dental identifications, seven fingerprint identifications, and two using both dental and fingerprint methods.

Disaster Victim Identification, United Airlines Flight 93, DMORT

G18 Domestic Homicide or International Terrorism? A St. Louis Murder Crosses the Line

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This presentation will provide forensic investigators incite into the workings of an international terrorist group set up in the U.S., and it will provide some clues to exposing and identifying them.

This case was originally presented as a domestic homicide. The daughter of a Palestinian family in St. Louis, MO, was found stabbed to death in her family's home in November of 1989. Her father said that he had stabbed her to death in self-defense. The teenaged girl supposedly had just come home after her first day at work outside of the family's business in a wild state "on drugs." She allegedly demanded \$5000.00 from her father. When the father refused the request she supposedly grabbed a knife and attacked him with it. He said he somehow grappled with her and stabbed her in self-defense and she fell to the floor of their residence, unconscious. According to the father's story, he then got a better knife and finished his daughter off by stabbing her to death while she lay unconscious on the floor.

The father's story does not coincide with the autopsy findings. In addition the murder had been tape recorded by the FBI because that agency was tracking a terrorist cell at the residence where the killing took place. The FBI released some of the information on those tapes, which indicated that the girl's parents murdered their daughter with premeditation, to the St. Louis, MO, Office of the District Attorney to ensure the arrest of the suspects because it was known that the suspects were prepared to imminently flee the country.

What really happened was that the parents ambushed their daughter. The unwitting girl never attacked anyone. During a heated verbal argument with her father, the mother grabbed the girl from behind and held her while the father stabbed his daughter to death. This was all recorded on audiotape and transcribed into English and the transcripts were read into court during the ensuing murder trial. The parents were both found guilty of first degree murder and they were both sentenced to death. Because of evidence on the audiotapes, at the time of the trial it was thought that the girl's murder was a so-called "honor death" because she had shamed the family by dating a black man and working outside of the family's business. Subsequently, it was disclosed that the girl's father was being tracked by the U.S. Government because he was a member of the Abu Nidal international terrorist group. The father, Zein Isa, was to go on trial with other Abu Nidal members in the U.S. who

were subsequently found guilty of terrorism, but he did not go to the second trial because he was already on death row and he was seriously ill (he died of natural causes a few months later). After the second trial it became known that the female victim, 17-year-old Palestina Isa, was probably murdered not as an "honor death" but more probably because she knew too much about her father's terrorist activity and was likely to disclose this knowledge to others if she were allowed to leave the family and go out on her own.

As a result of the scene investigation of the homicide, together with the autopsy findings and the audiotapes of conversations leading up to the murder and of the murder itself, authorities and a St. Louis, MO, jury were able to come to the conclusion that this was actually a first degree murder punishable by death. In addition, the FBI was also able to establish that Zein Isa was a member of the Abu Nidal terrorist group and that the murder of his daughter may have been a terrorist act committed in the U.S. prior to 911 and prior to the WTC bombing in 1993.

This case required extraordinary good fortune to crack; 6 separate wiretaps recorded the murder so that justice could prevail in court. In the future experts will have to be more vigilant than in the past and will have to develop even better technologies to root out terrorists and protect the public.

Honor Death, Abu Nidal, Terrorism

G19 Smallpox and the Medical Examiner/Coroner System

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The goals of this presentation are to familiarize the medico-legal community with the possible pathological presentations of the initial cases in a smallpox epidemic because of the probability that, in the event of a bioterrorist induce outbreak, such cases will be seen by these first line death investigators.

Medico-legal death investigators are very likely to be the first professionals coming into contact with deaths from a bioterrorist caused smallpox outbreak and must be prepared for this eventuality. This is because (1) in a new eruption of this disease in a non-immune population initial fatal cases often have atypical presentations, and will probably not be definitively diagnosed, even if coming under a doctor's care, and (2) few clinical physicians have seen even suspected cases of smallpox. Pathologists performing official autopsies will and should be called upon to examine such cases and must be cognizant of the possible appearance of any lesions and what specimens are required to confirm the diagnosis.

The threat of a bioterrorist attack in the U.S. using smallpox is being taken quite seriously by all, in spite of no known source of infection outside of either U.S. or Russian control. Terrorists have already done the unthinkable within the borders of the U.S. It is not impossible for bioterrorists to obtain smallpox virus from known or some unknown source. If smallpox were to be released into this country, a number of facts need to be considered by medical examiners who have a high probability of seeing the first undiagnosed cases.

- The probability of a medical examiner seeing these cases depends upon the particular state medical examiner law and the customary reporting procedures in the various jurisdictions. The laws governing public health hazard medical examiner jurisdiction and the customs in places without such statutes will be examined.

- Even without public health hazard jurisdiction, bioterrorist-caused deaths are a type of homicide and should be investigated and certified by the official medico-legal death investigation system. Medical examiners are fully aware of the legally necessary procedures, such as chain of custody in handling specimens that must be followed to support a

criminal prosecution. How this may play out in an international terrorist attack within the U.S. will be discussed.

- This presentation will show what to look for in possible smallpox cases early in a bioterrorist attack. This is important because the first mortal cases will contain a high proportion of victims with atypical disease. Most of us, particularly those who received their medical training after the supposed eradication of smallpox in the early 1970's, received a superficial instruction in the clinical and pathological appearance of the disease. It is time for a knowledge booster.

- It must also be recognized that the civilian population in the U.S. has not been vaccinated against smallpox since 1972. This means that medical examiners do not have immunity to smallpox since vaccination is not effective after about 20 years! Unless there has been a policy shift to vaccinate medical examiners and pathologists performing medical legal autopsies before this presentation, a bioterrorist attack with smallpox is likely to cause casualties within the profession. It is also time for a smallpox immunity booster.

Smallpox, Medical Examiners, Bioterrorism

G20 Autopsy Procedure and Findings in a Case of Inhalational Anthrax

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The goal of this paper is to present to the forensic community the autopsy procedures and findings in a case of inhalational anthrax so that the attendee can learn how to approach and what to expect in this type of case.

In the fall of 2001, there were eleven confirmed or suspected cases of inhalational anthrax of which 5 people died. Prior to the anthrax attacks in 2001, autopsy experience with inhalational anthrax was limited. Reporting the autopsy procedure and findings will make forensic pathologists aware of the precautions that need to be taken and of what to look for at autopsy in this hopefully rare type of case.

By report, this 47-year-old, Black male was an employee of the Brentwood postal facility in Washington, DC. He complained of "flu like" symptoms with a mild non-productive cough, sneezing, nausea, vomiting, and stomach cramps on October 16, 2001. While attending church on October 20 he had a brief self-limited syncopal episode and did not request transport to the hospital. Early the next day he went to the emergency room complaining of vomiting and profuse sweating. He was afebrile and had orthostatic hypotension and was treated with intravenous hydration and was released. Later that day he complained of myalgia, vomited and passed out again. Early in the morning of October 22 his wife found him unresponsive. On arrival to the emergency room he was afebrile, hypotensive, tachycardic and tachypnic. He required intubation and was treated with multiple intravenous antibiotics. Computerized tomography scans were remarkable for pleural effusions, perihilar infiltrates, probable mediastinitis, small bowel wall edema with small bowel air, portal venous air, and ascites. He had a progressively downhill course and was pronounced dead within six hours after arrival to the hospital. Gram stain of sputum and the buffy coat smear of the blood identified gram positive bacilli and direct fluorescent antibody test (dFA) and polymerase chain reaction performed by the Centers for Disease Control and Prevention (CDC) were positive for *Bacillus anthracis* on antemortem blood specimens. In addition, antemortem blood cultures grew *Bacillus anthracis* within 18 hours.

An autopsy, based on CDC recommendations that minimized the number and extent of procedures, was performed on October 22, 2001, using standard universal precautions in the isolation room at the OCME. It is recommended that the CDC be contacted prior to performing the autopsy for their suggestions and also to inquire about what type of

specimens that they will require for future analysis. Three forensic pathologists and an autopsy assistant performed the autopsy. Since the organisms that one is dealing with at autopsy are vegetative bacteria and not spores, the primary, but minimal risks to personnel are through splashes to mucous membranes and skin injury. Therefore, the eyes, nose, mouth and any prior open skin defects must be covered and protection against cuts and puncture wounds is necessary. As the body warms up and is exposed to air, it is unclear if and when the bacilli can sporulate, therefore gross contamination of the environment that could eventually lead to spore formation should be limited.

Gross autopsy findings showed marked soft tissue edema, pleural effusions, ascites, multifocal mediastinal and mesenteric soft tissue hemorrhage with extension along the hilar and pulmonary parenchymal bronchi and blood vessels, mild pulmonary hilar lymphadenopathy, friable and hemorrhagic hilar lymph nodes, no gross pulmonary consolidation, and a portion of hemorrhagic distal small bowel without mucosal ulceration. The mesenteric lymph nodes, terminal ileum, and large bowel were unremarkable. The brain and cerebrospinal fluid were not examined. Microscopic examination revealed hemorrhagic necrotizing hilar lymphadenitis, mediastinal soft tissue hemorrhage with mildly increased acute and chronic inflammation, pulmonary perivascular and peribronchial hemorrhage, no evidence of pneumonia, and a section of small bowel with necrotizing infection extending from the periintestinal soft tissue to the lamina propria and not involving the mucosa. Brown and Brenn special stains showed gram positive rods consistent with *Bacillus anthracis* in the hilar lymph nodes, mediastinal soft tissue, lungs, affected small bowel, stomach, liver, kidneys, adrenals, and spleen. Postmortem blood culture for *Bacillus anthracis* was negative.

Post autopsy, the isolation room, all instruments, body tray, and outer body bag were washed with at least 10% bleach with at least five minutes of contact time. The body was triple bagged, placed in the freezer, and subsequently transported to the funeral home with the recommendation that mortuarial care be limited to only what is necessary which included the avoidance of embalming and the consideration of cremation.

Investigation and autopsy determined that the cause of death was inhalational anthrax and the manner of death was homicide. The diffuse presence of gram positive bacilli in almost every organ indicates *Bacillus anthracis* sepsis. This report suggests an anthrax autopsy protocol and presents the autopsy findings. It emphasizes the relatively non-specific gross autopsy findings and the importance of clinical information, mutual cooperation with the CDC, and microscopic special studies that are required to make the proper determination as to the cause of death in this relatively rare type of case. In addition, it reinforces the fact that medical examiners play an important role in public health surveillance.

Anthrax, Bioterrorism, Necrotizing Lymphadenitis

G21 Discrepancy Between the Legal and Medical Definitions of Homicide

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The goals of this presentation are to compare the manner of death as certified by a medical examiner (ME) on a death certificate to a district attorney (DA) charging decision and final disposition of the case in the court system; and to measure the frequency of and identify factors

contributing to any disparity in classification of homicide by medical examiners and prosecutors.

Hypothesis: Medical examiners and district attorneys have differing responsibilities and interests in processing homicidal deaths, which results in disparity between the medical examiner classification as homicide, and the legal definition for the purpose of criminal justice.

Methods: All cases certified by the Milwaukee County Medical Examiner's Office as homicide; accidental motor vehicle deaths and accidental firearm deaths from 1990 through 1999 were matched to cases presented to the homicide unit of Milwaukee County District Attorney's office from October 14, 1991 through 1999.

Results: Of the 1247 cases certified as homicide by the ME, 766 were matched to the corresponding DA homicide cases. Approximately 40% of cases were not matched. Factors influencing successful matching included apprehension of perpetrator(s) and prosecution in adult court. In a sample of 67 homicide cases reviewed but not charged by the DA's office, almost half (47%) were determined to be self-defense, 26% insufficient evidence, 11% no defendant or death of the defendant, 3% accidental shooting, and 13% other.

Conclusions: There is significant variation in how medical and legal practitioners define "homicide." This variation results from the different goals of the practitioners as expressed in levels of intentionality and differing burdens of proof (reasonable medical certainty vs. beyond a reasonable doubt) that contribute to variations in definition of homicide. The effect of such variation requires additional research.

Homicide, District Attorney, Medical Examiner

G22 Rape/Sadistic-Homicide vs. Accidental Death During Voluntary Violent Sexual Activity: Three Case Reports Illustrating Difficulties in Assessing the Circumstances of the Deaths

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Three case-reports are presented to illustrate difficulties in assessing whether violent sexual activity has been forced or consensual. Didactic figures are displayed to illustrate various features in violent sexual intercourse and instrumental penetration.

In investigating a suspicious death, where there is evidence of sexual intercourse, the forensic pathologist has not only to determine the cause and manner of death, but also to answer the question of whether sexual intercourse was forced. The three following case-reports illustrate difficulties in assessing whether violent sexual activity has been forced or consensual.

Case 1. A 56-year-old woman was found dead in her bed, in the morning, by her husband. According to him, they had sex in the evening and fell asleep. The autopsy showed multiple hematomas on breasts, arms, hands, legs, shoulders, and head, as well as severe damage to the perineum, vagina and rectum. The anal margin had hematomas. There were large tearings of the rectal wall and perirectal muscles, of the vagina with complete prolapse of the cervix through the vulva. The victim was found with 3.68 g/l of alcohol in her blood. Death was assessed to have been caused by massive hemorrhage. Rectal and vaginal lesions were assessed to have been caused by a fist or a foreign object. The man confessed that he had beaten his wife and forcibly penetrated her with his fist while her consciousness was impaired by alcohol.

Case 2. A 22-year-old woman was found dead in her home, in her bathtub. Her boyfriend reported that she fainted during sexual intercourse. He said he carried her to the bathroom, put her in the bathtub,

and showered her with water, but she had fatal cardiac arrest. The autopsy showed evidence of asphyxia. There were hematomas in the perineum, the vagina and rectum, and large tearings of the vaginal wall. Toxicology was negative. The man confessed that they had sadomasochistic sexual activity, including fist penetration and strangulation with a dog's leash, when she fainted.

Case 3. A 40-year-old woman was found dead in her bed, by her husband. According to him, they had sex in the evening and fell asleep. At autopsy there were hemorrhages around the right carotid artery and infiltrating the right neck muscles. Lungs were found emphysematous. The anal margin was dilated with congestion of the mucosa, but there were no tearings. Histologically, hemorrhage was found in the rectal submucosa. The victim was found with 1.94 g/l of alcohol and 2.18 microg/l of Zolpidem (toxic level > 0.15) in her blood. There was no sperm. The cause of the death was assessed to have been mechanical asphyxia following neck compression. The rectal lesions were assessed to have been caused by a fist. Alcohol and Zolpidem contributed to the death.

In conclusion, severe lesions to the sexual organs are not always synonymous of sadistic/rape homicide. Thorough examination of the death scene, complete autopsy, histology and toxicology are necessary in assessing the cause and manner of death, and determining the circumstances of the sexual activity, whether voluntary or forced.

Rape, Sado-Masochism, Forensic Sciences

G23 Postmortem Genital Examinations and Evidentiary Protocol With Colposcopy

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This paper proposes to describe a sequential methodology and evidentiary protocol for the postmortem genital examination of sexual homicide victims. To this end, salient findings from baseline studies of postmortem genital anatomy, and the effects of postmortem changes, will be discussed.

A methodology for the genital exam of homicide victims by forensic nurse examiners to assist in the determination of concomitant sexual assault was first described in 1998 (Crowley, AAFS). This earlier protocol has been further defined during ongoing accumulation of baseline studies of genital anatomy and the nature of the anogenital tissues in the postmortem interval. This clinical research is done in collaboration with Brian Peterson, M.D., of Forensic Medical Group, Fairfield, CA. Further study will compare this baseline group with cases that present with genital trauma. Study of the nature and patterns of injuries found in sexual homicide victims will allow comparisons to those types of injuries previously noted in living victims of sexual assault. The use of colposcopy is well established as a component of the medical legal exam of living victims of both adult and child sexual assault. Patterns of injury have been described and findings compared to a control group of women who engaged in consensual sex (Slaughter, Brown, Crowley, and Peck, 1997).

Examination solely via gross visualization yields a paucity of genital trauma (10-30%) in living rape victims. Similarly, during the autopsy, gross visualization alone may preclude the more subtle findings of genital trauma that usually constitute injury in sexual assault. The use of colposcopy for the evaluation of postmortem cases by this author has demonstrated its usefulness and efficacy as an adjunct to the examination. The colposcope affords magnification at different settings, photographic capability via standard 35mm SLR or digital imaging, and if desired, video capacity. Photocolposcopy provides a mechanism for photodocumentation; this increases reliability and facilitates peer review. Higher magnifications afforded by the colposcope (e.g., 15X)

allow careful study of the effects of the postmortem interval and other variables on the genital tissue. Other equipment used in the postmortem genital examination in addition to the colposcope, include camera(s), various lenses, various sizes of vaginal speculums, anoscopes, Wood's Lamp +/or Alternate Light Source, sandbags, and disinfectant.

Materials and Methods: 28 postmortem patients (25 females; 3 males) were evaluated using a protocol that included colposcopy. Causes of death included suicide, accidental, and natural. All cases were examined with the mobile system of technology described by Crowley (AAFS, 2001). The postmortem interval varied from <24 hours (fresh) to 1 month (decomposed). Ages ranged from 32 months to 90 years old. Photographs were available for review on 18 of these cases, all females. Ages in this group ranged from 32 months to 89 years old, with a mean age of 47.9 years. Two of the 18 (11%) were pre-pubertal. Seven were in their 20s-40s (39%), and 9 (50%) were ≥ 50 years old. Two of the 18 were photographed only with macrophotography. Sixteen were photographed with colposcopy, at a fixed magnification rate of 7.5X, 15X, or both. In some cases, 35mm photographs were available for comparison to the colposcopic photos. Cases were assigned an ID number and entered into a modified version of the Sexual Homicide Database. Salient data include age, ethnicity/race, date/time body found, date/time of examination, cause of death, past medical history, reproductive status, and exam techniques. Eleven anatomic sites were evaluated on female cases: labia majora, labia minora, posterior fourchette, fossa navicularis, perineum, hymen, peri-urethral area, vagina, cervix, anus, and rectum. The genital findings were categorized by a system developed by Crowley and Peterson, to describe the nature of any postmortem changes to the anogenital tissues.

The Sexual Homicide Evidentiary Protocol is a sequential methodology for conducting the postmortem genital evaluation of the suspected victim of a sexual homicide. Specific features will vary by state/local jurisdiction. Prior to the actual autopsy, it is advisable to clarify individual roles and responsibilities in areas of potential overlap. If possible, conduct the genital examination and collect anogenital specimens prior to the general autopsy. This may be done after the medical examiner has conducted a preliminary overview of the body and noted gross features, such as clothing. This will allow prompt collection of biological evidence and avoid obscuring the genital area by leakage of body fluids through the vaginal opening. Salient features of the protocol include:

- Review of available data and historical information; much information may be missing at the time of the autopsy.
- General physical examination and general description of nongenital trauma.
 - a. Head/oral: items for Sexual Assault Evidence Kit and photographs, as appropriate.
 - b. Scan of body with Wood's Lamp and/or Alternate Light Source
 - c. Bite mark evaluation: documented on traumagram, in a manner consistent with ABFO guidelines, i.e., location, shape, color, size, type of injury
 - d. General description of nongenital trauma. Note "Defer to Medical Examiner's Report."
- Sexual Assault Evidence Kit and Clothing: integrated into general and anogenital examination, to ensure consistency and completeness.
- Genital/Anal Examination: includes collection of foreign matter/debris, pubic hair combings, evidentiary swabs/slides, reference standards, and lab. After patient has been positioned for genital examination, as many sites as possible should initially be evaluated using gross visualization.
- **Colposcopic** examination: Use labial separation and/or labial traction to visualize and photograph the following anatomic sites: **labia majora, posterior fourchette, labia minora, hymen, fossa navicularis, perineum, and peri-urethral** area. Inspect all aspects of the hymenal borders. Insert vaginal speculum; inspect

and photograph the **vagina** and **cervix**. Use the colposcope to visualize & photograph the perianal area, including the anal verge and anal folds. Insert an anoscope into the **anus** to inspect the **rectum**; collect rectal forensic swabs and make appropriate slides. For the male, the following sites should be evaluated: penis (glans, foreskin, shaft), urethra, scrotum, anus, and rectum. Adjuncts used to augment the examination should be documented. These include a 1% aqueous solution of **Toluidine Blue Dye** and balloon-covered swabs. Positive dye results show up as deep, linear staining in areas of denuded tissue. Both techniques should be done after collection of evidentiary samples.

The dye should not be applied to mucosal surfaces.

- **Specimen** packaging, storage, and chain of custody: Properly code and package all swabs, slides, and specimens. Employ measures to ensure that there is no cross-contamination of specimens.
- **Documentation** of the examination includes medical-legal forms, photodocumentation, narrative reports, summary of findings, and a discussion of the nature and pattern of genital findings. Documentation may require modification of existing medical-legal forms. Conventional terminology, i.e., blunt vs. sharp trauma, should be incorporated into the description of traumatic findings. It will be useful to develop a taxonomy, similar to that used by Crowley and Peterson (2001), to describe the nature and pattern of postmortem changes to the anogenital tissues at various postmortem intervals.

Suspect examination: a medical-legal examination of the suspect is suggested. Protocols for this will vary by jurisdiction. In addition to routine collection of reference and evidentiary samples, the Alternate Light Source is a useful adjunct. Barsley has described the use of the alternate light source with narrow-band illumination and reflective imaging (Crowley, Barsley, Peterson, Wood, AAFS, 2000). Photograph any identification marks, such as tattoos, moles, or birthmarks, which may appear in photos taken by the offender with the victim. Patterned injury may be the result of weapon use during the commission of the crime, or inflicted by the victim in self-defense.

Colposcopy, Postmortem Genital Exams, Sexual Homicide

G24 Validation of the Anthropology Research Facility in Knoxville, TN, as a Research and Training Site For Forensic Entomology

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The goal of this paper is to present to the forensic sciences community the latest findings on the scientific validity of the Anthropology Research Facility (University of Tennessee, Knoxville) as a research and training site for forensic entomology.

The on-campus Anthropology Research Facility (ARF) at the University of Tennessee, Knoxville, established by Professor William Bass in 1972, remains the only global site devoted to the study of human decomposition. The 20-year history of arthropod exposure to decomposing bodies at ARF led Tennessee v. Coe (1993) to speculate that this site is saturated with sarcosaprophagous arthropods thus rendering it biased and atypical. Here the authors report results of a comparative field test of the arthropod saturation hypothesis conducted during summer 1998 at ARF and three other sites at varying distances from ARF (S1): S2 (700 m away), S3 (6 km) and S4 (40 km). Three dead pigs

(*Sus scrofa* Linnaeus) of known weight were spaced 1.8-2.5 m apart at each of the four sites with two pigs placed on wire screens to record daily weight loss. Ground and flying arthropods were sampled from each pig using pitfall traps and sweep nets, respectively, once daily for up to 12 days. In excess of 81,000 invertebrates were collected and identified over the 12-day period representing 26 orders, 118 families, and 223 taxa. The fauna was reduced to 64,950 and 6,848 individuals after pitfall and sweep-net counts of forensically important taxa, respectively, were sorted, for a total carrion fauna of 71,758 individuals. On an experiment-wide level, pair wise tests showed carcass weight losses, surface temperatures, and maggot mass temperatures to be statistically comparable across days and sites in nearly every case. Likewise, matched abundance plots, accumulation curves, and ecostatistical tests each showed that the fauna at ARF is comparable to the other three sites with respect to colonization rates, aerial species richness, and ranked abundances of forensically important taxa. In the only exceptional case, pitfall catches were found to be statistically different in species richness (at the nominal 0.05 level) between Site 4 and the other three sites. Overall, these results support the conclusion that ARF is faunistically and statistically comparable to nearby field sites for conducting carrion ecology and forensic entomology field studies.

Forensic Anthropology Facility (ARF), Forensic Entomology, Decay Rates

G25 Extracting Human DNA From the Crops of Maggots That Have Been Collected During Different Stages of Development and Preserved Using Different Methods

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Upon completion of this presentation, participants will understand the effect of the maggot preservation method on the ability to extract human DNA from the maggot's crop and will understand how the size of a maggot and its crop affect the strategy for human DNA extraction from the maggot.

The type of corpse a maggot has been feeding on can be identified through DNA analysis of the maggot crop contents. The crop is a food storage organ located at the anterior end of the alimentary canal. Maggot dissection, followed by extraction of only the crop, is favored since it leaves the maggot's exterior available for identification purposes. Recently, Wells *et al.* identified several situations when maggot crop analysis would be useful in a forensic investigation (*J Forensic Sci* 46(3):685-687). DNA analysis could help investigators identify a missing victim if maggots are discovered at a suspected crime scene in the absence of a corpse. Maggot crop analysis also could provide a forensic entomologist with another way to associate a maggot with a victim. When making a postmortem interval (PMI) estimation, it is assumed the maggot's entire development took place on the victim. DNA analysis of the crop could reveal that the maggot had moved onto the victim from a different nearby food source. Maggot crop analysis also could be used to resolve a chain of custody dispute in which the origin of maggot evidence is in question.

The method of maggot preservation may affect the investigator's ability to successfully extract vertebrate DNA from the maggot's crop. The storage temperature and type of preservation fluid can alter the stability of human or other vertebrate DNA within the maggot crop. Also, the type of preservation fluid can change the physical characteristics of the maggot, which may inhibit the investigator's ability to dissect the maggot and remove the crop intact.

Another factor the investigator should consider during analysis is the maggot's stage of development. The size of the maggot and its crop may

render different strategies for extracting vertebrate DNA from the maggot. Young maggots may be too small for dissection and crop removal. In older, post-feeding maggots, the maggot stops feeding and the crop contents are emptied into the remainder of the maggot gut. Alternative methods of analysis, such as extraction of the entire maggot, may provide better results for maggots that are too small for dissection, or for post-feeding maggots when the crop is no longer visible.

For the preservation study, maggots raised on human spleen were preserved using eight different preservation methods (70% ethanol, 95% ethanol, 4°C in 70% ethanol, 4°C, -70°C, room temperature, Kahle's solution and formaldehyde). Maggots were dissected after time periods of 2 weeks, 8 weeks and 6 months. Each maggot's crop was removed and extracted. Human DNA recovered from each crop was quantitated using Quantiblot® Human DNA Quantitation Kit (Applied Biosystems, Foster City, CA). Amplification of the human mitochondrial hypervariable regions (HVI, HVII) was attempted for all crop extractions. Amplification of STRs using Promega's (Madison, WI) Geneprint Powerplex 1.2 System was also attempted for all crop extractions. Successful HVI and HVII amplifications were sequenced using a PE-Biosystems (Foster City, CA) 310 genetic analyzer and BigDye Terminator® sequencing kit. Successful STR amplifications were analyzed using the 310 genetic analyzer.

Preliminary results suggest that the preservation method does affect the ease of dissection and the quantity of DNA recovered. For example, in maggots preserved in 95% ethanol at room temperature, the dehydrated crop became attached to other internal organs, often resulting in a broken crop during dissection. In maggots preserved in formaldehyde, although the crop was easily removed, quantitation results suggest a reduced amount of DNA had been extracted, in some cases preventing the amplification of HVI and HVII regions. Additional preservation results will be discussed.

For the development study, maggots raised on human spleen were removed and preserved at half-day intervals until the maggots began to pupate. The collected maggots were dissected and, if possible, the crops were removed and extracted. In maggots that were too small for crop removal, the entire maggot was extracted. In older, post-feeding maggots that no longer contained a visible crop, the intestines were extracted. DNA sequencing and STR analyses were performed as described above.

Preliminary results suggest that in maggots too small for dissection, extraction of the entire maggot did allow for the recovery of human DNA. However, in older, post-feeding maggots, extraction of the intestines did not result in the recovery of human DNA. Additional results will be discussed.

The results demonstrate that the chosen preservation method does have an effect on the ability to dissect a maggot and on the quantity of DNA extracted from the crop. Also, recovery of human DNA is possible in maggots that are too young for crop extraction, but is not likely in older post-feeding maggots with empty crops.

Forensic Entomology, Maggot Crop, Mitochondrial DNA

G26 Bioterrorism Response and Training: Building Upon Mass Disaster and Multiple Fatality Preparedness at the Office of the Chief Medical Examiner, Boston, MA

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After attending this presentation the participant will understand how Massachusetts has sought to continue to build a multiple fatality plan with bioterrorism applications and will understand creative

solutions to administering anti-terrorism response modalities in level-funded state agencies.

In the aftermath of September 11, 2001, the Office of the Chief Medical Examiner (OCME) has a need to both augment its ability to respond to a mass casualty event involving nuclear, biological, and chemical agents; and to increase surveillance of deaths in Massachusetts for unusual infectious agents such as anthrax, smallpox, plague, and tularemia. Currently, the OCME must rely solely on the infrastructure and personnel of its headquarter office in Boston and personnel located at three minor satellite offices, resulting in insufficient resources to respond to a mass casualty disaster. This situation has been dramatically improved by the creation of partnerships with pathology departments of major academic medical centers in the Commonwealth, which have effectively served to "virtually" expand the infrastructure and personnel available for response and death surveillance.

The Office of the Chief Medical Examiner in Massachusetts has received level funding for a period of years. The forensic terrain over that time has become more complex and expensive. To provide current investigative techniques and analyses that contribute to case documentation and eventual courtroom presentation has taxed operational budgets. As a state agency, the OCME has access to and liaisons with other state agencies that provide analytical techniques and research resources. Through programs developed in response to complying with Mass Fatality Preparedness Initiatives, the office has established linkages with departments within the Executive Office of Public Safety, Public Health, the Boston Medical Hospital Community and the University System. The coalescence of state and public agencies has provided continued opportunity for state-supported grants and research partnerships. The OCME applied and received three phases of funding through the Executive Office of Public Safety, entitled the Edward Byrne Memorial State and Local Law Enforcement Assistance Formula Grant Program. The third phase is allowing the office to implement a virtual expansion of medical staff, through the greater Boston community by providing training in bioterrorism preparedness and surveillance.

In order to achieve these goals, it was necessary to create partnerships with several academic pathology departments in the greater Boston area. The purpose of these partnerships has been to provide training to personnel at each participating department in policies and procedures used in forensic death investigation and victim identification. Additionally, an early detection and surveillance system has been developed to recognize unusual infectious agents at autopsy, and to become familiar with procedures required in the processing of deaths due to chemical and nuclear agents. Training materials developed for this project will be made available for distribution.

Bioterrorism, Training, Virtual Staff Extension

G27 Computerization of the Autopsy Report "How to Build Your Own Desktop"

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Upon completion of this presentation, attendees will understand integration of the major components of the case file as well as how current software and computer technologies allow for a personalized desktop application that increases the productivity of the forensic pathologist and support staff.

Goals of Poster: The goals of the poster are to show the stages of development of a case file on the computer screen. The authors will create case specific folders and subfolders or nests of files and incorporate them into "Palettes." Those portions of a case file the pathologist reviews most often, i.e., the diagrams, dictated report and images are made available by clicking icons that represent specific documents, digital images or drawings. In this presentation the files and icons have

been chosen to meet the needs of a particular doctor. Other doctors may want different files immediately available and this presentation will show how he or she can create their own computerized case file.

Method: Flash, a *Macromedia* software program is first used to create an interface or form that will contain the palettes. Flash works with many types of media and allows the user to create his or her own case file, linked to a database of multiple file types.

First anatomy diagrams used in the autopsy room are scanned and then enhanced by using common drawing software such as *Adobe Illustrator*. The illustrations are then saved as JPEG, EPS, or PDF files in a folder. Icons of each diagram are created and organized within a palette. These diagrams or templates are now available for printing as a hard copy for use in the autopsy room or enhanced with additional icons symbolic of lesions.

The next step involves providing diagrams that show the sites of trauma for police and attorneys. A palette is designed with icons representing gunshot wound entrances, exits as well as abrasions, lacerations and sharp force injuries. Using simple drag and drop motions, the pathologist chooses an icon and places a small rendition of the lesion on a template, creating a simple and accurate diagram of the findings. These diagrams can then be printed as hard copy or attached to e-mail messages.

A third palette is created with dictation templates created in *Microsoft WORD* and saved in a folder. Icons of each template are inserted into a new palette. The appropriate template is opened and the autopsy report is dictated. A transcriptionist can then cut and paste the text into the office format.

Next a palette with icons representing digital images is added. Thumbnails of a particular case's digital images are called up from the physician's hard drive or office server. The optimum time to review the digital images is at the time of dictation and final sign out. Currently there is a tendency not to refer to the images as various browsers or steps are required to recall the files.

A file can contain any type of media, i.e., video, documents, images or recordings. Palettes for video and audio files will be used. This will enable the pathologist to record commentary while demonstrating a wound or create recorded notes about pending outstanding tests required to complete a report.

Conclusion: A personalized application has been created which reduces the steps to call up various files in the case folder. This application relies on readily available software for construction of an interface with links to many file types. Different software applications now share enough similarities in file management and language allowing for linkage. Some applications such as video rely heavily on memory as well as processor speed. Other advances in technology, i.e., cost reduction and software development have increased accessibility to the computer user. Here is an application that allows for a specific interface that is designed to suit a single pathologist.

File, Palette, Icon

G28 Using STR Analysis to Detect Human DNA From Exploded Pipe Bomb Devices

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The goal of this presentation is to inform the forensic community about this pilot study on the potential applicability of DNA testing on exploded pipe bomb devices.

Previous research has shown that DNA can be recovered from a variety of objects handled by the human hand, but it is unknown if DNA can withstand the effects of a low explosion. This study investigated

whether it was possible to recover a bomb assembler's DNA from an exploded pipe bomb device. It was hypothesized that the DNA from the sloughed skin cells may in some instances withstand the heat generated from the explosion. Two different surfaces, metal and PVC pipes were examined to determine if one surface type would have "more success" than the other due to heat conductivity properties.

Each of the ten participating subjects handled components (pipe, caps and fuse) of one metal and one PVC pipe bomb with a 10 second handling time per component, thus transferring sloughed skin cells onto the pipe bomb pieces. Using disposable gloves the Michigan State Police bomb squad assembled and deflagrated each pipe bomb in separate holes in the ground; each hole was covered with a large rock to contain the fragments. The fragments from each bomb were collected separately and swabbed using the double swab technique to recover any remaining skin cells. An AmpF/STR® Profiler Plus™ kit as well as an ABI 310 Genetic Analyzer® with Genescan® 2.0.2 and Genotyper® 2.1 software were utilized to generate DNA profiles from these swabbed bomb fragments.

The results indicated that enough human DNA from the "bomb manufacturer" could be recovered from exploded pipe bombs, both metal and PVC, to produce reportable genetic profiles. Overall, 1 of the 20 bombs rendered a full reportable DNA profile that matched the known DNA profile, and 3 others rendered partially reportable DNA profiles that also matched the known profiles. Additionally, there were 5 bomb samples with activity at some of the loci, although these did not meet the reportable standards followed by the Michigan State Police Crime Laboratory in Northville, Michigan.

There was no evidence to suggest one surface had more success with DNA recovery than the other; both surfaces were equally successful. The variable that appeared to have the greatest influence on the success of generating a DNA profile was the amount of fragmentation and recovery of the bomb device. The more intact the device after the explosion and the more pieces swabbed the better the results.

These findings are promising. However, problems such as allele dropout, heterozygote imbalance, elevated stutter, and contamination were observed with some samples due to low amounts of DNA and the extreme sensitivity of the method. Suggested improvements in the method could potentially double the success rate and eliminate some problems, which is exciting to consider and should be explored with future research. Recommendations for the collection of bomb fragments at a scene as well as guidelines for DNA tests on bomb fragments will also be displayed.

STR, DNA, Pipe Bombs

G29 An Atypical STR Genotype, Including a Three-Banded Allelic Pattern, From a Biopsy Tissue Sample

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The goal of this paper is to present to the forensic community an instance of a STR genotype that may have been misinterpreted as a mixture. The profile was confirmed by a comparison sample and included allelic peak height discordance and a discordant three-banded allelic pattern using the AmpFISTR ProfilerPlus™ system.

In support of a medical diagnosis carried out at a local hospital, the Centre of Forensic Sciences (CFS) was asked to identify the source of two biopsy samples due to a potential mix-up of samples using a third biopsy sample from a known individual. The results resolved the mix-up and in the process also identified, in a single source sample, allelic peak height discordance at amelogenin and vWA as well as a discordant three-banded allele pattern at D18S51.

Two paraffin blocks were submitted. The first contained two biopsies, one malignant and one benign, which raised suspicion that the two biopsies were from different individuals. The second block contained a malignant biopsy sample from a known source. The three biopsy samples were extracted using a xylene extraction technique followed by amplification of 1ng of DNA in the AmpFISTR Profiler Plus™ system. The paraffin block with the malignant and benign biopsies showed two different DNA profiles confirming that these biopsies were from different people.

One of these profiles showed peak height concordance of only 19% at amelogenin and 32% at vWA, as well as a 25% peak height concordance between two alleles as compared to the third allele in a three-banded allelic pattern at D18S51. Based on both internal and published validation studies, the presence of such anomalies is atypical when dealing with a sample known to have originated from a single individual. The fact that the anomalies are compounded is even more rare. CFS internal validation of the STR loci used in the AmpFISTR Profiler Plus™ system has shown that minimum peak height concordance observed at most STR loci where 1ng of single-source DNA has been amplified is 60%. Interpretation of this sample as an unknown or questioned sample would indicate a mixture. However, the comparison sample (of known origin) in the second block also showed peak height discordance at similar percentages at amelogenin, vWA and at the discordant three-banded allelic pattern at D18S51. The peak height discordance at amelogenin, vWA and discordant three-banded allelic pattern at D18S51 may indicate a chimeric genotype since the anomalies are seen at more than one locus and therefore occur at more than one chromosome. It is also possible that more than one genetic event may account for the observed profile.

This example emphasizes that caution should be taken when using tissue block samples as comparison samples in forensic casework. Information that a tissue sample is cancerous may not always be available. Therefore, when forensic DNA analysis involves tissues (a notable example is mass disaster identification), issues involving identification, interpretation and statistical significance regarding atypical profiles and three-banded allelic patterns may become increasingly important.

Biopsy, Three-Banded Pattern, STR

G30 DNA Databank Hits: Identification of the Perpetrator?

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Participants attending this presentation will learn of a variety of case scenarios where a convicted offender hit provided investigative information that was not a direct link to the perpetrator of a crime. This will further demonstrate the utility of DNA data banks as an investigative tool.

As a result of the DNA Identification Act of 1998, the Canadian National DNA Data Bank (NDDB) became operational in June of 2000. The Data Bank consists of two indices. The Convicted Offender Index (COI) is the electronic index that has been developed from DNA profiles collected from offenders convicted of designated primary and secondary offences as defined in section 487.04 of the Criminal Code of Canada. The Crime Scene Index (CSI) is a separate electronic index comprising DNA profiles obtained from crime scene investigations of designated offences. COI profiles are generated centrally at the Data Bank lab facility, while CSI profiles are generated at the various forensic laboratories throughout Canada. The Centre of Forensic Sciences (CFS) provides Forensic Science services for Ontario, a province with a population of approximately 10 million people.

Over the first two years of operation of the NDDB, the CFS submitted 1,803 (31%) of the Crime Scene Index profiles to the Data Bank. Of the nearly 25,000 convicted offenders profiled, 53% were from the province of Ontario.

To complement the national legislation that established legal requirements for entering profiles onto the Data Bank using CODIS software, the CFS has developed a Standard Operating Procedure, which includes the criteria for a profile to be uploaded, the format and content of reporting statements, a process for communicating and dealing with the disposition (once followed up with investigators), and the criteria and procedures for deleting profiles from the NDDB. The potential dispositions include the following categories:

Offender hit: Indicating one or more forensic samples are linked to a convicted offender sample at SDIS. This provides investigators with the identity of a known offender and thereby provides an investigative lead that may ultimately link the crime scene DNA profile to the perpetrator. Alternatively the hit may provide investigative information that subsequently eliminates the crime scene profile as having originated from the perpetrator.

Conviction Match: Indicates that a DNA profile developed from crime scene evidence match a DNA profile from an offender, but the crime from which the evidence was collected has already been solved and linked with the offender. This match serves as a form of blind external testing as the offender should match the evidence for which s/he was convicted.

The DNA profiles eligible for upload to the CSI are subject to both legal and scientific restrictions. The DNA identification act outlines the legal criteria as follows. In order to enter a DNA profile into the data bank, a designated offence (e.g. murder, sexual assault, robbery, break and enter) must have occurred. There must also be a sample of a bodily substance from an "unsolved" crime that was found at a place, on or within the body of a victim, on anything worn or carried by the victim, or on or within the body of a person, thing or place associated with the commission of a designated offence. The scientific criteria were agreed upon by a working group of scientists from the three government laboratory systems in Canada (CFS, Royal Canadian Mounted Police Forensic Laboratories, and Laboratoire de sciences judiciaires et de médecine légale). The criteria were designed to limit the frequency of adventitious matches to the databank. In contrast to similar criteria from the U.S., for an unknown profile to be uploaded to the national CSI, a result for at least 7 Profiler Plus loci is necessary, in addition, a CSI sub index is used to capture profiles derived from mixtures. To be eligible for the forensic mixture index, a result at all 9 Profiler Plus loci is required with no more than three of the loci with up to five alleles entered.

Any DNA profile, generated during the scientific examination of items submitted in connection with an investigation, that cannot be attributed to the victim or a person who has been excluded as the perpetrator is automatically uploaded to the CSI.

Over the first two years of the Data Bank's operation CFS has been notified of 287 CSI to COI hits and 72 CSI to CSI hits. Of the crime scene to convicted offender hits, 62% have been conviction matches and 32% of the hits have been classified as offender hits. Of the 32% of investigations aided a number of the offenders have been ruled out as the perpetrator, however in these instances the identification of an offender as the source of a crime scene DNA profile has nonetheless aided the investigation. Some examples of this include:

Homicide investigation where a bloodstain on the victim hit to a convicted offender who ended up being a witness to the crime, who was ultimately able to aid in the identification of the true perpetrator.

Sexual assault investigation in which the first suspect was excluded as the source of semen recovered from complainant. The profile was entered onto the CSI and hit to an offender, the complainant was interviewed further and it was determined that the person identified by the hit was actually the boyfriend. This information allowed the police to account for the semen and to re-investigate the original suspect.

Investigation of an attempted murder in which a DNA profile from the tape wrapping around a pipe bomb hit to an offender. The offender was identified as the police officer who originally collected the pipe bomb for submission to the laboratory. Upon investigation, it was found that he had been convicted of a designated offence some time after his involvement in this case.

This presentation will outline other such cases in order to emphasize how important it is for the scientist to critically evaluate all samples being uploaded to a data bank and the need to keep an open mind when dealing with data bank hits. A hit to a convicted offender does not necessarily equal a hit to the perpetrator.

DNA Databank, Offender Hit, Conviction Match

G31 Everything Old is New Again: A Program to Examine "Cold" Sexual Assault Cases

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The goal of this paper is to demonstrate the processes that can be employed in a dedicated program for the examination of sexual assault cold case. The poster will also present some of the challenges encountered and overcome in the cases submitted.

This poster will provide an overview of a purpose-built program recently established at the Centre of Forensic Sciences (CFS) to deal with the examination of cold sexual assault cases. Cold cases can be defined as cases where the police investigation has been scaled down and the case is effectively lying dormant. In addition, some interesting and challenging cases submitted as part of the program will be described to illustrate the types of samples encountered and the methods employed to extract information and contribute to the investigation of unsolved sexual assaults where investigative leads have been exhausted.

Recently, a joint initiative was undertaken by the Centre of Forensic Sciences (CFS) in partnership with the Toronto Police Service, an agency serving a large metropolitan area with a population of approximately 2.5 million. This initiative was undertaken to examine or re-examine unsolved sexual assault cases with the goal of uploading DNA profiles from perpetrators to the National DNA Databank (NDDB) of Canada. For the purposes of this project, the term 'unsolved' refers to any case for which a conviction has not been registered. Criteria for eligibility were established first and consisted of the following categories:

1. Cases for which a submission had never been made to the CFS previously;
2. Cases submitted to the laboratory but not previously examined due to the absence of a suspect (in accordance with CFS policy prior to 1997);
3. Cases in which material suitable for DNA analysis was detected, however DNA analysis had not been attempted as the identity of the perpetrator was not at issue;
4. Cases in which DNA analysis was attempted using RFLP technology but was not successful at the time (RFLP has been discontinued at CFS since 1995); and
5. Cases in which a DNA profile had been obtained but was not compatible with the requirements of the databank (i.e., profiles developed in the RFLP, DQA1, PM, or STR Quad systems).

The Centre of Forensic Sciences is a provincial government laboratory (Ministry of Public Safety and Security) that serves a population base of approximately 10 million people throughout the province of Ontario, and carries out forensic analyses free of charge for all police agencies in the province, as well as other clients. In consideration of an

already heavy caseload and a commitment to timely results, a key requirement was that the laboratory be able to regulate the number of items submitted in support of this project, while providing effective scientific consultation and expertise in the process. To this end cases were assigned to one of two stages for examination.

Stage 1 submissions were those that consisted strictly of a limited number of relevant swabs (in accordance with the case history) from the Sexual Assault Evidence Kit (SAEK). A user-friendly flowchart was developed at the CFS so that investigators could review their files and readily target only those swabs with a high probability of success, given the case history. The provision of this tool developed by forensic scientists allowed investigators¹, as opposed to forensic scientists, to carry out the task of identifying relevant items according to scientific expectations of success given the case history. Moreover, restricting stage 1 submissions to swabs only allowed the development of a streamlined screening protocol for the presence of semen, which in turn allowed for batch processing and turnaround times of 30 days or less. Any case that did not meet the criteria for a stage 1 submission, as well as any case determined to be negative following a stage 1 submission, was directed for consideration at stage 2.

Since stage 2 cases normally involved the examination of clothing or other scene items not as readily amenable to rapid processing as internal swabs, a senior scientist was made available to provide consultation as to which items in these cases, if any, would be suitable for examination based on the history. Once accepted, stage 2 cases were blended with normal operations.

The Biology Section of the CFS has successfully integrated the analysis of cold cases with ongoing workload with no disruption to work flow. This is the result of an effective partnership between the laboratory and the police service and a mutual, reciprocal respect of one another's capacity and constraints. Within the first few months of implementation, DNA evidence generated from submitted items led to investigative breakthroughs in four unsolved cases through a combination of crime scene to crime scene linkages as well as linkages to convicted offenders. Approximately 50% of cases submitted under the project (stage 1 and 2) have had a DNA profile from semen generated and uploaded to the National Databank.

Based on the success of the program to date, the CFS is in the process of establishing partnerships with other agencies in Ontario to provide a similar service, and is also reviewing its case and item acceptance policies to more effectively target minimum numbers of relevant and suitable items for examination, based on the case history provided and the hypotheses being tested.

1: It is important to note that the bulk of the administrative work in this project (e.g., review of case files, tracking of old evidence, etc.) was carried out by police investigators assigned to work full-time on the project.

Cold Cases, Sexual Assault, DNA Databank

G32 Bone Extraction Procedure for Nuclear DNA Analysis Used in World Trade Center Human Identification Project

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The goal of this presentation is to demonstrate a highly effective method to extract and purify amplifiable nuclear DNA from severely compromised bone samples

The described extraction strategy was established for human bones recovered from the World Trade Center mass disaster site after September 11, 2001. Morphologically, the samples were in different

states of preservation - ranging from very good with preserved bone marrow, to semi-burned, and completely burned. The heat and friction forces at the disaster site had reduced many of the bones to small, severely damaged pieces. Each sample was individually assessed visually as to the amount of the bone tissue to be taken for the extraction procedure.

Osteocytes (mature bone cells), with their central, nuclear containing region are completely surrounded by the bone matrix. The bone matrix is permeated by an extensive and complex system of lacunae (cavities occupied by the cell bodies of osteocytes) and canaliculi (narrow channels that radiate from the lacunae). The predominant organic component is collagen, while the inorganic matrix is calcium phosphate in the form of hydroxyapatite, which accounts for about 75% of the bone mass. The philosophy of this protocol is to use as much bone tissue as needed, as determined by the quality of the sample, to obtain a sufficient amount of DNA, by "untrapping" the DNA containing osteocytes from compact and spongy bone matrix.

In order to minimize contamination with any external DNA each bone specimen was cleaned vigorously using a series of disposable scalpels and brushes. After sonication in a 5% Terg-a-zyme solution, the outer surface was sanded down (using a Dremel tool equipped with a disposable emery disk), until the outer surface was completely free of dirt and debris. This step was followed by an additional Terg-a-zyme and H₂O wash step; then the bone specimen was cut into approximately 0.5x0.5x0.5 cm pieces, frozen in liquid nitrogen, and ground in a MicroMill Grinder (Scienceware, Bel-Art Products, Pequannock, NJ) into a dust. The mill was cleaned vigorously after each sample.

Depending on the condition of the bone sample, the bone dust was divided into 50 ml conical tubes (2 g of bone dust per tube). 4g for good specimen, 6g, 8g, and 10g for more compromised samples. Each dust aliquot was incubated in 3 ml of organic incubation buffer (shaken at 56°C, overnight). The DNA was extracted using Phenol-chloroform-isoamylalcohol (24:24:1) in 1.5mL Phase Lock Gel tubes (Eppendorf, Hamburg, Germany) and Microcon 100 microconcentrators (Amicon, Inc., Beverly, MA). The extracts were further subdivided into smaller aliquots. As the final step all aliquots were recombined and concentrated further using Microcon 100 vials. Samples were quantified using QuantiBlot (ABI, Foster City, CA), and amplified with the PowerPlex 16 (Promega, Madison, WI) multiplex. The resulting DNA profiles were analyzed and interpreted following the standard procedure established for the WTC Human Identification Project.

Usable STR profiles with a sufficient number of loci were obtained in ~ 75% of cases. Approximately 50% of all analyzed cases even had more than 13 loci typed. The procedure has been successful for nuclear DNA based identifications even if the bones were in an extremely poor condition. The approach of dividing samples into smaller aliquots and then recombining the extracts later allows for the processing of a large amount of bone matrix. This also allows the use of the Eppendorf Phase Lock Gel technology while avoiding clogged Microcon membranes.

Nuclear DNA, Bones, Mass Disaster

G33 Digestion Time of Human Mitochondrial DNA in Blowfly Larvae, *Calliphora vicina*

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The goals of this presentation are to determine the digestion time of human mitochondrial DNA after blowfly larvae have ceased feeding on human tissue.

This poster will display results obtained from a study measuring the digestion time of human mitochondria DNA in Blowfly larvae. The amount of time the blowfly larvae have been feeding on the human tissue will be measured over a 3-day period. Forensic entomologists

have developed a new technique that can be used to identify a corpse. This technique involves analysis of blood recovered from the digestive tract of an arthropod, which can help identify an individual host. From the blood extracted human mitochondrial DNA is recovered. Previous studies have shown that even if physical contact between the larvae and human corpse is not observed mtDNA analysis may be able to connect larvae with the corpse.

Blowfly larvae, *Calliphora vicina*, will be starved for one day before feeding on human tissue to remove previously eaten food from the larvae's digestive tract. Larvae will be placed in appropriate containers with human tissue. Three groups composed of three replicates each will feed on human tissue for varying amounts of time, 24-hours, 48-hours, and 72-hours respectively. Larvae will be placed in an incubator set at 36°C in the dark. This will help to mimic the environment of a human carcass. After being removed from the human tissue, a period of time will pass before each replicate of a group is preserved. The 3 replicates from each group will be immediately preserved, preserved after 36-hours, or preserved after 56-hour. The larvae will be preserved in 70% ethanol and stored at -20°C. An additional trial will be performed. Adhering to the protocols of the QIAamp DNA Blood Mini Kit from Qiagen, the Blowfly larvae will be analyzed to determine if human mtDNA is present in their digestive tracts.

These results will provide more adequate information for forensic investigators when determining the length of time human mtDNA remains in the larvae's digestive tract. The results of this study hold promise in enhancing the utilization of arthropods in forensic investigations, especially in the area of homicide.

Human Mitochondrial DNA, Blowfly Larvae, Digestion Time

G34 Postmortem Interval (PMI) Determined by Analyzing Temperature Variations of Maggot Masses

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The goal of this presentation is to measure temperature variations within maggot masses and compare these with published temperature studies of dipteran developmental cycles conducted in labs for forensic growth rate base lines.

Hypothesis: the *in vivo* maggot mass temperature will result in increased growth rate of the larvae when compared to laboratory studies on developmental cycles.

A black bear carcass approved for research by the Florida Fish and Wildlife Conservation Commission Wildlife Research Laboratory in Gainesville, FL was placed into a remote, semi-wooded location within their grounds. The bear was struck by a car and the carcass arrived in early June 2002. Within five hours of the carcass being exposed to the environment a HOBOä external logger was placed at the carcass site and set to record wet bulb temperature, air temperature, and temperature of the soil beneath the bear carcass, and in the center of the largest maggot mass present at the time. Temperature was recorded continuous @ 10 minute intervals for ca. 1.5 months. Adult insects and developing larvae were collected about 6 PM until carcass decomposition was complete. The adult beetles and flies were killed using an ethyl acetate kill jar. Fly larvae were initially placed into empty vials, and then taken back to the lab to be boiled briefly for preservation purposes and then placed into 70% ethyl alcohol. Pictures of the various insects and the growing maggot masses were taken every other day, along with shots of the dif-

ferent decomposition stages the carcass went through. These photos were made with a 35mm camera with macro close up attachments. A separate 35mm camera with an infrared filter was used to take IR shots of the maggot mass for observation of the heat spots. Sketches of the maggot mass locations and decomposition stages were taken daily for visual reference.

Results showed varying temperatures in the maggot mass corresponding with the ever-changing Florida summer weather. The greatest temperature was recorded at maggot mass locations with the greatest number of larvae. When the weather was overcast or immediately following rain the mass temperature was much lower than on days with clear skies and no rain. The larvae were observed moving in and out of the center of the mass in a routine motion as if they are were making a circle in to the mass and back out again. The highest temperatures were taken in the center of the mass with temperatures decreasing exponentially farther away from the center. The larvae composing the first maggot masses were first instars on June 5 and began to migrate away from the carcass on June 13. Several of these larvae were taken in to the lab to be raised during the pupal stage at a set temperature of 26°C; pupation occurred by June 15 and adults emerged on June 20. The remaining larvae left in the field on the carcass developed similarly. The maggot masses began appearing at the orifices within the first four days that the carcass was exposed to the environment. From there they moved around the perimeter of the carcass encasing all of the extremities, the head and the anus region. The masses then moved in towards the center of the carcass as decomposition progressed with the last masses being observed around the exposed vertebral column. The maggot mass was composed primarily of *Chrysomya rufifacies* (Macquart) (Diptera: Calliphoridae) larvae throughout the duration with a few other species intermixed throughout.

Conclusion: Whether the hypothesis was verified has yet to be determined because data are still being analyzed. Species found in and on the carcass are summarized in the poster tables. Variations in species may have increased if insect collections were made at a different time of year and day. The insect faunal succession change with decomposition levels as related to time of day and this could lead to a variety of temperatures and developmental rates. The maggot ball temperature varied with environmental temperature. The maggot ball consisted of the hairy blow fly, *C. rufifacies*. The maggots in the maggot ball moved in and out of the high temperature center of the maggot ball.

Maggot Mass, *Chrysomya rufifacies*, Developmental Cycle

G35 A Summer Carrion Study in the North of Italy

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After attending this presentation, participants will more fully understand variables affecting postmortem changes to carrion exposed outdoors during summer. The presentation will show how weather conditions, combined with effects of extensive predation, may result in incorrect assumption of an extended PMI.

Forensic pathologists are often called upon to establish the time since death in badly decomposed bodies. Physical, chemical and biological changes start immediately after death and their development rate varies according both to external factors (temperature, humidity, and sunlight, insects) and internal factors (body characteristics).

Entomological analyses for the estimation of the postmortem interval are primarily based on the fly life cycle. Flies are rapidly attracted to the body were each female can oviposit hundreds of eggs. Within a few hours, depending on species and ambient temperature, eggs will hatch and a large

number of larvae begin actively feeding on the body. In this stage, predators such as beetles, ants, or wasps are able to remove a large amount of fly larvae resulting in a slower rate of decomposition. Conversely, later foraging activity by predators while larvae are migrating from the carriion during the post-feeding stage may result in few larvae reaching the pupal stage. This interaction between insects colonizing remains may lead to an incorrect assessment of the level of Diptera activity on the decomposition rate and suggest a longer PMI.

Data concerning this problem were obtained by research conducted on exposed carriion in the North of Italy.

One pig carcass, *Sus scrofa* L., was exposed in a rural, grassy field. The animal, weighed 32 kg, was exposed in a wire mesh cage in direct sunlight. Hourly internal temperatures were recorded by two probes inserted into the mouth and anus. Additional information such as ambient air temperature, humidity, rainfall, wind, maggot mass temperature, soil and body surface temperature were also recorded.

At least two daily samplings were performed during the first ten days. During each sampling pictures of both morphological changes and insect activity on the carcass were taken and, entomological specimens were collected for species determinations and microbiological analyses.

The observations demonstrated that a large number of green bottle flies arrived immediately after the carcass was exposed, exploring head area. Insect colonization started from primary sites of oviposition (nose and mouth). Eggs were observed less than 2 hours after exposure. Hatching was observed 20 hours later. Few Sarcophagidae occurred on the carcass on day 2 and their larvae were noted in a small area on the head.

After 24 hours, large masses of eggs were observed on the pig skin at the interface with the soil, all around the carcass. The high ambient temperature caused the death of a large number of eggs on the dorsal surface.

Highest maggot activity was recorded at 72 hours when maggots completely covered the carcass. Stressed by both increasing temperature and ventilation, fully developed 3rd instar larvae start their migration at the end of day 4, leaving a nearly completely skeletonized carcass. Ambient conditions also affected the decomposition of the small amount of tissues spared by the feeding activity of larvae. The skin covering a small area of the abdomen was dehydrated, hardened and took on a dark brown color, usually observed in cadavers exposed for a long time after death.

Coleoptera (Staphylinidae, Dermestidae) were observed all around the carcass beginning on the afternoon of day 4; other species of Coleoptera (*Necrobia*) started their activity on the carcass after day 5, reaching the maximum at day 8 (*Necrobia*) and day 10 for Dermestidae.

Coleoptera were very abundant and their presence may explain the small number of pupae found in the ground all around the cage.

In order to clarify all variables affecting insect activity on the carcass, insects were tested for bacterial and chemical contamination by both microbiological and toxicological analyses. Results of this research are still in progress.

Forensic Entomology, Decomposition, Postmortem Interval

G36 Of Leaves and Men: Botanical Evidence Leads Investigators to a Missing Girl's Body

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The goal of this presentation is to demonstrate the importance of botanical evidence in the location and recovery of human remains.

On 29 May 2002, a sheriff's deputy in Butte County, CA, responded to a report of an apparent suicide victim in a pickup truck parked alongside a mountain road. Inspection of the vehicle revealed a 35-year-old male decedent with a single self-inflicted gunshot wound to the head. A significant amount of blood spatter and pooling on the passenger seat indicated to the investigators that a second victim might be involved, although a thorough search of the area surrounding the vehicle revealed no additional evidence.

Identification of the male decedent quickly led deputies to a missing persons report that was filed in Los Angeles County 2 days prior to discovery of the body. The decedent had reportedly picked up his 11-year-old daughter from school on 20 May 2002, with a probable destination of Lake Havasu, Arizona. When the daughter did not return home after the trip, her mother reported her missing.

Detailed examination of the decedent's pickup truck produced several pieces of evidence, including a receipt from a Las Vegas hotel and a bloodstained girl's jacket with a significant amount of plant debris inside one of the sleeves. Investigators conjectured that the girl was likely deceased or seriously injured; however, they were somewhat daunted by the size of the search area. Based on witness accounts and evidence collected from the truck, the girl could be in Arizona, Nevada, or California.

In an effort to narrow the search area, investigators took the plant material recovered from inside the girl's jacket to California State University, Chico, for examination by a botanist. Analysis of the sample, which ranged in composition from whole to partially decomposed leaves, revealed that it had been taken from the top few centimeters of leaf litter. The species present (in order of abundance) were canyon live oak (*Quercus chrysolepis*) or interior live oak (*Q. wisileneii* var. *wisileneii*), white fir (*Abies concolor*), greenleaf manzanita (*Arctostaphylos patula*), ponderosa pine (*Pinus ponderosa*), and black oak (*Quercus kelloggii*). Additionally, the sample also contained a whole leaf of greenleaf manzanita torn from a living shrub.

Possible sites were eliminated based on known species distributions and ecological site requirements. The species identified do not occur together in Arizona, Nevada, or the eastern Sierra Nevada. The live oak, in particular, indicated that the sample was most likely from the western exposure of the Sierra Nevada. Overlapping species distributions indicated that the sample was removed from an elevation of 762 to 1,372 m. The relative abundance of the species present was a bit unusual in that the dominants were live oak and white fir, indicating that the site had to have both slightly mesic (white fir) and slightly xeric (live oak) characteristics. It was unlikely that the site was a north- or east-facing slope due to the presence of the live oak, and a south-facing slope was equally unlikely based on the presence of the white fir. The sample must have been from a west-facing slope with some available moisture. Further, the composition and dark color of the leaf litter sample indicated a high organic content, which placed the site under a fairly dense forest canopy. The notable occurrence of the greenleaf manzanita indicated that there must be some available light at the site, despite the dense canopy.

A survey of possible sites within northern California that satisfied the botanical criteria led to the discovery of the girl's body in less than two hours. Surprisingly, she was found only 0.3 km from her father's truck, an area that had been searched thoroughly following discovery of his body 8 days earlier. The girl was wrapped in a blanket and partially buried under tree limbs and litter. The site proved to be a 30 percent west-facing slope with a close canopy of coniferous vegetation, where canyon live oak and white fir were the dominant species, and was located at an elevation of approximately 1160 m. The body was in close proximity to a small patch of exposed chaparral with greenleaf manzanita as the dominant species.

This case is an illustration of the potential significance of Forensic Botany in crime scene investigation. Botanical evidence is often overlooked or underutilized by investigators, but it has the potential to provide critical and detailed information about the circumstances surrounding death, or in this case, the actual location of the remains.

Forensic Botany, Missing Persons, Scene Investigation

G37 A Study of Three Suicidal Hangings in Jail Using Telephone Cords

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The goal of this presentation is to present three cases of hanging suicides that occurred in custody, and the specific changes that were made to address the problem.

In a three month period of 2000, three suicide hanging deaths with telephone cords occurred in North Texas jails and were autopsied at the Southwestern Institute of Forensic Sciences in Dallas. The first incident was a 36 year-old woman who was arrested for outstanding traffic warrants. She had a history of depression, drug abuse, and prior arrests. On the day of her death, the decedent was discovered in a kneeling position by the pay telephone in the cell she occupied, hanging from the metal spiral telephone cord looped around her neck. She was the only occupant of the cell, which was under video surveillance. The telephone cord measured 15 and 3/4 inches in length.

The second case occurred ten days later in a different jail in an outlying county. A 24 year-old man had been arrested for a number of charges including assaulting a public servant. Because he was already on probation, these charges would mean his immediate return to prison. The decedent was found hanging from the metal phone cord attached to the pay phone in his holding cell. He was the sole occupant of the cell, which was not monitored by electronic surveillance. Investigation revealed that the man had phoned his wife to tell her he was going to commit suicide prior to the act. The telephone cord measured 19 inches in length.

One month later, a third incident occurred in another jail. A 29 year-old man had been arrested for disorderly conduct. At the time of arrest the man was under the influence of alcohol, but no other drug use was reported. He was the sole occupant of a holding cell that contained a mounted video camera. The camera was filming, but was not constantly monitored. A telephone was mounted on the wall just inside of the cell. A review of the video tape showed the decedent hanging himself with the telephone cord ten minutes after entering the cell; he was discovered approximately two hours later. According to his family, he had made two prior suicide attempts.

Autopsies were performed in each of these cases and showed typical ligature furrows without evidence of other trauma or neck injury. Blood toxicology studies were positive for methamphetamine, methadone, fluoxetine, and diazepam in the first case, a blood alcohol level of 0.12% in the second, and a blood alcohol level of 0.18% in the third.

Because of these types of incidents, solutions such as providing shortened receiver cords have been suggested. A cord-free inmate phone that has a recessed, cordless handle is also available. These phones can function similarly to a speaker-phone, but with the privacy of a telephone. Following the incidents described above, a proposal was made to the Texas Commission on Jail Standards (TCJS) to standardize the types of telephones used in detox and holding cells. The proposal did not pass at that time, and there are currently no plans to make changes on a state-wide level. The current Texas Administrative Code for the TCJS addresses inmate rights concerning telephone calls and the accessibility of telephones, but does not define a specific type of telephone to be made available. There are also no rules written regarding the placement of telephones within or around holding cells. It is currently up to the individual jails to decide what type of phones to provide and where to mount them.

The three jails above each responded to these incidents by changing their telephones. Two of the jails shortened their receiver cords to a total length of 6-8 inches. The telephones are otherwise unaltered, and are still in the same locations. The third jail replaced their entire phone with a cordless telephone. These three incidents highlight the need to provide telephones that, if placed within holding cells or other jail cells, do not provide a possible means of suicide.

Hanging, Suicide, Custody

* Presenting Author

G38 Diabetic Ketoacidosis—A Silent Death

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The goal of this presentation is to determine the percentage of cases investigated by the Office of the Chief Medical Examiner (OCME) with a known history of diabetes versus de novo detection of diabetes

Diabetic ketoacidosis may be the initial manifestation of type I diabetes or may result from increased insulin requirement in type I diabetic patients during the course of infection, trauma, myocardial infarction, or surgery. It is a life-threatening medical emergency with mortality rate just under 5% (1). Type II diabetic patients may develop ketoacidosis under severe stress such as sepsis or trauma.

Cases investigated by OCME over a 6-year period whose cause of death was diabetic ketoacidosis were identified. For each case, the initial investigation and follow-up investigation report were reviewed to determine whether a history of diabetes was included. In all cases investigated by OCME, a specimen, usually blood is analyzed routinely for volatile substances, including methanol, ethanol, acetone, and isopropanol by Gas chromatography at a limit of quantitation of 0.01 g/dL

A postmortem diagnosis of diabetic ketoacidosis is based on either some or all of the following: a history of diabetes, increased vitreous humor glucose, or increased blood acetone. From January 1996 to December 2001, 20,406 autopsies were performed, with 34.49% (n=7039) natural deaths. The total number of deaths secondary to diabetic ketoacidosis was 1.43% (n=101), with 85.1% (n=86) of them available for review. A total of 35.2% (n=31) of the decedents did not have a previous diagnosis of diabetes and were diagnosed for the first time at autopsy. The age of the deceased ranged from 10 years to 70 years with a male to female ratio of 62:24. The race was not significantly different with African American to Caucasian ratio of 46:40. In this study, a total of 57 cases (66.2%) were diagnosed based on vitreous acetone and/or vitreous glucose, and/or blood acetone. In 18 cases (20.9%), vitreous and blood acetone were used for diagnosis. The urine and blood acetone were used instead of vitreous acetone in 6 cases (6.8%) with or without vitreous glucose. The other cases were diagnosed either based on vitreous acetone alone (2 cases; 2.3%), blood acetone and vitreous glucose (1 case; 1.16%), decomposition fluid (1 case; 1.16%), and vitreous acetone and glucose (1 case; 2.1%). The variability of specimens tested depended on the availability of test material. There were 4 (4.6%) decomposed cases, in which urine and blood acetone were used in 2 cases, liver acetone in 1 case, and decomposition fluid and blood acetone in 1 case. The blood acetone level ranged from 0.01 g/dL to 0.117 g/dL (mean=0.035 g/dL). The vitreous acetone range was from 0.014 g/dL to 0.97 g/dL (mean=0.05g/dL). The level of the vitreous glucose ranged from 89 mg/dL to 1233 mg/dL (mean=597 mg/dL).

A positive acetone can indicate diabetic ketoacidosis, isopropanol ingestion, or malnutrition. Acetone, a ketone body, is produced in the liver from spontaneous decarboxylation of acetoacetate, which is produced as a result of incomplete breakdown of fatty acids. Once acetone has been detected, the Medical Examiner routinely requests a vitreous glucose concentration. An elevated vitreous glucose with an elevated vitreous acetone indicates diabetic ketoacidosis. It is recommended that the volatile toxicology analysis at a Medical Examiner's Office should not only include ethanol, but also acetone to screen for the diabetic ketoacidosis in cases of sudden deaths.

Diabetes Mellitus, Ketoacidosis, Acetone

G39 Investigation of Time Interval For Recovery of Semen and Spermatozoa From Female Internal Genitalia

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The goal of this presentation is to investigate time intervals associated with recovery of spermatozoa from various sites of the lower genital tract in adult females thus providing new data regarding the best anatomic site from which to collect evidence in victims of sexual assault.

In cases of rape-homicide, the biological evidence obtained from the body of the victim may be the only link between the victim and the suspect. This biological evidence, in the form of semen and spermatozoa, can provide proof of sexual contact and a genetic profile of the assailant. There is limited data regarding the actual recovery of spermatozoa from various areas of the genital tract. The limited anecdotal case reports available indicate that the cervical os may be the best site for recovery. However, there have not been any prospective studies to evaluate site-specific recovery times, and most standardized kits recommend vaginal pool collection only. Because of the importance of recovering spermatozoa from the female internal genitalia in criminal investigations, the authors undertook the current study to further elucidate the best anatomic site from which to collect evidence in victims of sexual assault.

The study, including the protocol and consent form, was approved by the IRB and the University Human Studies Committee at the University of Louisville. The study population consisted of patients who presented to Planned Parenthood for routine annual examination in Louisville Kentucky from May 1999 through October 2000. Prior to examination by a nurse practitioner at Planned Parenthood, the patient was asked if she would like to participate in the research study. Once consent was obtained, each participant was assigned a number to ensure confidentiality. The participant was asked a series of questions including age, method of birth control, date and time of last sexual intercourse, and history of instrumentation (i.e. douche).

Prior to routine examination and following insertion of the speculum, a nurse investigator from the Office of the Chief Medical Examiner (OCME) used cotton tip applicators to obtain separate specimens from the cervical os and the vaginal pool. Separate smear slides were made from the swabs of the cervical os and the vaginal pool. These were air dried and packaged in containers with the subject's identification number. The air dried cervical os and vaginal swabs were then placed in separate paper envelopes and labeled with the contents and the identification number.

The specimens were transported to the Kentucky State Police Forensic Science Laboratory in Louisville Kentucky for examination by a forensic serologist. The presumptive presence of semen on a portion of each cotton tip applicator was determined by testing for seminal fluid acid phosphatase activity via thymolphthalein monophosphate. An extraction procedure was performed on the cotton tip applicators. The extracted material was placed on a slide, stained with hematoxylin and eosin, and examined microscopically for the presence of spermatozoa. The slides prepared at the time of the examination at Planned Parenthood were also stained with hematoxylin and eosin and examined microscopically for the presence of spermatozoa.

Sixty-one patients participated in this study. Semen was presumptively present on the cervical os cotton tip applicators in 33 of 61 cases. In 1 of those 33 cases, semen was presumptively present only on the cervical os cotton tip applicators. The postcoital time interval in that

case was 9.5 hours. The extracted material from the cervical os cotton tip applicators demonstrated spermatozoa microscopically in 17 of 61 cases. In 6 of those 17 cases, spermatozoa were demonstrated microscopically in the material extracted only from the cervical os cotton tip applicators. The postcoital time interval in those cases ranged from 9.5 to 75.5 hours with an average interval of 47.9 hours.

Semen was presumptively present on the vaginal pool cotton tip applicators in 39 of 61 cases. In 7 of those 39 cases, semen was presumptively present only on the vaginal pool cotton tip applicators. The postcoital time interval in those cases ranged from 14 to 95.25 hours with an average interval of 53.6 hours. The extracted material from the vaginal pool cotton tip applicators demonstrated spermatozoa microscopically in 17 of 61 cases. In 6 of those 17 cases, spermatozoa were demonstrated microscopically in the material extracted only from the vaginal pool cotton tip applicators. The postcoital time interval in those cases ranged from 4.5 to 58.25 hours with an average interval of 24.9 hours.

Spermatozoa were observed microscopically in cervical os smears prepared at the time of the examination at Planned Parenthood in 25 of 61 cases. In 5 of those 25 cases, spermatozoa were observed microscopically only in the cervical os smears. The postcoital time interval in those cases ranged from 37.5 to 82 hours with an average interval of 59.7 hours. Spermatozoa were observed microscopically in vaginal pool smears prepared at the time of the examination at Planned Parenthood in 24 of 61 cases. In 4 of those 24 cases, spermatozoa were observed only in the vaginal pool smears. The postcoital time interval in those cases ranged from 17 to 95.25 hours with an average interval of 46.6 hours.

Thus, in summary, there were 2 cases from the cervical os site and 5 cases from the vaginal pool that would have been missed, had the other collection site not been included. The total number of cases from which only one site was positive was 7 of 61, or 11.4 per cent.

The information gained from this study suggests that biological samples should be collected from both the cervical os and the vaginal pool in victims of sexual assault. It also suggests that, on average, spermatozoa may be recovered from the cervical os after longer postcoital time intervals than from the vaginal pool.

Semen, Spermatozoa, Female Internal Genitalia

G40 The Role of Hyponatremia in Fresh Water Drowning and Water Intoxication: Making the Distinction at Autopsy

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The goals of this presentation are to educate the forensic community to the role of hyponatremia in both drowning and water intoxication.

Drowning is defined as death following an episode of submersion. Water intoxication is defined as the intake of a sufficient quantity of fluid to cause symptomatic hyponatremia. The role of hyponatremia in both conditions will be reviewed. The case of a 4-year-old boy that drowned and his twin brother that survived the incident will be presented. At initial exam, both boys were unresponsive and documented to have hyponatremia; however, no seizure activity or cerebral edema was documented. The theory of acute water intoxication has been proposed as an alternative explanation for the events surrounding the incident.

Numerous studies have evaluated the role of serum electrolytes in the mechanism of death in drowning deaths. Serum sodium levels

routinely remain above 126 mEq/L; however, approximately 12% of the cases will have serum sodium levels below 120 mEq/L. The hyponatremia is a consequence of absorption of aspirated hypotonic fluid, which has been calculated to be less than 22 ml/kg in 85% of drowning deaths. The hyponatremia associated with fluid aspiration resolves without medical intervention and is not considered a life-threatening anomaly. Therefore, hyponatremia is not associated with the mechanism of death in drowning.

Acute water intoxication occurs over a short period during which the individual consumes sufficient quantities of low sodium-containing fluids to cause symptomatic hyponatremia. The hyponatremia does not spontaneously resolve and results in prolonged seizure activity secondary to cerebral edema. In three cases that resulted in death, children from 6 to 16 years old were forced to consume between 3 and 6 liters of water at one time as punishment. The volumes retained averaged 41 ml/kg/hour and the serum sodium ranged from 109 to 114 mEq/L. All three children developed seizures, and cerebral edema was noted at autopsy. The literature has numerous reports of infants less than 1-year-old that developed acute water intoxication during swimming lessons. Serum sodium levels ranged from 111 to 123 mEq/L and seizure activity was documented in all cases. All of these infants recovered with medical therapy aimed at treating the hyponatremia. A single case of acute water intoxication occurring in a 12-year-old boy lodged in a drainpipe of a swimming pool has been documented. After a complete recovery from a serum sodium level of 111 mEq/L, the boy recalled swallowing large quantities of water.

In conclusion, fresh water drowning is not routinely associated with hyponatremia, but a small percentage of cases do have documented hyponatremia. Acute water intoxication is associated with symptomatic hyponatremia and requires diagnosis-directed therapy. Most of these cases have been documented in infants undergoing swimming lessons or in child abuse cases.

Hyponatremia, Drowning, Acute Water Intoxication

G41 An Unusual Cause of Sudden Death in Infancy: Hypertrophic Cardiomegaly

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Hypertrophic cardiomegaly in infancy may cause sudden death in infancy. This presentation discusses the clinicopathologic features, describes the gross and microscopic features, and addresses the differential diagnostic features.

Introduction: The number of cases of Sudden Infant Death Syndrome (SIDS) is decreased by an increasing number of cases that can be ascribed to specific medical conditions. A case of the sudden death of an infant is described that autopsy revealed was due to the unusual finding of hypertrophic cardiomegaly in a two-month-old.

Clinical History: The infant was a healthy, full-term two-month-old white male, who was found unresponsive in his crib following a morning nap. The father began CPR and called emergency personnel. The infant was transported to the hospital, where resuscitative efforts were unsuccessful, and the baby was pronounced dead.

The infant was born to a G2P2 30-year-old woman, who had a history of a motor vehicle accident that resulted in brain trauma. She

later underwent temporal lobe resection for control of seizures. During pregnancy, seizure activity required that she was started on levetiracetam (Keppra), beginning at approximately 20 weeks gestation at a dose of 1000 mg per day that was later increased to 1500 mg per day. Towards the end of the pregnancy, she was also started on gabapentin (Neurontin) at a dose of 5400 mg per day. Her pregnancy otherwise was uneventful. At 32 weeks gestation, a second level ultrasound showed no fetal abnormalities, and the heart was normal in size.

Autopsy Findings: At autopsy, the body was that of a well developed and well nourished two-month-old white male, weighing 11 pounds and measuring 23 inches in length. There were no signs of trauma. All internal organs were in their normal anatomic relationships. The heart, in the fresh state, weighed 72 grams (average weight for age was 30 grams) and was structurally unremarkable. Upon sectioning, the myocardium was red/brown, without fibrosis, hemorrhage, or distinct lesions. The interventricular septum was intact. The atria were unremarkable, and no interatrial defects were present. The coronary ostia were normally located, and the distribution showed right dominance with a circulation pattern within normal limits. The valves were thin and unremarkable.

Microscopic Examination: Hypertrophic cardiomyocytes found on H&E sections of the heart. No other microscopic abnormalities were found. Electron microscopy and special histochemical stains were performed.

Discussion: Hypertrophic cardiomegaly in many ways resembles hypertrophic cardiomyopathy. There is left and/or right ventricular hypertrophy that is usually asymmetric and involves the interventricular septum. The hallmark features are myocardial hypertrophy and structural derangement. In this case, the heart was approximately double the normal weight and size.

Neonatal cardiomegaly may resemble hypertrophic cardiomyopathy. However, at autopsy a variety of cardiovascular defects, such as aortic coarctation or malformation of the coronary arteries, are usually found. In addition, in some patients without cardiovascular defects, another cause for ventricular hypertrophy may be present, such as chronic renal failure or maternal diabetes. In this case, no other cardiovascular defects, besides left ventricular hypertrophy, were found, and no additional medical conditions were known.

The differential diagnosis in this case includes amyloidosis, glycogen storage disease, and Fabry disease. These conditions can be eliminated from consideration by microscopic examination of the heart. In this case, sections of the heart showed no abnormal intracellular accumulations.

The etiology of this infant's hypertrophic cardiomegaly is unknown. The parents were concerned that the anticonvulsant medications taken by the mother during pregnancy may have adversely affected the fetus. This question cannot be answered with certainty. Both levetiracetam and gabapentin are pregnancy risk category C drugs, meaning there are no adequate studies of the drugs in humans, although animal studies have shown an adverse effect on the fetus. Category C drugs may be useful in pregnant women despite their potential risk.

It is possible that there may be a familial component to this case. The infant's paternal grandfather has a history of hypertrophic cardiomyopathy.

Conclusion: Hypertrophic cardiomegaly is a rare finding in infants and may be a cause of unexpected sudden death. This condition should be considered in the differential diagnosis of SIDS. A careful examination of the cardiovascular system is warranted in each case. Microscopic and special studies may be used to rule out other causes of cardiomegaly in infants.

Infancy, Hypertrophic Cardiomegaly, Sudden Death

G42 Use of Expert Consultation in the Evaluation of Tissue Donors With a Postmortem Diagnosis of “Hepatitis” to Determine Eligibility For Transplantation

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The goals of this presentation are 1) to emphasize the importance of attempting to specifically determine and report infectious vs. non-infectious etiologies of hepatitis in cadaveric donors of tissue for allotransplantation, 2) to emphasize that correlation of morphology with viral serologic testing results is integral to establishing the initial diagnosis of viral hepatitis, and 3) to assess the utility of expert consultation in making this determination.

Introduction and Hypothesis: Chronic hepatitis is a clinical-pathologic syndrome which may result from a number of causes including viral infections, autoimmune or metabolic diseases, drugs (medications), or other unknown etiology (cryptogenic). Chronic hepatitis is defined clinically as inflammatory liver disease continuing for at least 6 months. However, patients with chronic hepatitis may have asymptomatic clinical phases, for example in hepatitis C and autoimmune hepatitis. Patients with viral hepatitis, especially infections due to hepatitis C virus (HCV) or to hepatitis B virus (HBV) with or without hepatitis D virus (HDV) superinfection, are at significantly increased risk for developing hepatic cirrhosis and hepatocellular carcinoma. Chronic hepatitis due to viral infection is a clear contraindication for blood donation and is likewise a contraindication for allogeneic organ and tissue donation. The Federal Drug Administration (FDA) and American Association of Tissue Banks (AATB) standards require tissue donors to be screened by medical / social history for risk factors for viral hepatitis and to have negative laboratory tests for hepatitis B surface antigen (HBsAg), Hepatitis B core antibody (anti-HBc), hepatitis C virus antibody (anti-HCV), and human immunodeficiency virus, types 1 and 2 (anti-HIV-1/2). Cadaveric donation of tissue (e.g. bone, skin, fascia, tendons, heart valves, and corneas) may also be preceded or followed by postmortem examination of the donor, including liver biopsy. Since chronic hepatitis is a clinical-pathologic syndrome resulting from both infectious and non-infectious causes, it was hypothesized that many potential tissue donors with a postmortem diagnosis of “hepatitis” without reference to etiology made initially at autopsy, but with otherwise acceptable AATB donor criteria, would have minimal liver inflammation resulting from non-specific or non-infectious causes and would therefore be acceptable donors.

Methods: Seven potential cadaveric donors ranging in age from 16 to 72 years were referred to a regional tissue bank by either hospital (n=4) or medical examiner's office (n=3) staff. The causes of death included cardiac events (n=3; 1 acute myocardial infarction, 1 hypertensive cardiovascular disease, and 1 hemopericardium with cardiac tamponade), vascular rupture (n=2; 1 abdominal aortic aneurysm and 1 porta hepatis), and head trauma (n=2; 1 gunshot and 1 blunt injury). Based on initial screening criteria, including a detailed medical / social history obtained from next-of-kin and an external physical examination, the donors were approved as being suitable for tissue donation. After informed consent was obtained from next-of-kin, donor tissues including skin, saphenous and femoral veins, heart (for valves), ilia, fascia lata, long bones and achilles tendons of the lower extremities were procured

under aseptic conditions within 24 hours of asystole. In all cases, a post-mortem examination was performed either before or after the tissue procurement by a pathologist from the referring institution. Infectious disease testing was performed on ante- or postmortem plasma or serum samples meeting acceptable plasma dilution criteria with FDA-approved cadaveric test systems for HBsAg, anti-HBc, anti-HCV, anti-HIV-1/2, HIV p24 Ag, and HIV DNA by PCR. These seven donors, each with an autopsy diagnosis of “hepatitis” without reference to specific etiology, were re-evaluated after procurement of tissues. These cases, with complete clinical and laboratory findings including routine histological sections of liver from autopsy and results of infectious disease tests, were subsequently referred to independent expert gastrointestinal / liver pathologist consultants for a formal second opinion regarding the possible diagnosis of viral / infectious hepatitis. Tissues of donors with clinical and histological findings determined by the expert to be insignificant, non-specific or non-infectious were processed to a variety of grafts at an AATB-certified processing facility and released for transplantation. Clinical follow-up was obtained.

Results: For all seven potential donors, screening criteria from the medical / social history, including risk factors for infectious hepatitis, and the physical examination were acceptable on re-evaluation. In each case, all infectious disease laboratory test results for viral hepatitis markers were also acceptable. In addition to other findings, each autopsy report from the referring institution listed “hepatitis” as a significant postmortem finding. As these reports did not specify either an infectious or non-infectious etiology of hepatitis, histological sections of liver from autopsy were obtained in order to assess the suitability of grafts derived from each donor for transplantation. Preliminary review in all cases showed only minimal to mild, patchy inflammation limited to portal areas. The histological sections, along with clinical and laboratory results, were forwarded to independent expert gastrointestinal / hepatic pathologist consultants for a formal opinion of the possibility of hepatitis of infectious cause. In all seven cases, in the opinion of the expert, the findings were either a) unremarkable hepatic parenchyma (n=2), b) non-specific portal triaditis (n=4), or c) non-diagnostic of chronic hepatitis of viral etiology (n=1). Based upon these opinions, the donors were approved as suitable for transplantation and tissues from the seven donors were processed into a total of 254 surgical allografts, potentially benefiting an equivalent number of recipient patients. At the time of this writing (12.5 to 47.5-month follow-up from date of procurement), no cases of infectious hepatitis have been reported in the graft recipients.

Conclusion: Chronic hepatitis of viral etiology is a contraindication for cadaveric tissue donation. In contrast, hepatic inflammation due to non-infectious etiologies may not be prohibitive for donation. Thus, at postmortem examination of decedents who have donated tissues for transplantation, efforts should be made to accurately diagnose hepatitis and, if possible, to further determine the specific etiology (infectious or non-infectious) of hepatic inflammation. Correlation of morphology with viral laboratory testing is often integral to establishing the diagnosis. Typical histological findings of hepatitis of varying etiologies will be discussed. Microscopic findings of only mild, patchy portal triaditis should be interpreted as “hepatitis” with caution when viral serologic tests are negative or in the absence of such tests. The use of consultation by expert gastrointestinal/hepatic pathologists may assist hospital autopsy pathologists, forensic pathologists and/or tissue bank medical directors in making this determination and may result in an increase in the supply of acceptable tissue for transplantation to many patients needing surgical allografts.

Hepatitis, Tissue, Allograft

G43 Determining the Cause of Death and Contributing Factors in Fatal Recreational SCUBA Diving Accidents

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The goals of this presentation are to provide the forensic community with epidemiological data on diving fatalities and offer guidance and resources for investigating such deaths.

Diving with SCUBA (self-contained underwater breathing apparatus) equipment while breathing compressed air is a popular pastime in the U.S. An average of 90 to 100 recreational diving deaths occur in the U.S. or involve U.S. citizens diving abroad each year. Few medical examiner offices have enough experience with diving related deaths to adequately investigate such cases and errors in reporting the cause of death and contributing factors frequently occur. The goal of this presentation is to provide background data on the epidemiology of fatalities involving recreational divers and to arm the forensic community with some tools and guidance in properly determining the cause of death in such cases.

The Divers Alert Network (DAN) is a diving safety organization affiliated with Duke University Medical Center and located in Durham, North Carolina. DAN collects data on all recreational diving accidents and fatalities that occur in the U.S. or that involve U.S. citizens diving abroad. The information collected includes autopsy reports, investigational reports from law enforcement agencies and the U.S. Coast Guard, witness accounts, newspaper articles, and any other information from contributors involved in the case (e.g., medical treatment personnel, other divers, rescue personnel). Each case is reviewed by DAN staff, which includes individuals with technical diving expertise as well as a physician trained in both diving medicine and pathology. The Divers Alert Network publishes the data, including case reports, in an Annual Review of Diving Accidents and Fatalities. DAN also provides formal consultative services, free of charge, to any medical examiner office or government agency.

The Divers Alert Network fatality database was queried to obtain information on recreational diving deaths that occurred during the period 1989-1998. During that time there were 911 total diving deaths, over 70% involving male divers. Nearly half of all diving related fatalities involved divers age 30 to 49. Autopsies were performed in most, but not all, of the fatalities and in some cases a body was never recovered.

Not surprisingly, the most common cause of death was drowning (59%), though this should be considered a final common pathway in recreational water sports and the circumstances resulting in drowning are far more meaningful from a public health aspect. Other significant causes of death included cardiac events (11%) and arterial gas embolism (9%). Significant contributing factors that resulted in death while diving included running out of air at depth (17.2%), entrapment in a cave or other structure (10.7%), and having a medical problem during the dive (e.g., cardiac event (19%), asthma attack, etc.).

Diving experience varied but many were novices. Nearly half of the deaths involved divers who had made 20 or fewer lifetime dives, though a small, but significant, percentage occurred when the diver was under instruction in a formal training class. A large number of deaths involved divers who were involved in more challenging types of diving, such as cave exploration, wreck penetration, and deep diving. Of the divers who died while involved in these specialty types of dives, only a third had any documented formal training in that type of diving. Many divers in the fatality database were infrequent divers, making only a few dives each year. Diving dogma dictates that one always dives with another diver (the dive buddy). For the fatalities in the database, 40% became separated from their dive buddy during the dive; 14% chose to dive alone and had no assistance available when a problem occurred in the water.

Deaths that involve recreational divers are infrequent but can occur in almost any jurisdiction. For the ten-year period of data used in this report, nearly a third of the fatalities occurred in the southeastern part of the U.S. The states with the greatest number of diving related deaths were Florida, California, and Hawaii. However, a significant number of diving fatalities occurred in New England, the states bordering the Great Lakes, and the Pacific Northwest.

The medical examiner or forensic investigator involved in the investigation of a diving related fatality should either have a solid foundation in diving techniques and underwater physiology or seek expert consultation. To correctly assign a cause and manner of the death, these cases require a thorough investigation of the scene, knowledge of the circumstances surrounding the death (including a detailed history of the dive, if available), professional evaluation of the diving equipment used, and a complete autopsy with proper toxicological studies. Some modification in the autopsy protocol to look for pneumothorax and air embolism are necessary and a carboxyhemoglobin should be part of the standard toxicology for these cases.

Despite being uncommon events, recreational diving fatalities often involve young people with a large number of years of productive life lost and the cases nearly always go to litigation. The importance of a thorough investigation and arriving at accurate conclusions cannot be overstated.

SCUBA Diving, Drowning, Air Embolism

G44 Sphenoid Sinus Petechiae: Incidence and Significance

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After attending this presentation, participants will gain insight as to the incidence and significance of sphenoid sinus petechiae.

Purpose: Petechial hemorrhages, while a non-specific finding, may be indicative of an asphyxial death. Many studies have reviewed the importance of petechiae in a variety of sites, such as the conjunctiva, skin or visceral surfaces, however information regarding petechiae of the sphenoid sinus mucosa is not often commented on. The consensus of many investigators suggests that the pathogenesis of petechiae is related to the combined effects of increased venous pressure and hypoxic damage to endothelial cells, although the latter has been discounted by some authors. It is surmised that petechiae of the sphenoid sinus occur by the same mechanisms. The following investigation aims to demonstrate the significance of petechiae discovered in the sphenoid sinus, as well as to correlate their presence in conjunction with petechiae at other sites on the head.

Materials and Methods: The Southwestern Institute of Forensic Sciences in Dallas, Texas conducts approximately 3500 autopsies per year. Over a 30-day period, a series of autopsies were prospectively examined for the presence or absence of petechiae of the sphenoid sinus. Near the conclusion of the autopsy, i.e., after all organs had been eviscerated, the roof of the sphenoid sinus was removed via a triangular shaped opening made with a Stryker saw. Cuts were made through the lesser wing of the sphenoid bone on each side of the sphenoid sinus and just anterior to the sella turcica. Once the piece of bone was removed, the sphenoid sinus mucosa was examined with the aid of a halogen lamp or penlight. Petechiae were described as none, few or many; the latter equating to too numerous to count. Other variables documented in each case were: age, race, sex, cause and manner of death, the presence or absence of facial or conjunctival petechiae, body position at the time of death and whether or not cardiopulmonary resuscitation was attempted.

Results: As with petechiae identified in other sites, the presence or absence of sphenoid sinus petechiae neither confirms nor disputes the cause of death. However, they are seen in certain types of deaths with a

higher frequency than others. In cases where autopsy findings are subtle or vague, such as in drowning deaths or certain asphyxial deaths, the presence of sphenoid sinus petechiae can be useful corroborative evidence to support a particular cause of death. The position of the body at the time of death is important information when interpreting the usefulness of sphenoid sinus petechiae, as they are seen with increased frequency in specific body positions. While not specific for any particular cause of death, sphenoid sinus petechiae can provide pathologists yet another piece of information in certain settings, and when interpreted in the total case context, help support a particular cause of death.

Sphenoid Sinus, Petechial Hemorrhages, Incidence

G45 Homicide in the Elderly— Paris and Its Suburbs, 1996-2001

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Be it intra or extrafamilial, violence against the elderly has become an important source of concern. Surveys suggest that domestic violence and elder abuse and neglect are underestimated. The present study examined the circumstances surrounding homicides in the elderly, and autopsy findings.

As the population of the industrialized countries ages, the problems associated with the care of the elderly increase. Of those, violence against the elderly is an important source of concern. Most surveys indicate that the frequency with which elderly persons are assaulted or abused is likely to be underestimated. Among other forms of violence, domestic elder abuse and neglect has been suggested to be perhaps the most underreported crime. Homicide might be the extreme and most tragic form of abuse and neglect, and therefore may represent an accurate indicator of violence against the elderly. However, medicolegal autopsy-based studies and international comparisons are infrequent.

The aims of this study were to examine the circumstances, demographics, and autopsy findings in homicides involving persons aged 65 years or older, in Paris and its suburbs, between 1996 and 2001.

Results: 99 homicides occurred during the 6-year study period, 23 in 1996, 11 in 1997, 21 in 1998, 15 in 1999, 11 in 2000, and 18 in 2001. There were 59 female victims. The mean age of victims was 77 years, 79 in females (range, 65-97) and 74.5 in males (range, 65-87). There were 18, 24, and 17 females in the 65-74, 75-84, and ≥85 age groups, respectively, and 25, 9, 6 males in these age groups, respectively. 76% of victims were killed in their home. In 43 cases, the perpetrator was unknown to the victim. The murderer was a family member in 28 cases and an acquaintance in 28 cases. The most common motive for homicide was robbery, 40 cases. 30 of those occurred in the victim's home. 7 women were raped. There were 12 homicide-suicides. Disputes involving acquaintances or relatives accounted for approximately 25% of cases. In 12 cases, the perpetrator and motive could not be determined. Among the 99 homicides, 28 were domestic, including 20 intimate partner homicides, with the husband being the perpetrator in 14 cases. Guns were used in 14 of the 99 cases, 12 of which involved intimate partner homicides. Guns were never used in rapes or robberies. Stab wounds were found in 15 cases. Fifty-six persons died of blunt force injuries. In 39 cases, asphyxia was the cause of the death, with 25 of these in combination with blunt force. In 5 of the robbery cases, a cardiac disease, in addition to blunt force, contributed to the death.

Conclusion: During the 6-year study period, the number of elderly homicide victims, older than 65 years, in Paris and its suburbs has been approximately 16 per year. Males were at highest risk in the 65-74 age group, whereas females accounted for 75% of victims in the ≥85 age group. The elderly homicide victim was most likely to die from blunt force injuries. Domestic violence accounted for less than 30 % of homicides, whereas robbery was the most frequent motive for homicide,

accounting for 40 % of cases. Frailty and social isolation that come with illness or advanced age render the elderly more vulnerable to crime and make it impossible for some elderly individuals to protect themselves.

Elderly, Homicide, Forensic Sciences

G46 Abuse and Neglect: A 10-Year Review of Mortality in Elders

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The goals of this paper are to present the prevalence and pertinent findings of elder abuse and neglect in a major metropolitan city in Kentucky.

Methodology: to analyze data representative of or suspicious for elder abuse from a ten-year (1992-2001) retrospective case review of morbidity and mortality among elders (greater than or equal to 60 years old) at a State Medical Examiner's Office serving a major metropolitan city in Kentucky conducting both medicolegal autopsies and examining living cases pursuant to a Clinical Forensic Medicine Program.

Elder abuse refers to an act or omission, which results in harm, including death, or threatened harm to the health or welfare of an elderly person. Between one to two million Americans experience elder abuse and neglect per year. Elder abuse may be divided into six discrete, but often overlapping, categories: physical, sexual, and psychological abuse; neglect; financial exploitation; and violation of rights. While elder neglect is the most commonly discovered and investigated form of elder abuse, it represents the least well-defined and most controversial form of maltreatment. The abused elder often is over the age of 75, lives in social isolation with few social contacts, and suffers from poor health and cognitive impairment. The abuser frequently lives with the elder, has a history of mental illness and/or substance abuse, commits violence, displays antisocial behavior in relationships, and is financially and/or emotionally dependent on the elder.

The 10-year retrospective study included 74 postmortem examinations and 22 living patients evaluated at a clinical forensic center in Louisville, KY. The authors present the 74 postmortem cases of victims age 60 and older, in which 52 deaths were attributed to a homicidal act and 22 deaths were suspicious for neglect. The homicidal causes of death included gunshot, beating, stabbing, and asphyxia. The primary cause of death in neglect cases was bronchopneumonia. Distinctive factors among this elderly cohort, such as the frequency of cancer and Alzheimer's disease, were uniformly evaluated.

Forensic pathologists or emergency room physicians and forensic nurses through the Clinical Forensic Medicine Program evaluated 22 living individuals greater than or equal to 60 years old. Among these clinical investigations, 19 cases constituted physical and/or sexual assault and 3 victims suffered from neglect.

The authors summarize the characteristic features of elder abuse in both postmortem and living cases and underscore the necessity for multi-agency collaboration in order to reach an accurate conclusion in case work. Policies gleaned from a well-established elder abuse task force enable the interaction necessary to formulate criteria for future prevention. In the majority of physical and sexual assaults evaluated in the Clinical Forensics Program and at autopsy, which appear to be inflicted by "unknown perpetrators," further in-depth investigative work must be done. These initially termed "unknown perpetrators" may represent acquaintances, family members, and people who live or work in the vicinity of the victim. With the ongoing communication between agencies, assailant identification and clarification of the circumstances will increase the likelihood that the case is brought to litigation.

Elder Abuse, Elder Neglect, Clinical Forensic Medicine

G47 Elderly Neglect/Abuse

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This presentation is designed to bring awareness to the forensic community of elderly neglect/abuse which is a widespread problem possibly affecting hundreds of thousands of elderly across the country. It is still underreported due to a variety of reasons. This will discuss in detail what constitutes elderly neglect/abuse, medical, investigative, and autopsy assessment with presentation of several case reports from the State of Hawaii.

On June 18, 2002, the U.S. Congress heard detailed accounts of case reports of elderly neglect/abuse by a panel of experts and a report issued by the National Research Council stating, "Based on the available estimates, between one to two million Americans 65 and older have been injured, exploited, or otherwise mistreated by someone on whom they depended for care and protection." The overall national response to elder mistreatment currently remains weak and incomplete. Information on neglect/abuse cases and policies on how to deal with it vary from state to state. Therefore, they requested that someone at the Federal level take charge of the situation, gather statistics, and try to find a way to deal with the problem that will only grow worse as the population ages.

The National Center on Elder Abuse has defined three major categories of abuse/neglect as domestic, institutional, and self-neglect. The types of abuse are physical abuse, sexual abuse, psychological abuse, financial exploitation, and neglect. If not considered in the differential diagnosis, like a disease, elderly neglect may not be diagnosed. Inconsistent statements by the caretakers, evaluation of the environment, medications, nutritional evaluation, and statements in regard to the explanation of injuries/ulcers should be considered in investigating deaths due to the neglect/abuse. Medical and autopsy assessments should indicate the nature and extent of injuries, evaluation of hydration and metabolic status, detailed documentation of decubitus ulcers with the size, extent, and appearance with reference to staging, determination of the cause of death with evaluation of the duration of specific conditions, and documentation for legal proceedings.

Preventive measures include public awareness through education and early identification, intervention, and treatment for elders and their caregivers in high-risk situations, increasing the staff in the care homes, and even criminal prosecution of caregivers.

Elderly, Abuse, Neglect

G48 Morphological Considerations of the Hyoid Bone

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This presentation will demonstrate the tremendous variation that characterizes the hyoid bone

Combining the anthropological focus upon skeletal variation with the pathological interest in trauma, this study reveals the immense variation and complexity in laryngeal structures, and dispels the common notion of a causal relationship between advancing age and fusion of the hyoid bone.

Fractures of the laryngeal structures are frequently associated with manual and ligature strangulation, although external manifestation of such trauma is not always evident. Often, assessment of the condition of the hyoid bone may merely involve palpation of the laryngeal tissues at autopsy. Unfortunately, such interpretations are plagued by the unquestioned acceptance that the skeletal elements of the hyoid bone unite with

advancing age. Understandably, this erroneous consideration of the development of the laryngeal skeleton is frequently assumed in forensic interpretations.

The hyoid bone is comprised of several distinct skeletal components, the body and pairs of greater and lesser horns. However, throughout the anatomical and scientific literature the hyoid bone is traditionally described as a "U" shaped bone of a consistent form; a form that develops and fuses with advancing age. This interpretation, therefore, biases the potential anatomical, pathological, and clinical evidence that can be gleaned through examination of the components of the hyoid bone. Although the literature produced within these disciplines contains a wide variety of references to hyoid conditions, these reports suffer from a failure to recognize the variability that characterizes the human hyoid bone. Clearly, a thorough appreciation of the range of variation inherent in this structure is crucial for the accurate assessment of the hyoid in both antemortem and postmortem situations.

Toward this end 1,814 hyoid bones from individuals ranging in age from 2 months to 101 years, maintained in the Department of Anthropology at The University of Tennessee, were examined. Specimens were assessed for fusion and categorized as unfused, unilaterally fused, or bilaterally fused. Additionally, a series of measurements were performed to quantify overall size and shape. The structure of the hyoid, as revealed by the extent of fusion and overall size measurements was then compared against known age, sex, and ancestry data.

Results indicate that the hyoid is sexually dimorphic, though no significant differences exist between males and females with regard to fusion. However, age is a factor when considering a union between the body and greater horns in that among the young (0-9 and 10-19) no union occurs. There is minimal evidence for the occurrence of fusion between the body and greater horns during the third and fourth decades of life. Although an increase in the frequency of union occurs during succeeding decades, this study demonstrates that advanced age cannot be equated with fusion between the body and greater horns.

This enhanced awareness of the variability that truly characterizes the hyoid will enable more accurate pathological, anthropological, anatomical, and clinical descriptions of the hyoid in forensic settings.

Hyoid Bone, Laryngeal Trauma, Morphological Variation

G49 Relevance of the Autopsy as a Medical Tool: A Large Database of Physician Attitudes

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The goals of this presentation are: 1) to examine a large data base of physician attitudes about the value of the autopsy, 2) to attempt to correlate physician opinions about autopsy to their levels of experience with and knowledge of the procedure, and 3) to determine whether there is sufficient interest in the autopsy to make revitalizing it worthwhile as a contributor to medical practice.

Background: Autopsy rates for patients dying in hospitals have declined from approximately 50% in the 1950s to at or below 10% of similar patients today. A previous pilot study survey distributed to attending physicians in a large, urban, university hospital center suggested that in spite of this decline, physicians believed strongly in the usefulness of the autopsy. Most disagreed that diagnostic procedures were so accurate that autopsies had become irrelevant, and most disagreed that concern over litigation affected their desire to request autopsies. Given the results in this pilot survey, physicians' positive opinions about the value of the autopsy appeared to contradict their apparent declining requests for the procedure. It became important, then, to confirm that these attitudes hold true in a larger and more varied sample, perhaps more indicative of the population of physicians in general.

Methods: This study uses essentially the same survey on autopsy knowledge and opinions that was distributed in the pilot study. A slightly revised survey was distributed to all attending physicians in a second large, university-affiliated medical center and a large military-affiliated medical center. The database of physician responses now includes three major hospitals, two university-affiliated (one private and one public) and one military, as well as one east coast and two west coast hospitals. Including the pilot study, the 10-question survey has now been distributed to 723 full-time attending physicians. The survey was an anonymous, one-page, multiple choice format questionnaire, that could be completed in under five minutes. Clinicians first identified their department, years of practice, and the number of autopsies they had observed or participated in as a student, resident, or attending physician. They then estimated their departmental autopsy rate and opined on the sufficiency of that rate to meet departmental goals for education and research. The remaining questions examined, among other topics, physician belief in the value of the autopsy for confirming diagnostic results, its potential affect on medical practice, the effects of possible litigation on autopsy requests, and how prepared physicians felt to discuss autopsy with families of patients.

Results: A total of 113 military physicians and 94 university physicians provided 207 (29%) total responses to the survey. Departmental response rates varied from 13% to 80%, with response rates slightly higher on average at the military facility. Attendance was fairly evenly spread in years of practice from less than 5 to over 20 years. Physicians at the military center had been in practice somewhat longer than their civilian counterparts and, as a result, seemed to have had slightly more exposure to autopsy. However, overall exposure to autopsy by observation or participation was low, with 52% of physicians being involved in fewer than 5 cases (11% responded 0 cases) and only 21% indicating involvement in more than 20 cases over their careers. Respondents in nearly equal percentages (35% and 40%) agreed and disagreed that their departmental autopsy rates were sufficient to meet departmental goals, with this bimodality probably traceable to 46% indicating no knowledge of the rate. Fully 36% (the largest response category by far for this question) could not say whether or not results were reported in a timely fashion. The pattern of responses of military-affiliated physicians did not appear to be statistically different from those of university-based physicians on opinion-based (non-demographic) questions, so the two groups were combined for much of this analysis. Physicians across years of practice, autopsy experience and knowledge, and departments agreed (72%) that autopsy results could affect their medical practice and disagreed (74%) that the accuracy of modern diagnostic procedures makes autopsy obsolete. Interestingly, one of the largest concentration of responses in the survey (77%) disagreed that litigation concerns played a role in the request and use of autopsy. This result directly contradicts one of the principal conclusions in the literature offered to explain declining autopsy rates. Also, in spite of the apparent collective lack of experience with autopsies indicated by responses to the demographic questions, physicians mostly (79%) claimed to be comfortable with discussing the autopsy with family members. However, the most resounding result from the 207 physician responses to the survey appears to be that both military and civilian physicians feel that the autopsy is a relevant clinical instrument and medical tool, even when they have experienced, requested, discussed, or personally used very few of them.

Conclusions: The expanded survey data confirms that physicians highly value the autopsy as a clinical tool, in spite of declining rates and decreasing exposure to autopsy over their professional lives. These opinions do not appear to vary significantly across types of institution or years of experience. The survey data does not support (in fact, seems to refute) causes of the decline in the use of autopsy often cited in the literature, i.e., delayed reporting of results, concern over litigation arising from findings, or belief in the accuracy of current diagnostic procedures. The next step of this research will be to model the effects of

implementing changes in autopsy education and procedures on physician request rate and use. The anticipated changes would include, at minimum, more widespread exposure to autopsies at each stage of medical education, better pathologist to clinician communication, and prompt and relevant reporting. The autopsy, a procedure that physicians claim to value so highly, should not be allowed to become only a forensic tool and slip out of existence as a contributor to medical knowledge.

Autopsy Rates, Autopsy Relevance, Physician Attitudes

G50 Analysis of Five Thousand Forensic Medical Expert Opinions

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The goals of this presentation are to describe and characterize the major types of forensic expert medical opinions done by forensic pathologists in Hungary and explore strategies that may help improve service.

Methods: In majority of European forensic institutions, forensic pathologists play an important role to formulate expert medical opinion, additional to their regular medico legal autopsy workload. In many places these expert opinions even outnumber the forensic autopsies performed. At the Institute of Forensic Medicine, nearly 15,000 written opinions have been prepared (non-autopsy cases) during the last four years on wide variety of cases. Although majority of these involved forensic psychiatrists and psychologists, approximately 5,000 cases were clearly completed by the Institute's forensic pathologists.

Results: Cases include medical malpractice but also homicides, accidents, disability, worker's compensation, fight injuries, interpreting toxicological results, etc. Results of expert opinions will be provided based on the type of case and authorities' requests (civil or criminal court, police, DA's office, other institutions). The major categories of cases will further be broken down and scrutinized from many aspects. Preparing the expert opinion does not necessarily require complete patient examination; the percentage of giving opinion from documentation and charts only varies widely (i.e. in 6% of civil cases and in 23% of criminal cases no patient examination was involved). The increasing number of suspected mistakes in medical treatment allowed the authors to point out recurrent mistakes, and to categorize and statistically analyze the causes of claims. (i.e., misguided allegations, error of judgment, incompetent care, failure of communications, lack of expertise, etc.). Dealing with medical malpractice cases by forensic expert sometimes require input from clinicians to overcome the gap between academic approach (theory) and the care and treatment of an individual patient (practice). The authors will present personal experiences on why and when clinicians are asked to participate in formulating an expert opinion.

Disability evaluation is an important part of forensic medical evaluation in caseloads. The Institute represents a 3rd level forum. All patients were examined twice before a civil court, specializing in disability issues, referred them to the Institute for a final opinion. Further details will be provided on cases involving temporary and permanent injuries (what is done, how is it accomplished). Additionally, the number of questions submitted and the most often asked relevant questions, which an expert opinion should answer in each of the expert opinion categories, will be discussed.

Finally, challenging the forensic medical opinion in court of law works in Hungary will be explained. A very important index of the Hungarian forensic expert's work is the acceptance rate of expert opinion in the court, which will be presented.

Forensic Expert Medical Opinion, Medical Malpractice, Disability Evaluation

G51 The Happy Land Homicides: 87 Deaths Due to Smoke Inhalation

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After attending this presentation, the participant will understand the roles of carbon monoxide, cyanide, ethanol, and hydrochloric acid in fatal smoke inhalation.

On March 25, 1990, eighty-seven people died of smoke inhalation at the "Happy Land Social Club" in New York City. A 36-year-old man, who earlier had been ejected from the unlicensed club after a verbal altercation with his former girlfriend who worked at the club entrance, intentionally started the fire. He went to a nearby service station, filled a plastic container with a dollar's worth of gasoline, and returned to the club. He threw the gasoline and lit matches into the only entrance of the two story social club. Smoke quickly filled the club. Although the fire was extinguished within minutes, all but five of the occupants of the building were found dead within the building.

Within 36 hours the New York City Office of Chief Medical Examiner performed 87 autopsies on this group of healthy, young people, all of whom quickly died from smoke inhalation from a common fire source. All decedents were visually identified and all had soot in the airway extending to the major bronchi. Only 30% of the decedents had thermal injuries and most were partial thickness burns involving less than 20% body surface area.

Carboxyhemoglobin (COHb) concentrations ranged from 37% to 93% with a mean of 76.5%. The vast majority (92%) of the decedents had COHb concentrations over 60%. Ethanol was detected in 72% of decedents with a range of 0.01 to 0.29 g% and a mean blood concentration of 0.11 g%. Of the 24 decedents with no ethanol detected at autopsy, the average COHb concentration was 79%. The 15 decedents with blood ethanol concentrations of 0.15 g% or higher had an average COHb concentration of 73%. Cyanide concentrations ranged from 0 to 5.5 mg/L with a mean of 2.2 mg/L. Nine decedents had no cyanide detected and seven had cyanide concentrations of less than 1 mg/L. The tracheal pH ranged from 5 to 7 (mean 6.4).

Since all decedents in this instance died from smoke inhalation in the same smoke filled environment, if cyanide was a reliable indicator of smoke inhalation, then all the decedents would have detectable cyanide. The fact that nine of the decedents had no cyanide detected and another 7 had less than 1 mg/L demonstrate that cyanide did not play any role in several deaths. In fire deaths, cyanide concentrations do not provide helpful, interpretable information and need not be performed on suspected smoke inhalation deaths. Alcohol does not appear to cause death at a lower COHb concentration as the mean COHb concentrations in the intoxicated (BAC >0.14g%) and sober groups were similar (73% vs. 79%). Hydrogen chloride inhalation, as judged by comparison of the pH of tracheal mucosa to controls, was not a factor. The cause of all deaths was smoke inhalation and the manner was homicide.

Forensic Science, Carbon Monoxide, Smoke Inhalation

G52 Documenting Patterns of Injury in Fire Victims

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The goals of this presentation are to review 1) problems associated with documenting burned human remains, 2) recording patterns from fire trauma, 3) identifying features that may indicate body position and fire dynamics, and 4) suggestions for charting victims of mass disaster fatalities.

Dynamic burning processes affecting a human body produce one of the most complex alterations of form by distortion into the pugilistic posture. Additionally, further obfuscation occurs from superficial thermal changes to skin (charring, blistering, and splitting) and as damage progresses, exposure and destruction to deeper layers of subcutaneous tissue, musculature, viscera, and bones. Adequate records and documentation of burning changes are vital since it is known that the sequence of tissue changes correlates with heat source, origin, and body position especially if the expected pugilistic posture is not attained. The ability to use pathological examination of the body in this manner allows results to be integrated with independent investigation by anthropologists, fire marshals, and arson investigators. In such instances mere dictation of the findings fail to capture all the salient features and would otherwise be long and cumbersome. Borrowing on the ancient wisdom of a picture is worth a thousand words, a graphic presentation seems to be in order; however, accomplishing that in a constructive way is challenging.

One of the most difficult tasks in forensics is the ability to produce records for public consumption that are also useful as a court document and effectively convey the necessary information to communicate the same concepts understood by the examiner. Even more difficult is documentation limited by two-dimensional representation of a complex three-dimensional process. The emphasis on mass disaster preparedness compels experts to improve the entire process for all types of fatalities but this seems more so in the burn victim. These fatalities are virtually always out of the anatomical position, and usually have various layers of tissues or organs exposed. Photographs are very useful but hardly fit for public release and if overly graphic, may even be considered too inflammatory in the autopsy protocol and render it unsuitable for jury use unless redacted.

At the University of Tennessee, Memphis physicians have undertaken several methods to achieve a permanent record of observations that retains a continuity of interpretation readily discernable after the passage of time and serves as an effective basis of communication to investigators and juries alike. Taking advantage of this active research in the burning process the authors are now sufficiently aware of the expected sequence of the changes to the body to identify what parameters are more useful to record. The manner in which they are recorded may vary with the case and several examples are presented.

With the advent of the digital age it is possible to take photographs of any sort and convert them into digital images (if not so originally) and digitally redact them to the point of abstraction with a subsequent loss of inflammatory content. Although this has not been subject to challenges in court, the digital images are not tendered as evidence so much as an aid to testimony. It is also important to be able to describe the process by which the redaction occurred. Most often the techniques used are to eliminate the color aspect and present the photo in grayscale (black and white) followed by use of computer filters to portray the edges of the image. At times retaining the color scheme does enhance clarity and is retained. It is then helpful to graphically add text to point out the various landmarks and interpret the image so orientation and understanding are not lost.

Another method goes back to the time honored process of diagramming various views of the body using charts depicting the skeleton outlined by the body contour. In this fashion changes in the skin, soft tissue, and skeletal elements are charted together, merging the pathology and anthropology findings into the same document. Charts depict the body in anatomic position since this is a reference standard, and allows for notation of any deviation from the expected pugilistic posture. Using either different colors or textured fills can document the stages of soft tissue changes. Once recorded, a comparison with diagrams depicting the expected pugilistic posture, patterns of soft tissue loss, exposure, and direction of skeletal exposure can be easily accomplished. This creates a permanent visual record to be utilized by other agencies or investigators as an adjunct to their investigation and serves as a non-inflammatory source document to educate the jury.

Skeletal Trauma, Anatomical Charting, Fire Investigation

G53 Suicide Attempt Using a Self-Made Rifle

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The literature reports mainly the use of self-made guns but more seldom the use of self-made rifles. As a contribution to the understanding of this unusual firearm, the author presents a case involving a suicidal gunshot wound to the head from a self-made rifle that fortunately did not result in the death of the victim.

The use of self-made guns is quite unusual because of the general public's ready access to professionally manufactured handguns or rifles, especially in the U.S. In France, the policy is very different and it is difficult to purchase a handgun or even a rifle for hunting purpose. Nevertheless, the use of self-made guns is rare in France and the experience of pathologists with firearm injuries caused by such guns is fairly limited. The literature reports mainly the use of self-made guns but more seldom the use of self-made rifles. As a contribution to the understanding of this unusual firearm, the authors present a case involving a suicidal gunshot wound to the head from a self-made rifle that fortunately did not result in the death of the victim.

A 34-year-old, depressed man with medical history of suicide attempts was discovered in his bedroom with a rifle near him. Still alive, he was rapidly carried by helicopter to the hospital of Strasbourg and underwent cerebral CT-scan examination and skull radiography. The local prosecutor requested the authors examine the victim.

The victim was examined in the emergency unit. He was maintained artificially unconscious. Skin examination showed a medio-frontal contact gunshot wound located 10 cm above the glabella. No exit wounds were seen. The CT scan showed a right subdural hematoma and a fragmentation of the bullet through the entire right hemisphere. A major element of the bullet was found in contact with the right occipital lobe, under the skull. Skull X-Ray showed the fragmentation of the bullet following a horizontal direction. The direction of the bullet was from front to back, slightly from left to right, and quite horizontally. The maximum distance between the frontal wound and the right or left second finger was 76 cm. The victim was known to be right handed.

The prosecutor informed examining physicians that the distance between the muzzle of the rifle and the trigger was of 84 cm. This was inconsistent with a suicide. Therefore a decision was made to review the scene and rifle.

The rifle was a self-made weapon with a broken trigger, and the only manufactured part was the barrel. The needle was broken and the butt was missing. A striker had been made with a plain pipe sliding within a boiler tube. The posterior part of the plain tube was pointed. On the scene ground and the walls were examined for a crack. A 12 cm vertical recent crack was found on a wall, starting 173 cm from the ground. The victim was 176 cm tall. He had certainly put the muzzle of the rifle on his forehead and fired the weapon by hitting the wall with the posterior part of the rifle. This could explain the direction of the bullet within the skull and the location of the entrance wound. This could also explain how the rifle had been fired making any consideration regarding the distance between the trigger and the muzzle irrelevant.

Epilogue: the victim survived with a left hemiplegia, and confirmed a few months later exactly what the authors had supposed on the scene.

Self-made Rifle, Suicide, Zip Gun

G54 Suicidal Jumping

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The study was undertaken to investigate the pattern of injuries, the survival times, and the demographics of people who committed suicide by jumping from a height.

The authors reviewed 495 forensic autopsies performed at the Institute of Forensic Medicine, Semmelweis University, Budapest, Hungary between 1996 and 2001 in which the manner of death was suicidal falling from height (all jumps resulted from suicidal intent). During this period suicidal jumping was responsible for 16 % of all suicides in males and 18% in females. In the case of suicidal jumping the male/female (m/f) ratio was 1.35; the overall suicide m/f ratio was 1.6.

Important to note is that 78% of the males and 82% of the female victims immediately upon impact in a public place. The hospital was listed in the authors' database as the place of death in 13% of the males and 14% of females, although a fraction of these people actually committed suicide by jumping while being treated in a hospital. Statistical data pertaining to what department and why the jumper was hospitalized will be provided. Of the remote suicides, 4% of males and 2.4% of females could not reach the hospital and died during EMS transportation.

Demographic analysis shows that age distribution curves run fairly together for males and females after the age of 40. In younger age groups a strong male predominance was present (m/f ratio was 10 under 20 years of age, 2.7 in age group between ages 21-30 y).

The most important aspect of this work evaluates the injuries sustained during landing. All victims sustained wide range of multiple injuries. The frequencies of bone injuries (upper, lower limbs, pelvis, vertebrae, chest, and cranium) and soft tissue injuries (chest, abdominal organs, and aorta) were collected and analyzed statistically. The most common injury patterns were fractures of lower extremities and the spine. The Injury Severity Score was used to grade injuries for quantitative comparison with the height of falling. Most suicides (two-thirds) had serious mental illness. The blood alcohol level in toxicological reports on all victims was also reviewed. Overall 19% had positive results, although alcohol was present in blood of 38% in the youngest age group (16-20 years of age) and it was present in only 8 % in the oldest victims (age 71 and over). Positive alcohol tests revealed alcohol levels less than 0.15% in 62% of the jumpers and 17% of positive cases showed blood alcohol levels higher than 0.25%.

Monthly periodicity revealed the highest number of cases occurred in June and the lowest number of cases occurred in February in both sexes. Weekday analysis revealed that Monday is a critical day for males and Tuesday for female suicidal jumpers.

Falling From Height, Injury Severity Score, Survival Time

G55 Suicide in Eastern Crete

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The goals of this paper are to present data on suicide cases from autopsy records of the Forensic Sciences Department of the University of Crete, during the years 1997-2001 and to inform the forensic community of the variation extent of parameters like sex, age, time, and method of suicide.

Introduction: When pain exceeds pain-coping resources, suicidal feelings are the result. Suicide prevention programs try to lower the incidence of the event but it is still a serious public health problem. It is well known that geographic variation and ethnic composition are very important parameters affecting suicide. This study is an attempt to provide detailed information of the present situation in Eastern Crete and try to find the slope of the relationship between the suicide cases in this area and the rest of the country.

Methods/Results: Data collection involved medico-legal records of completed suicide cases from January 1, 1997 to December 31, 2001. A total of 139 records were reviewed. Results indicated that 25.18% of the victims in successful suicides were females and 74.82% were males. Spring was the period of the year with the most elevated numbers and the highest month recorded was May. Of the cases reviewed, 15.82% of suicides were under the influence of alcohol and 8.63% under the influence of illegal drugs. Only one case under the age of 20 years old was observed, whereas in the U.S. approximately three fourths of all deaths among persons aged 10-24 years result from only four causes: motor vehicle crashes, other unintentional injuries, or homicide and suicide. Suicide rates among elderly were found to be low. A finding that is quite contradictory with the rest of Europe where the suicide cases in elderly are approximately equal to the youth levels. Suicide methods were mostly violent. The most frequent method was hanging, seen in the 36.69% of the all cases followed by fatal poisoning with an incidence of 29.5%. Poisoning was generally the result of pesticide ingestion and was very widely used by females. The use of firearms forms 13.67% of the cases and is used exclusively by males. Although some studies indicate that rural men of all ages are twice as likely to commit suicides as their urban counterparts, the authors' study showed that 79.14% of suicides occurred in Heraklion the mostly populated city of Crete.

Conclusion: Suicidal events are initiated in order to change the contents of awareness of personal existence. Potential victims regard their lives as having unacceptable values because their understanding of meanings converges on a self defined criteria for which death is preferable. As this convergence approaches congruence, the wish to return to an earlier more satisfying state is approximated by a wish to die. The facts of termination and the occurrence of a physical death are expected to change distressing awareness without causing cessation of all awareness. Even those who deny life after death will imply that nothing will feel better than the present situation. However, there is always a window of opportunity to introduce prevention efforts. The authors believe that reliable and valid data of the present situation in an area will be beneficial in combating this very serious problem and establishing prevention programs.

Suicide, Crete, Autopsy

G56 Postmortem Findings in 22 Victims Due to Two Grain Silo Explosions in France

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The goals of this presentation are to describe and recognize the injuries and types of wounds resulting from explosions.

Silos located on industrial sites in Metz and Blaye, France and containing barley grain exploded; the first on October 18, 1992 in Metz and the second on August 20, 1997 in Blaye. In total there were 25 victims including 23 deaths (12 in Metz, 11 in Blaye) and one survivor in each case. This retrospective study concerns 22 cases, 11 at each site.

All 22 victims had multiple lesions due to the explosion and its consequences. The lesions demonstrated the effect of the blast associated with falling and projection of concrete fragments, heat, intoxication, and asphyxia. Death was instantaneous for all victims except one in whom the autopsy findings and complementary tests suggested an extremely

short period of survival. The role of the forensic doctor is therefore essential and should be included in emergency plans in order to facilitate the initial assessment, shorten the time taken to identify the victims, and improve thanatological procedures. Although dust explosions in agro-business plants, particularly cereal units, are becoming more and more frequent, postmortem data are rare in the literature.

Explosion, Postmortem Findings, Injury

G57 Injuries of an Armored Vehicle Occupant During Armed Robbery: A Case Report

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The goal of this case report is to illustrate, by means of text and photographs, peculiar passenger injuries related to gunshot damage of the parts of an armored vehicle.

Armour plating is a system of reinforcement of a vehicle designed to protect passengers from attacks perpetrated from the outside for various purposes (robbery of valuables, homicide, abduction, car theft, etc.). The vehicle is usually built in such a way as to resist penetration by bullets from firearms. However, hi-powered military guns can damage the vehicle's structural parts and may cause high velocity fragments (secondary bullets) to be projected, which can seriously wound passengers. The authors report the results of an investigation carried out to establish the dynamics of the wounding of a policeman seated in a valuable transport van during a robbery.

In June 2002, along a main road in the district of Bari, a Fiat Ducato armored van was assaulted by unknown muggers and was robbed of a large sum of money. After the robbery, 25 cartridge shells were found lying in the road belonging to three different military weapons (a .223 Remington automatic rifle and two 7.62x39 Kalashnikov assault rifles). One of the members of the crew inside the van was wounded in the right buttock, diagnosed at the hospital E.R. as a firearm injury with retention of the bullet. The victim underwent surgery to extract the foreign body, a steel rod with an irregular circular section of about 7 mm in diameter and 3 mm in thickness with a concave surface while the other convex side was lined by thin parallel longitudinal stripes. These features excluded the possibility that this metal fragment could be a component of a firearm cartridge. Inspection of the van revealed no less than 29 points of bullet damage; 7 of these had struck glass surfaces (the windscreen and left back window) without breaking them, and the others had pierced the metal bodywork of the vehicle; 7 in the posterior part; 5 in the anterior part; and 10 in the left lateral part (including the driver's door). The 7 holes discovered in the rear of the vehicle were regular in shape, almost perfectly circular, with clean borders and a diameter of around 6 mm; all the other holes had different characteristics (irregular shape, 8-9 mm diameter, etc.). Further examination of the rear part of the vehicle showed that two bullets had reached and penetrated the armor plating protecting the cabin, perforating the backs of the anterior seats; the right one was completely pierced and blood stains were found on the anterior covering. The two seats were removed and disassembled; in the back of the left seat two very small metallic fragments were recovered. Nothing was found in the back of the right seat. The above data enabled the authors to conclude that one of the .223 Remington bullet had penetrated the rear part of the vehicle, with a horizontal trajectory, and detached the fragment of armor plating that had wounded the victim.

The recommended strategies for accurately determining causes of injury are discussed, including ballistic and medical data that have to be considered and evaluated in order to gain an overview of the mechanisms underlying injury of armored vehicle occupants.

Armed Robbery Assault, Armored Vehicle, Occupant Injuries

G58 Roll-Over Automobile Accident Survived By the Author as a Passenger

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The attendee to this presentation will learn that most transportation accidents are multifactorial and that 3-point restraints are very effective in preventing serious injuries and deaths in vehicular accidents.

Trained investigators and attorneys recognize that most, if not all, transportation accidents are multifactorial. Rarely does a survivor of a vehicular accident such as this have both the desire, and the opportunity to document the scene of the accident and the condition of the vehicle soon after the event. Images of vehicle and scene will be presented.

In England, four friends took a day trip by automobile in late winter. The owner and driver of the 1992 Toyota Carina 4DS was a 76-year-old male. Three friends accompanied him, the author in the left rear seat. The owner-driver drove about 184 miles with several stops on two-lane roads in cold wind and rain. The destination was reached in late afternoon. The return trip was begun at about 7:30 p.m. on two-lane roads and in pitch-dark and rain.

Nearing the driver's home and on a straight, smooth, two-lane asphalt road, he allowed both left-side wheels to suddenly fall onto the shoulder. He quickly over-corrected with the car sliding right and into the center of the road. Over-correcting again to the left, the driver narrowly avoided a telephone pole on the left shoulder as the car left the road and traveled obliquely down a 2-3 foot steep bank turning onto its right side. The right front nosed down into a muddy field, the car then overturning in its longitudinal axis and coming to rest on its top facing the direction of travel. Each occupant was belted; each escaped through his/her window. Three occupants each sustained minor injuries.

The next afternoon, the author obtained the driver's permission to take Kodachromes for teaching purposes. The windshield was extensively cracked, and was detached at its crown. The roof was indented back to the center posts, but passenger space was otherwise preserved. The accident scene was also documented.

Analysis - This accident was clearly multifactorial: 1) an elderly driver with chronic disease, 2) poor weather, 3) driver fatigue, 4) a slick, newly paved road at the accident site, and 5) the driver, once in trouble, over-correcting twice.

Ameliorating factors: 1) speed slowed by braking before leaving the road, 2) no other traffic, 3) driver avoiding the telephone pole, 4) rain-soaked field absorbing roll-over impact, and 5) all passengers were restrained.

Conclusion: A potentially serious multifactorial accident in which the restrained occupants were nonetheless fortunate to survive.

Automobile Accident, Multifactorial, Restraint Systems

G59 Intracranial Internal Carotid Laceration at the Site of an Atherosclerotic Plaque: A Case Report

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The goals of this paper are to present to the forensic community an unusual injury and an analysis of its mechanism with respect to both trauma and natural disease.

This is a case of a 35-year-old man who received a blow to the face that abruptly and forcefully hyper-extended and rotated his head to the left. Autopsy revealed an intracranial right internal carotid artery laceration extending from a calcified atherosclerotic plaque, with an

associated basilar subarachnoid hematoma. This injury is unusual both because of its intracranial location and because of the presence of the atherosclerotic plaque.

Hyperextension of the head can cause injury to the vessels at the base of the brain. Generally, the extracranial portions of the vessels are affected, and laceration is believed to be caused by the sudden stretching of these vessels due to the abrupt movement of the head. In this case, the intracranial internal carotid is affected, which can be partially explained both by the rotational acceleration of the brain within the cranium as the head moves in response to the blow, and the abrupt increase in intravascular pressure caused by vessel stretching. During hyperextension or rotation of the head, the brain oscillates in the cranium due to its inertia, and this oscillation is opposite to the movement of the head, exposing tethered vessels within the head to shear forces. The quick and exaggerated movement of the head also stretches vessels, particularly those present in the neck, causing an abrupt increase in intravascular pressure that is transmitted to the intracranial portions of the vessels.

The atherosclerotic plaque found at the site of the laceration may also have contributed to the injury. Atherosclerosis has been documented to alter the structural integrity of vessel walls by destroying and altering tissue. Additionally, atherosclerosis changes the elastic property of arterial vessels and therefore lessens their ability to respond to abrupt or large changes in pressure load, with the response being more impaired the greater the pressures applied. Synergistically, the effects of atherosclerosis may have made the intracranial carotid more vulnerable to trauma than a healthy, non-atherosclerotic vessel might have been.

In order to delineate the roles of trauma and natural disease in the formation of this unusual lesion, photographs of the case are shown, and several published references on both traumatic injury to the head and neck vessels and atherosclerosis are reviewed and cited.

Hyperextension, Atherosclerosis, Subarachnoid Hemorrhage

G60 An Unusual Case of Crossbow Homicide

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The goals of this paper are to present a case of homicide due to a cranial encephalic wound provoked by an unusual lethal means identified also through experimental investigation.

A homicide is presented. A male is first rendered defenseless, blinded by a caustic substance and suffered head and chest wounds by a penetrating weapon missing from the scene of the crime. The peculiarity of the wounds and the scarcity of circumstantial evidence made additional investigation necessary in order to identify the weapon, including firing tests on experimental cranial models, for comparison.

A 52-year-old Caucasian male, a farmer missing from his home for two days, was found in a comatose state by the police in a forest in the Tuscan countryside. No weapon was found at the scene of the crime. The subject was revived in intensive care where wounds from a caustic substance were revealed on the face, eyes, shoulders, and back. In the left occipital region there was a round wound 1 cm in diameter and on the left hemithorax an oval wound 0.8 x 0.3 cm in diameter. The CT cranium revealed a large area of hemorrhage (25-30 cm) in the left temporal-mesial capsular nucleus, with hemo ventricle and shift to the right of the median line, the encephalic trunk appeared compressed with an obliteration of the pons mesencephalic cistern; the CT chest revealed integrity of the pulmonary and cardiac structures. The subject died 98 hours after he was found. The autopic macroscopic exam confirmed the presence of wounds due to liquid burns on the face, eyes, shoulders, and back. The chest revealed, on the cutaneous level, an oval shaped wound,

with the dimensions of 0.8x 0.3 cm. On the skull, in the left occipital region, the scalp revealed an oval shaped wound, 0.8x 0.3 cm in diameter that continued into the soft tissues provoking a small semicircular sternal bone erosion, 0.3 cm in diameter. On the cranium, in the left occipital region, the scalp presented an oval shaped wound, on the main traversal axis, 1x 0.3 cm in diameter, surrounded by traces of reddish color; in correspondence to this wound the left occipital bone revealed a round wound with clean cut outlines, 1 cm in diameter. The frontal left bone presented, on its external surface, an area of irregularly shaped estrous flexions of the bone 1.3 x 1 cm in diameter and, on the internal surface, a round wound with clean cut outlines, not along the entire depth, 0.5 cm in diameter. The brain was sectioned with coronal cuts according to the Pitres technique. The left occipital pole presented a round wound 1cm in diameter along all of the encephalic lining, from the base upwards, crossing the hypothalamic region, the anterior horn of the lateral left ventricle until reaching the left frontal pole, where a round wound, 0.8 cm in diameter, was present. The entire distance from the left occipital region to the frontal left bone measures 23 cm. The histological findings of the brain revealed subarachnoid and intraparenchymatous hemorrhage, "red neurons," diffuses axonal damage, confirmed by the positive results to the immunohistochemical dye for amyloid precursor protein (BAPP). According to the findings from the sectioning table it was possible to conclude that judging from the position and extension of the caustic wounds, acid was used to render the subject defenseless and successively strike him with greater ease. The chest wound was attributed to the use of a weapon with a pointed apex and scarce penetrating potential (2-3cm). In the cranium, the penetrating weapon once perforating the left occipital bone completely penetrated the brain and terminated in correspondence with the frontal bone, where it did not have the necessary force to completely perforate it. These findings permitted the authors to direct the investigation towards identifying a long penetrating object, 1cm in diameter and not less than 15 cm in length. It must have been animated by a weapon supplying the necessary force to penetrate the bone surface in such a clean cut manner and the cerebral substance so deeply; also it must allow a manual extraction of the arrow or dart, or one via automatic mechanisms of return, incorporated in the weapon utilized. The hypothetical weapon compatible with similar penetrating means must be capable of firing a manually extractable dart (crossbow, bow, spear gun, etc) similar to the pistols used for animal slaughtering with captive bolt. In order to establish the lethal weapon, firing tests were effected utilizing both mechanisms and, in particular, a Bernet "Wildcat II" model crossbow with a 150 pound bow, loaded with a 38 cm long, 1cm in diameter aluminum arrow with a conical head of the same diameter and a captive bolt pistol with a 20 cm long, 1 cm in diameter stylus loaded with caliber 22 ammunition, a model conventionally utilized in many Italian slaughterhouses. Experimental models of human craniums were constructed using plaster to simulate the bone structure and filled with a synthetic spongy material, easily penetrable, but minimally resistant, in order to reproduce the brain. The test with the crossbow, from a distance of 12 cm, produced a wound perfectly compatible with the postmortem data. The test with a captive bolt pistol resulted compatible with the wounds observed in the postmortem examination only if a modified weapon was utilized (a. with a prolonged external stylus, b. removal of the blocks that limit the internal path of the stylus) producing a 23cm wound, much longer than the 7-9 cm normally produced by common pistols used for slaughtering animals. The wounds produced in the experimental models with both types of weapon have characteristics compatible with those observed in the cranium of the subject, however the captive bolt pistol created a wound superior to 21 cm only when subject to difficult handmade modifications of the weapon, possible but extremely complicated. These data led the authors to consider as feasible the hypothesis of a manually extracted dart. Thanks to this technical support and to testimonial evidence some months after the homicide, the investigation led to the arrest of an individual. A search of his property produced a

crossbow and modified metal crossbow arrows (removal of the head and filing of the penetrating extremity, positioning of the distal extremity of a device that facilitates manual extraction of the arrow). According to the postmortem findings and observation of experimental data, the sequestered crossbow and arrows proved to be the most probable scientific hypothesis of the weapon utilized for the crime. Only few cases of wounds due to crossbow mostly accidental or suicidal and rarely homicidal are reported, therefore, this rare case of homicide due to crossbow seems even more unique if the combined use of caustic substances to render the victim defenseless and the penetrating device (arrow) was not found on the scene of the crime was considered.

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Homicide, Crossbow, Caustics

G61 Body Found in the Waterway of Lille—Accident, Suicide, or Homicide?

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The authors report the case of a man found in a waterway and discuss the differential diagnosis for bodies found in water. These data are compared to those of the literature.

History: On June 20, 2002, a 42-year-old man is found floating face down in the waterway of Lille, France. At 8:00 p.m., a forensic pathologist performs a first examination at the edge of the waterway. He observes several wounds on the face with fracture to the skull and a peri-orbital bruise. The lesions are recent and could be attributed to a boat's propellers. This waterway is used as a barge crossing. There is a large brown bruise at right thoracic area. There is no suicide letter found and the man has no history of depression. An Autopsy is performed the next day and time of the death is estimated during preceding night.

Autopsy findings: The cadaver is not putrefied and is easily identified. The lesions on the face are not parallel. Some are small and blood flows out the wounds. The lesions have vital characteristics. Two hypotheses are considered: 1) the barge's propellers created the face lesions while he was still alive or 2) he was thrown in the waterway dead. The skull examination confirmed the second hypothesis. The brain was contuse with lesions. A round wound is observed. An entrance wound is present on the right temporal area and an exit wound is seen on left parietal area. This case was classified as a homicide. On X-Ray, no foreign bodies are found. All lesions on the face were penetrating. The cause of death is a hemorrhage of the brain with bruises.. After investigation by the police, the aggressor was found. He is a 40-year-old man. He reported that he used a large tool to strike the decedent in the head and face in a garage.

Discussion: A body recovered from water presents many challenges to the forensic pathologist. Drowning is a diagnosis based upon the circumstances surrounding the death with exclusion of other causes of death. Often, identification of subjects is complicated by decomposition. As in this case, the determination of cause and manner of death can be a daunting challenge. Moreover, many of the essential questions surrounding water deaths are answered after performing an autopsy. Was the individual alive prior to entering water is the essential question.

This case is a good illustration. The diagnosis of drowning is one of exclusion. Most of drowning deaths are accidental. This case was compared to suicides by drowning. The characteristics are studied to point out the difference between homicide and suicide during the crime scene investigation. The importance of crime scene investigations is reviewed. This case illustrates the difficulties in obtaining forensic evidence to conclude a homicide or suicide. Characteristics of skull bones lesions were compared to discover the important time of immersion with lesions as in this case. The characteristics of these lesions are important to when reviewing a subject without putrefactive changes.

Homicide, Drowning, Autopsy

G62 Pink Teeth in a Series of Bodies Recovered From a Single Shipwreck

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The goals of this presentation are to review the causes and distribution of the phenomenon of pink teeth among a series of bodies.

Pink staining of the teeth is more common in victims where sudden death occurred because the blood can remain liquid due to increased fibrinolytic activity. Hemoglobin is the most likely pigment responsible for this postmortem process that can be considered analogous to postmortem lividity. In fact, there is general agreement that the first requirement for the occurrence of pink teeth is an increase of blood in the pulp. All the reports on pink teeth indicate that the diffusion of the blood in the pulp into the dentinal tubules causes the red discoloration of the teeth; this seems to be favored mainly by blood accumulation in the head either due to congestion (as observed in prefinal insufficiency of the right heart) or a postmortem head-down position (as in cadavers floating with their head in a downward position).

Pink teeth have most often been observed in victims of drowning but have also been reported in subjects who died suddenly and unnaturally by strangulation, hanging, knifing, and carbon monoxide poisoning. Since there is no obvious connection between the occurrence of pink teeth and the cause of death, the condition of the surroundings (especially humidity and temperature) must certainly play an important role in the development of pink teeth. This is supported by the fact that the majority of the cases described in the literature were exposed to a wet or moist environment, most having been recovered directly from the sea. The existence of water or a high concentration of aqueous solution intimately surrounding the teeth is one of the most important requirements for this postmortem phenomenon. Further prerequisites are hemolysis either by autolysis or by osmosis leading to subsequent diffusion of hemoglobin into the dentinal tubules.

Since in some of the retrospective studies not all jaws and/or teeth may have been examined thoroughly, the real frequency and distribution of the phenomenon remains unknown. In fact, forensic pathologists must have observed that the distribution of pink teeth can vary in a mouth and not all teeth are necessarily involved. The purpose of the present investigation is to study the frequency and distribution of postmortem pink coloration of the teeth among a representative sample of 52 cadavers. All bodies were victims of a single shipwreck, which occurred on March 13, 1997 in the middle of the Otranto Canal (Mediterranean Sea). An Albanian ship trying to land clandestinely on the Southern Italian coast sank following a collision with an Italian Navy warship patrolling the border. All the passengers in the four holds died as the ship was engulfed and settled on the bottom of the sea at a depth of 800 meters. The bodies were recovered from the seawater on October 21,

1997 after approximately seven months. All the cadavers shared the same cause of death (drowning), the same storage time in water (7 months) and identical environmental conditions (the temperature of the water at 800 meters depth was 4°C). A team of forensic pathologists carried out the pathological examinations while two forensic odontologists performed all odontological examinations separately and at different times. Sex, age, degree of decomposition, and dental examination were registered for each cadaver. A distinct pink coloration of the teeth was found in only 23 cadavers (17 females and 6 males) of ages ranging between 13 and 60-years. The average age of the deceased was 27 years in accordance with the fact that the phenomenon is more pronounced in younger individuals because the dentinal tubules become narrower or are obliterated with age and are less penetrable by the pigment responsible for postmortem pink staining. It was also possible to confirm another common observation that the pigmentation is more prominent on the anterior teeth with single roots than in the posterior teeth with multiple roots. Using histochemical methods the causative pigment was also identified as hemoglobin and/or its derivatives.

Pink Teeth, Postmortem Staining, Marine Environment

G63 Calcified Primary and Metastatic Pancreatic Carcinoma Discovered in Skeletonized Remains

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The goals of this presentation are to report a case of interest detailing the unexpected discovery of calcified masses during reduction of a body to bone for anthropologic study

Calcification in adenocarcinoma is not unusual and is reported to occur in many types of gastrointestinal neoplasia. Calcification associated with pancreatic carcinoma has been reported in the context of both discrete calculi formation and diffuse calcifications. Calculi are usually described within pancreatic ducts proximal to the tumor mass, presumably as a function of obstruction. However, stone formation has also been reported to precede identifiable carcinoma, making the causal and temporal relationship a topic of debate. Diffuse calcification of a tumor mass, surmised to be a type of calcinosis, is described in both primary and metastatic sites. Diffuse calcification in pancreatic neoplasia is described largely as either peripheral plaques or central, irregular nodules. This is a report of an archival case of calcified pancreatic cancer that is unusual with regards to the nature of the calcified masses and the circumstances in which they were discovered and obtained. Two relatively large, previously undetected finely trabeculated hard masses representing the calcified remains of the primary tumor and a hepatic metastatic focus were retrieved after the rendering of retained remains to bone for the purpose of anthropologic study.

A 76-year-old female first reported acute symptoms of weight loss, epigastric pain and nausea to her family physician in April of 1978. A diagnosis of cholelithiasis was made at that time. She was temporarily lost to follow up for one year and was eventually admitted for work-up and evaluation of her progressive epigastric pain. During her admission history she reported marked weight loss over several years that she attributed to poor diet. A history of pancreatitis was denied. Abnormal findings upon physical exam included a pelvic mass, hypokalemia, anemia, and malnutrition. There is no record of abnormal calcium metabolism or radiologically identified abnormal calcifications. An exploratory laparotomy was performed that revealed an inoperable carcinoma of the head of the pancreas resulting in palliative care. Her clinical course deteriorated until she was found to be unresponsive. An autopsy was not performed.

Since the body was not claimed, New Mexico State law provided for the retention of the remains for medical education purposes via the Department of Anthropology, Forensic Division, The University of New Mexico. In August 1979, the process of reduction to skeletal remains began. During the cut-down procedure, the initial harvesting of bones from the decomposed remains, previously undetected hard masses were found in the pancreas and liver. These were retained for continued enzymatic flesh removal. Subsequently, two calcified masses and a smaller dense stone were recovered. Current study of the archived stones revealed a 19.8-gram ovoid, white, trabecular, hard mass measuring 5.6 x 4.3 x 3.9 cm and a smaller, similar curved mass that measured 2.7 x 2.1 x 2.0 cm and weighed 4.5 grams. Chemical analysis of the masses revealed a composition of calcium carbonate. The small dense gallstone was rough, ovoid, light brown and measured 1.9 x 1.4 x 1.2 cm.

The calcifications in this case are unique in that they are apparently completely calcified primary and metastatic tumor masses that were not detected during medical evaluation. The masses consist of calcium carbonate in a lattice-like pattern recapitulating the extra-cellular space of the tumor. In the literature, calcifications in pancreatic neoplasia are commonly described as discrete nodular calcifications or peripheral plaques. The architectural complexity of the calcifications in this case is noteworthy. Since an autopsy was not performed, the discovery of hard hepatic and pancreatic masses during the initial bone harvest was unexpected. Although, there was a 5-month interval between death and discovery of the masses, it is unlikely that this represents some type of post-mortem calcification. It is probable that evidence of the existing calcifications was either lost or not collected. Viewed from the standpoint of forensic anthropology, this case begs a different type of question. It can be speculated whether a positive identification would have been made if this were a case of discovered skeletal remains including the two calcified masses, given the above medical history of a missing person.

Pancreatic Cancer, Skeletal Remains, Forensic Science

G64 Undefeated by Surgery: The Utility of Post-Surgical Foot and Ankle Radiographs for Identification: Focus on the Ankle

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After attending this presentation, the participant will 1) understand that radiographic comparisons of the ankle for positive identification can reliably be made even if there has been an alteration in the anatomy, 2) be able to quantitatively evaluate the "matchability" of such an identification, and 3) be able to recognize when such a comparison may be limited and more information is required before an opinion can be rendered.

Foot and ankle radiographs can be utilized as a basis of identification in forensic investigations. This type of information may be especially useful when examining fragmented, mutilated, and decomposed remains. The process of radiographic comparison is usually binary in nature, yielding a "yes" or "no" answer to the question: within a reasonable degree of medical certainty, did these radiographs come from the same individual? The authors have previously outlined, with respect to the foot, a quantitative method of reporting results, allowing for a systematic approach to the identification process. The same method had been applied in this study. This study focuses on the bones of the ankle joint; specifically, the talus and the distal segments of the tibia and fibula.

Experimentally, 53 sets of pre-surgical (antemortem) and post-surgical (simulating postmortem) radiographs of the foot and ankle were obtained from a tertiary care medical center. Up to four different radiographic views were considered: lateral, medial oblique (MO), ankle mortise, and antero-posterior (AP) projections. As in the previous study, the radiographs were not actual antemortem and postmortem radiographs, rather a simulation utilizing radiographs taken in the course of routine medical care. Sets of radiographs were selected by one of the authors, and included both legitimate matches and actual mismatches to simulate forensic context. The time lapse between the antemortem and simulated postmortem radiographs included a surgical procedure on the foot and / or ankle, and ranged from 2 months to 48 months allowing for alteration in anatomy by surgical repair and subsequent healing. As in the previous study, the authors wished to evaluate and grade, by a numeric system, the reliability of the match results. Radiograph sets were compared by two of the authors (NET and DED). Ten characteristic skeletal features were considered in the simulated postmortem radiographs. The antemortem radiographs were then evaluated for the same features. The results were scored as follows:

- (+1): If the feature was present and matched.
- (0): If the feature was either not present or its presence could not be determined.
- (-1): If the feature was present, but did not match, or (-1) if the trait was present in either the pre- or post-surgical radiograph but not both.

The radiographic sets were then independently evaluated, considering only the ankle joint, according to the medicolegal standard, "with a reasonable degree of medical certainty, these radiographs came from or did not come from the same person". Additionally, it was noted if there was not enough data visible in the ankle joint portion of these radiographs to determine a positive identification. Spearman correlation coefficients, to measure how the two methods of evaluating correlate, were calculated from the raw data.

Results were consistent with previous studies, and indicate that surgical intervention with subsequent healing does not preclude positive identification in foot and ankle radiographic comparisons. However, because the ankle joint is structurally less complex than the foot it contains fewer features that may provide the basis for identification.

Forensic Pathology, Human Identification, Ankle

G65 To Rave or Not to Rave: A Report of Three Fatal GHB Poisonings

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Gamma-hydroxybutyrate (GHB) has surfaced in the "rave" and "club" scene as a recreational drug, which is believed by users to be safe. There are increasing reports of near fatal and the occasional fatal outcomes of the use of this drug. It is simple to make, has euphoric effects, and has associated amnesiac effects, which make it an ideal candidate for use in the arena of date rape.

This report is of three deaths where GHB was the primary or sole toxic agent. In one case, death resulted from a suicidal consumption of drug where polypharmacology played a role. In the second case, hypothermia was a significant contributor to the cause of death. The third fatal case represents an accidental, isolated drug poisoning.

All blood samples obtained and analyzed were autopsy or admission blood and stored in sodium fluoride (NaF). Analyses were by liquid chromatography in the laboratory of Hospital for Sick Children in Toronto for Cases 1 and 2 and in the Virginia Division of Forensic Sciences in Case 3.

Results identified the levels of GHB to be: Case 1: 690 mg/L, Case 2: 55 mg/L, Case 3: 269 mg/L.

While GHB may be produced postmortem and may also be identified as a normal metabolite especially in the central nervous system, levels detected in these three decedents were well into the fatal ranges. The overlap with survivable intoxication is large. Why some individuals die with lower concentrations is unclear. Combination with other drugs or environmental conditions as in Case 1 and 2 respectively may have resulted in enhanced toxicity.

While GHB compared to other illicit drugs such as cocaine, opiates, or alcohol appears to be less serious to users, the clinical presentation of toxicity including death needs to be recognized by clinicians involved in the care of these patients. Pathologists performing forensic autopsies need to be aware of the use of this drug by this group of at risk individuals.

Samples from autopsy with subsequent testing of well preserved blood (in NaF), urine, and tissue needs to be processed in a laboratory geared to the identification of this drug. Interpretation of results must bear in mind the natural production of GHB for correct conclusions to be reached.

Lastly the dangers and legal implications of the use of GHB in date rape situations need to be remembered.

GHB, Fatality, Rave

G66 Methadone-Related Deaths in Palm Beach County

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The goals of this presentation are to examine the role of methadone in drug-related deaths in Palm Beach County from 1998 to 2002.

Methadone is a long acting oral opioid agonist used therapeutically to treat opiate dependency and in the management of chronic pain. Recent media accounts of an increase in the number of deaths attributed to methadone toxicity in Palm Beach County, FL, particularly among teenagers, have raised public concern over the illicit use of the drug. The authors examined cases investigated by the Palm Beach County Medical Examiner's Office over the period from 1998 to 2002 in which post-mortem toxicologic studies indicated the presence of methadone, to examine the role of the drug in these deaths. The reports of the post-mortem examinations and toxicologic studies and the investigative reports were reviewed.

Identified were 70 methadone-positive cases. There was a dramatic increase in the number of cases during the period, from 2 cases in 1998 to 37 cases in 2001 and 18 cases in the first quarter of 2002. The cases included 57 males and 13 females. Ages ranged from 16 to 72 years (mean 37.1 years). All decedents were white except for one black male. Methadone had been prescribed for chronic pain to 16 of the decedents. There were no cases in which the decedent was known to be enrolled in a methadone maintenance program.

The methadone-positive cases included 57 in which the death was classified as an accident due to drug toxicity. In 12 of these cases the cause of death was attributed to methadone toxicity alone and in 35 cases methadone was identified as contributing in combined drug toxicity. Non-toxic levels of other drugs were present in 9 of the methadone toxicity cases. Cocaine and/or cocaine metabolites were identified in 27 of the 36 cases of combined drug toxicity, morphine in 9 (5/9 with 6-MAM), oxycodone in 8 and ethanol in 8, with blood alcohol levels

ranging from 0.024-0.183 G/dL (mean 0.095 G/dL). In 23 deaths methadone was detected but was considered to be an incidental finding. These included 9 deaths attributed to other drugs and 13 to non-drug related causes (5 natural, 3 suicide, 4 accident due to trauma, and 1 undetermined gunshot wound). Methadone was detected only in the urine in six cases.

There was considerable overlap in the postmortem blood methadone levels among the groups. Levels ranged from .114-.984 mg/L (mean .430 mg/L) in cases where death was attributed to methadone toxicity; trace-1.243 mg/L (mean .331 mg/L) in cases of combined drug toxicity; .069-.664 (mean .242 mg/L) in deaths attributed to other drugs; and .072-.782 mg/L (mean .303 mg/L) among non-drug related deaths.

Data indicates that most deaths in which methadone plays a role are due to the use of the drug in conjunction with other prescription or illicit drugs. Establishing the role of methadone in these cases can be difficult in light of the other drugs present. The levels of methadone detected in these cases indicate that it may not be possible to determine what constitutes a lethal methadone range since the majority of cases involved drug interactions and since individuals may have different levels of susceptibility and/or tolerance. However, the data demonstrate that death can occur at methadone levels below the previously reported lethal ranges. Determination of the cause of death in methadone-positive cases necessitates correlation of the postmortem toxicologic results with autopsy results and investigative findings.

It is possible that the increase in methadone-related deaths may be in part due to more physicians prescribing the drug in light of the recent recognition of the hazards of other analgesics such as oxycodone. Street users of methadone may be unaware of its long half-life, with frequent use resulting in its accumulation to dangerous levels.

Methadone, Death, Drug Levels

G67 Comparison of the Distribution of Fentanyl in Deaths Related to Use and Abuse of the Duragesic® Patch and Intravenous Administration of Patch Contents

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The goals of this presentation are to provide the audience post-mortem distribution data of fentanyl relating to its route of administration

Fentanyl is a synthetic narcotic analgesic of high potency and short duration that has been in clinical use since 1963. Initially the drug was used as an adjunct to surgical anesthesia. The transdermal fentanyl system, under the trade name of Duragesic®, was developed for chronic pain control. The product labeling for the patch states that it is a schedule II controlled substance that can produce drug dependence similar to that produced by morphine. The transdermal system allows for the maintenance of a relatively even steady state blood concentration. The patches are available in three dosage forms: 25, 50, and 100 mcg/hr. Because of its relatively short half live of 3 ½ hours and high potency, an addicted individual is likely to constantly seek a source (supply) of the drug. The Sedgwick County Regional Forensic Science Center has seen increasing numbers of cases where death was due to or related to use and abuse of the Duragesic® patch.

The 6 individuals in this series, 3 males and 3 females, ranged in ages from 30 to 53 years of age. All were Caucasian. Five of the decedents were reported to have chronic pain syndrome: fibromyalgia, lower

back pain, chronic headaches, Crohn's disease, and pain due to remote blunt force injuries from a traffic accident. Three of the individuals had been prescribed the Duragesic® patch as part of their pain management therapy. The patch had been obtained by 2 individuals without a prescription. The prescription history of the last individual was not known. Found dead in bed were 2 decedents, 1 of the decedents was found obtunded in bed and died a short time later, and the 3 remaining decedents were found dead either seated or lying on a couch or chair.

On external examination, 2 individuals had transdermal patches on their trunk, 1 of the individuals, a 45-year-old white male had 6 100 mcg/hr patches on his lower chest/upper abdomen, 1 decedent from another county had the patch removed at the scene of death, and 3 of the decedents had injected the patch contents intravenously.

At autopsy, 4 of the individuals had bilateral pulmonary congestion; 3 had aspirated gastric contents. All the decedents had mild to moderate cardiomegaly with heart weights ranging from 370 g to 470 g. In one case, coronary artery atherosclerosis was listed as a contributory cause of death. All of the individuals with a history of intravenous injection of the patch contents had extensive amounts of polarizable material in the lungs on histologic examination.

Toxic effects of fentanyl were listed as the cause of death in 3 of the cases. The cause of death for the remainder of the cases was mixed drug intoxication. Toxicological analyses revealed multiple prescription medications in 5 of the 6 cases. Toxicological analysis in one case revealed the presence of benzoylecognine, fentanyl and amphetamine. The presence of ethanol was detected in only one case.

The analysis of fentanyl (identification and quantitation) was accomplished by gas chromatography-mass spectrometry in the selective ion-monitoring (SIM) mode.

The average postmortem blood/tissue distribution of the "patch" cases were as follows: heart blood, 13.3 ng/ml (range 4-25); femoral blood, 10.3 ng/ml (range 4-18); vitreous, 10.0 ng/ml (range 3-14); brain, 32.0 ng/g (range 12-52); and liver, 35.6 ng/g (range 28-42). The average postmortem blood/tissue distribution of the "IV" cases were as follows: heart blood, 11.3 ng/ml (range 5-17); femoral blood, 4.0 ng.ml (range 2-7); vitreous, 3.3 ng/ml (range <2-5); brain, 26.6 ng/g (range 21-34; and liver, 25.6 ng/g (range 11-38).

Fentanyl concentrations did exhibit site dependency. The average heart/femoral blood concentration in the "patch" cases was 1.2 (range 1-1.3); whereas the "IV" cases demonstrated a greater concentration, averaging 3.3.

The data from these case studies demonstrates that the distribution of the fentanyl is similar, irrespective of the two common routes of administration: transdermal absorption or intravenous injection of the patch contents.

Duragesic®, Fentanyl, Postmortem Distribution

G68 Sufentanil Toxicity in Healthcare Professionals

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The goals of this paper are to present to the forensic community an awareness of two recent cases of sufentanil toxicity involving healthcare professionals.

This presentation demonstrates two autopsy cases from the Harris County Medical Examiner's Office involving sufentanil toxicity among healthcare professionals. Sufentanil citrate is available under its generic name of sufentanil and is often used in the surgical suite by anesthesiologists as an adjunct to general anesthesia. Sufentanil is available in Dosette ampules of 50-mcg/1 ml, 100-mcg/2 ml, and 250-mcg/5 ml. It is a Class II controlled synthetic narcotic, which is about 5 to 7 times as potent as fentanyl and 500 to 800 times as potent as morphine. The usual adult dose is 1 to 2 mcg/kg. Supplemental doses of 10 to 25 mcg may be given as needed. Profound analgesia is achieved with doses of 2 to 8 mcg/kg. Deep general anesthesia is achieved with doses of 8 to 30 mcg/kg. Sufentanil easily crosses the blood-brain barrier and is quickly routed to body tissues. After 24 hours, approximately 80% of the drug dose is excreted in the urine. Sufentanil is metabolized into N-desmethylsufentanil and O-desmethylsufentanil. Approximately 30% of a dose metabolizes as conjugates in both urine and feces. Sufentanil has a number of toxic effects including respiratory depression, acute respiratory arrest, seizures, hypotension (also sudden hypotension), euphoria, dizziness, muscle rigidity, drowsiness, nausea, vomiting, bradycardia, and irregular heartbeat. The literature reports 2 deaths in adults after self intravenous administration of sufentanil indicating blood levels of 1.1 and 7.0 mcg/L and liver levels of 1.8 and 3.4 mcg/L. It is not clear if these adults were healthcare professionals.

The following are details of two cases involving sufentanil toxicity that have occurred in less than a two-month period. Case one is a 41-year-old Caucasian male anesthesiologist who was found, in the bathroom, sitting on the toilet with his pants on and unresponsive. An empty syringe was found inside a dry beer can. A small vial of sufentanil 50 mcg, ¾ empty, was found in the bathroom. The autopsy findings included: a recent injection site in the left antecubital fossa with a 3/8 inch hematoma, cardiomegaly (450 grams) with moderate atherosclerotic cardiovascular disease, bilateral pulmonary edema and congestion, hepatomegaly (2550 grams), and erosions of the gastric mucosa.

Case two is a 34-year-old Caucasian male registered nurse who was found at work in the ladies bathroom face down on the floor with his pants and underwear down around his ankles. In addition to the 1 opened ampule of sufentanil, 15 different ampules, vials, and bottles of medications were found in the bathroom. In addition, 1 previously used syringe with needle and cap was found at the scene. The autopsy findings included: bilateral injection sites on the medial thighs, cardiomegaly (550 grams) with right ventricular dilatation and concentric left ventricular hypertrophy, and hepatomegaly (2400 grams).

Sufentanil can be assessed in the laboratory by multiple methods including gas chromatography with nitrogen specific detection, radioimmunoassay, and gas chromatography-mass spectrometry (GC-MS). The blood analysis for sufentanil was identified and quantitated by GC-MS method. Biological specimens were made alkaline (pH 13) using 2N, NaOH. Sufentanil was extracted using a mixture of hexane:ethanol (19:1). D5-fentanyl was used as an internal standard. The dried extracts samples were injected onto the GC-MS and the ions 250, target ions, 194, 195, 151 for D5-fentanyl and 250 (target ion), 290, 291, 140 for sufentanil were monitored. Postmortem blood in case one was positive for ethanol 0.12 g/dL and sufentanil 2.95 mcg/L. The syringe wash was also positive for sufentanil. No other drugs were identified. In case 2, sufentanil was the only compound in concentration of 2.63 mcg/L. The cause of death of death was sufentanil toxicity for both cases. The manner of death was ruled as accidental for both cases.

In conclusion, these 2 deaths resulting from sufentanil toxicity in Harris County Medical Examiner Office in less than 2 months are warning signs of the popularity of this potent, narcotic substance among healthcare professionals with substance abuse problem.

Sufentanil, Harris County Medical Examiner Office, Healthcare Professionals

G69 Acute Fatal Propafenone Toxicity: Drug Concentration, Distribution, and Clinical Features in Two Suicides

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The goals of this presentation are to illustrate clinical and toxicological features of deaths due to acute propafenone toxicity.

Propafenone is a class 1C antiarrhythmic agent, an agent that reduces the upstroke velocity of the cardiac muscle cell action potential by inhibiting the fast inward sodium channel. Propafenone is indicated in the treatment of paroxysmal atrial fibrillation/flutter and supraventricular tachycardia in patients without structural heart disease, and non-sustained ventricular arrhythmias. Potential proarrhythmogenic effects of propafenone are recognized. However, few cases of fatal propafenone toxicity are reported in the literature. This presentation reports two autopsy cases of acute propafenone toxicity, including history, and postmortem propafenone concentration and distribution.

The first case is a 29-year-old white female with a long medical history of benign conditions including an ankle injury with multiple orthopedic surgeries and borderline diabetes mellitus. She had a complaint of cardiac palpitations; Holter monitor evaluation in 1999 demonstrated episodes of atrial fibrillation/flutter. No structural defects were identified by echocardiogram. Treatment with propafenone was begun. Her clinical course was uneventful with regard to cardiac complaints, until approximately 2 years later when she presented with a complaint of chest pain of four days duration. Evaluation at that time, including electrolytes, chest X-Ray, and V/Q scan were normal; an EKG had first degree atrioventricular block, and nonspecific T wave changes. Following spontaneous symptomatic relief she was discharged home. She returned to the same hospital approximately 16 hours later, with migration of pain to the epigastric region. Additional laboratory studies included a normal gallbladder ultrasound. An EKG at that time indicated a first-degree atrioventricular block with slight prolongation of the QRS interval. During a four-hour period of observation, she was administered lidocaine, compazine and ketorolac, with symptomatic relief and was discharged home. EKG prior to discharge revealed slight narrowing of the QRS interval compared to what was seen in the previous EKG. The QTc interval was not appreciably prolonged in any EKG. Propafenone is known to cause some prolongation of PR and QRS intervals, but has no effect on QTc intervals. She returned to the hospital by ambulance eight hours later, after collapsing with seizure-like activity at home. An agonal arrhythmia was documented during unsuccessful attempts at resuscitation. At autopsy, the mildly obese female had hesitation scars on the left wrist, and contusions and lacerations of the tongue. Her lungs were congested. The heart and brain had no structural anomalies. Complete toxicology analysis revealed blood temazepam (0.17 mg/L), lorazepam (0.01 mg/L), oxazepam (< 0.01 mg/L), venlafaxine (<0.25 mg/L), and nortriptyline (0.28 mg/L; liver nortriptyline 4.0 mg/Kg). Lidocaine was also detected. Unexpectedly, the post-mortem blood level of propafenone was 5.4 mg/L. Total amount of propafenone in gastric contents was 70 mg. The blood level of propafenone indicated intentional overdose (the plasma therapeutic range of propafenone is 0.06 – 3.2 mg/L). Hesitation scars, and the presence of other psychiatric medications provided further support for a suicidal manner.

The second case is a 32-year-old Hispanic male with no previous medical history who checked into a motel room with a female companion. The female subsequently left the room; the male was discovered dead on the floor of the bathroom 13 hours later. A brief suicide note was under the body. A bottle of propafenone, 150 mg tablets, prescribed

to the female companion, was in the room, with approximately 68 tablets missing. At autopsy, the lungs were edematous and congested. Blood and vitreous ethanol were 0.20 g/dL and 0.28 g/dL, respectively. Less than 0.1 mg/L cocaine and cocaethylene were detected in the blood, along with 0.65 mg/L benzoylecgonine. Blood propafenone was 9.1 mg/L, and liver propafenone was 230 mg/Kg. A total of 135 mg of propafenone was in the gastric contents.

These two cases provide data on suicidal intoxication with the antiarrhythmic drug propafenone, including data on drug distribution, and evolution of EKG changes.

Class 1C Arrhythmic Agents, Propafenone, Suicide

G70 Flecainide: A Suicidal Pharmacist's Choice

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The goals of this presentation are to illustrate scene findings and toxicologic analysis of an unusual death of a pharmacist involving flecainide toxicity.

Flecainide is a class 1C antiarrhythmic agent that reduces upstroke velocity of the cardiac muscle cell action potential by inhibiting the fast inward sodium channel. Class 1C agents are approved for treatment of nonsustained ventricular arrhythmias. Proarrhythmogenic properties of flecainide and other class 1C agents are known. The authors report a case of suicidal ingestion of flecainide, with additional unusual toxicology findings and bizarre scene findings. The toxicologic findings and pharmacokinetic considerations are discussed in the context of the scene findings.

A 44-year-old black male pharmacist had no significant medical or psychiatric history. He was an avid diver; a dive logbook found in the apartment indicated over 255 dives. He had recently been depressed because of a busy work schedule, and having been denied vacation time for his annual dive trip. A coworker became concerned when he did not show for work for two days. On the third day, police were summoned and gained entry into the secure apartment where they found him deceased, supine in the bathtub. He was clad only in a pair of swim trunks. The tub was partially filled with water, the water was off, and the drain was plugged. At the time of discovery, water did not completely cover the face, and the nose and mouth were above water level. Two partially submerged, full, sealed 5-gallon water bottles were on the decedent's left abdomen and right chest. Several pieces of clear plastic wrap were adjacent to the decedent, on the edge of the tub, on the nearby toilet seat, and on the bathroom counter top. An open box of plastic wrap was on the floor just outside the tub. Complete toxicology analysis revealed flecainide with the following distribution: blood 11 mg/L, liver 324 mg/L, and gastric 367 mg. A large amount of flurazepam (1 g) was also in the stomach, although flurazepam was not detected in the blood. Blood and vitreous ethanol were 0.02 g/dL and 0.03 g/dL, respectively.

The high blood level of flecainide indicated a suicidal manner of death (the reported therapeutic serum concentration of flecainide is 0.2 – 1 mg/L.). Moreover, the decedent did not have a prescription for flecainide; in fact, he had no preexisting arrhythmia or other known cardiac problem, suggesting that he sought out a medication specifically for the purpose of ending his life. As a pharmacist, he had access to a variety of agents and had knowledge of pharmacologic mechanisms and pharmacokinetics. Perhaps flecainide was chosen because the mechanism of death was considered to be similar to a myocardial infarct, potentially less violent than other means. Perhaps he thought the unusual nature of the drug would preclude its detection on routine postmortem toxicology.

The large amount of flurazepam in the gastric contents further supports a suicidal manner, and the lack of flurazepam in the blood indicates preterminal ingestion.

The complex scene findings and unusual toxicology suggest purposeful activity by this decedent; several aspects remain puzzling. For example: why would flurazepam have been added? What was he doing with the plastic wrap? Why was he holding bottles of water on his chest and abdomen? Is his extensive knowledge of diving relevant? These aspects will be discussed during the presentation.

Class 1C arrhythmic Agents, Flecainide, Suicide

G71 The Use of Lidocaine to Commit Homicide: A Case Report and Review of the Literature

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The goals of this presentation are to report the first case of Lidocaine being used to commit homicide outside a hospital setting, to pull known cases of iatrogenic homicidal Lidocaine poisoning into the forensic sciences literature, to review and compare the two groups highlighting similarities and differences, and to distinguish those situations where an elevated Lidocaine level should trigger a more extensive investigation.

Lidocaine is a drug that is commonly used during the course of resuscitating critically ill patients. It is most effective at treating ventricular tachycardia associated with a myocardial infarct. It is therefore a common finding on the toxicology reports of medical examiner cases. It is so common one could even say that it has become part of the "normal flora" of drugs found in people who die suddenly and unexpectedly along with Cotinine and Caffeine. It is also not uncommon for Lidocaine levels to be elevated, even above the "potentially toxic" level because of the grave situations in which the drug is administered. As a result, medical examiners/forensic pathologists can become desensitized to the dangers of this drug. Above therapeutic levels, it can cause severe cardiovascular and neurologic effects including immediate asystole, apnea, and convulsions. It lowers seizure thresholds and may increase the risk of bradycardia and asystole. Yet, the common assumption about Lidocaine is that if it is found in a patient's blood, the careful hand of a physician or paramedic with the goal of saving the patient's life administered it. The cases presented here illustrate that this is not always true. One case illustrates how Lidocaine was used as a tool to commit homicide by a non-professional while the other three show that when used in the medical setting, it is not always with a therapeutic intent. The former case is the first reported of its kind.

In this paper, the cases of iatrogenic homicide are briefly reviewed, characterizing the perpetrators, the victims, the motives, and the keys to recognizing the deaths as homicides. The majority of the focus is on the case involving the homicidal Lidocaine poisoning outside the hospital. Similarities and differences between that case and the hospital-based homicides are highlighted with the goal of raising awareness as to when an elevated Lidocaine level should trigger a more extensive investigation.

The majority of known Lidocaine homicides have been committed by so called "Medical Murderers." These are health care providers of one form or another who made Lidocaine their weapon of choice. Robert Diaz was a 46-year-old nurse who killed 12 patients (and possibly 50 more) by Lidocaine injection while he worked as a nurse at two California Hospitals. His motive stemmed from his desire to appear to

have a "doctor's" knowledge of how sick patients were and to "predict" when they would die. Joseph Dewey Akin was convicted of killing a quadriplegic patient by injecting him with Lidocaine for the "fun of watching him die". He committed this crime in Birmingham AL but was suspected to have killed 17 others while working at a hospital in Atlanta GA. And finally Randy Powers was a 26-year-old respiratory therapist who was never convicted of murder but was convicted of "assault with a deadly weapon" and "practicing medicine without a license." He gave an eleven-month-old child an intramuscular injection of Lidocaine inducing a high fever and seizure activity. He participated in the resuscitation and was originally thought to be a hero. Physicians however identified a needle puncture wound on the child's thigh and toxicology revealed elevated Lidocaine. Powers was suspected to have been involved in many other unexplained deaths. However, the bodies that were exhumed failed to show needle puncture wounds or elevated Lidocaine levels.

The case of homicidal Lidocaine poisoning outside a hospital involved the husband of a 69-year-old female with a past medical history most significant for Alzheimer's disease, schizophrenia, and macular degeneration. He was her sole caretaker but was also an active volunteer at the Red Cross and a local Michigan hospital. On the day of her death, he found her lying on her bed around 8:00 a.m. She was unresponsive and this prompted him to notify emergency medical personnel. On arrival, paramedics determined that she had been dead for some time and pronounced her dead at the scene. Her husband reported that she was in her usual state of health and had no complaints when he put her to bed on the prior evening (around 11:00 p.m.). The police and the medical examiner investigator found the scene secured with no evidence of a struggle. She was lying on top of the bedding in her nightshirt with a pillow lying over her right leg. There was no evidence of injury to the body. At autopsy the diagnosis of Alzheimer's disease was confirmed and there was no evidence of injury or needle injection marks. Two EKG leads were the only evidence of therapy. She was a normally developed female and had moderate atherosclerotic cardiovascular disease. Postmortem urine toxicology revealed Lidocaine, Tocainide, Meperidine, Salicylate, and Caffeine. A postmortem blood drug screen (subclavian blood) revealed Lidocaine 12.4 mcg/ml (potentially toxic >8 mcg/ml) and Salicylate (non-toxic levels). Discussions with MEI personnel confirmed that EKG monitoring was the only resuscitative procedure performed on the decedent and that there was no evidence of accidental ingestion of topical anesthetics. A police investigation was started and revealed information that suggested her husband would have the knowledge to administer the drug and may have been involved in previous attempts to kill her. Follow up testing (including DNA analysis) confirmed the presence of Lidocaine and ruled out the possibility of specimen mix-up at the laboratory. Based on this information the cause of death was determined to be Lidocaine poisoning and the manner of death was homicide.

This paper is valuable for multiple reasons. It first pulls cases of homicidal Lidocaine poisoning into the forensic literature. Secondly, it highlights how the deaths of elderly people and the severely ill are not infrequently treated with benign neglect despite the fact that they are precisely the people most likely to be the victims of homicidal poisoning. It highlights how elevated Lidocaine levels are treated with similar benign neglect. This is clearly illustrated in the comment by one forensic pathologist who was asked to evaluate the toxicology report knowing only that it was a case of an elderly person who died at home. He quickly stated, "There is nothing here" automatically attributing the elevated lidocaine level to "an artifact of resuscitation." This paper illustrates how the hobby or profession of the assailant/caregiver can give important clues as to the cause of death and to the poison used. And finally it illustrates how doing a thorough scene investigation including a detailed medical and social history of the decedent and the family can alert you to a situation perfect for homicidal poisoning.

Lidocaine, Homicide, Forensic Science

G72 The Normal Heart Weight: Diagnostic Criteria for Cardiomyopathies

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The definition of normal heart weight is discussed. Various features and causes of cardiac hypertrophy are examined and illustrated. Criteria for the diagnosis of cardiomyopathy are discussed.

In medicolegal practice it is not uncommon that the cause of a death cannot be determined by autopsy, histology, and toxicology. Among other questions, the following deserve special attention: Was the heart weight normal? Can an isolated cardiac hypertrophy be a cause of death? What can be expected from cardiac histology?

In the first part of this presentation, the definition of the normal heart weight is discussed on the basis of a personal series of normal hearts and the literature. For this purpose, the weights of 973 hearts from adults with normal hearts who died of violent death were measured in order to determine the upper limit of the normal heart weight as a function of sex, age, body weight, body height, and body area. In the second part, gross and histologic findings in 38 hypertrophic hearts were examined. The meaning of myocyte disarray is discussed. Diagnostic criteria for the diagnosis of primitive hypertrophic cardiomyopathy are examined. Contribution of cardiac histology to the assessment of the diagnosis of cardiomyopathy is also analyzed.

Heart, Hypertrophy, Cardiomyopathy

G73 Normal Fat in the Right Ventricle vs. Arrhythmogenic Right Ventricular Cardiomyopathy/Dysplasia

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Fat is a normal component of the right ventricle. In this presentation, the diagnostic criteria for right ventricular cardiomyopathy are examined. The role of fat *per se* in sudden death is discussed.

Fat is a normal component of the right ventricle. However, in some hearts the proportion of fat is dramatically increased. The question of whether fat infiltration of the right myocardium *per se* can be responsible for sudden death has not yet been answered. In a previous series of sudden cardiac deaths related to arrhythmogenic right ventricular cardiomyopathy, the authors showed that in this disease, fat was constantly associated with fibrosis^[1]. The significance of fat infiltration without fibrosis in the right ventricle was not discussed. In a first part of the present study, the authors examined 30 right ventricles with an increased amount of fat, which was semi-quantitatively evaluated using a score of severity ranging from 1 (minimal increase) to 4 (transmural involvement). These hearts were obtained from persons who died of violent or natural death, but sudden cardiac deaths were excluded. The hearts were compared in blind conditions to those from the authors' previous sudden death series. In the non-sudden death group, the mean age was 62 years (range, 42-97), 80% of victims were female and 20% of right ventricles had grade 4, 45%, grade 3, 30%, grade 2 and 5%, grade 1. Fibrosis was never observed. In a second part of the study, case-reports of the literature were analyzed, in which fat infiltration *per se* was considered the cause of sudden cardiac death. A personal case-report is also reported in which sudden cardiac death occurred in a person who had only fatty replacement of the right ventricle.

Conclusion. Fat is a normal component of the right ventricle, and may be increased in certain persons, especially obese and/or old women. Sudden cardiac death is most likely to occur when fat is associated with fibrosis. Sudden cardiac deaths have rarely been reported to have occurred despite absence of fibrosis. In such cases, additional factors may contribute to the arrhythmogenicity.

[1] Fornès P, Ratel S, Lecomte D. Pathology of arrhythmogenic right ventricular cardiomyopathy/dysplasia. An autopsy study of 20 forensic cases. *J Forensic Sci* 1998; 43: 777-83

Arrhythmogenic Right Ventricular Dysplasia, Sudden Death, Cardiomyopathy

G74 Isolated Noncompaction of the Left Ventricle: A Rare Cause of Sudden Death

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This presentation will review the literature and the autopsy findings of Isolated Noncompaction of the Left Ventricle, a rare congenital cardiomyopathy.

A 44-year-old black female with no known medical history was witnessed to collapse suddenly at work. Upon arrival, paramedics found an initial rhythm of ventricular fibrillation; their initial efforts resulted in conversion to sinus tachycardia, which quickly deteriorated into ventricular fibrillation. The patient was taken to a nearby hospital where she was pronounced dead in the emergency room.

Autopsy examination showed a well developed, well nourished black female weighing 158 pounds and measuring 5' 2" in height. Internal examination revealed a 409 gram heart with no evidence of coronary artery disease. The left ventricle measured 1.3 centimeters in thickness, the right ventricle measured 0.5 centimeters, and the septum ranged in thickness from 0.5 to 1.3 centimeters. On cut surface, the left ventricle had a sponge-like appearance. Filling the left ventricle, from the apex to the level of the mitral valve were extensive trabeculations with deep intertrabecular recesses. An area of scarring and hemorrhage was present along the anterior third of the septum. Autopsy also showed pulmonary edema and congestion, emphysematous changes of the apex of the upper lobes of the lungs bilaterally, and nephrosclerosis. Histologically sections from the heart showed trabeculations lined by ventricular endocardial endothelium, which was continuous with the ventricular endocardium. The trabeculations showed areas of endocardial thickening and ischemic changes with myocyte necrosis and hypertrophy of the surrounding myocytes. Sections from the lung showed chronic congestion. Toxicology tests were negative.

Isolated noncompaction of the ventricle (INLV) is a rare congenital cardiomyopathy thought to be caused by an arrest of compaction of the loose meshwork of myocardial fibers during embryogenesis. Noncompaction results in the formation of muscular trabeculations that fill one or both ventricles imparting a spongy appearance. The overall incidence in the adult population is 0.05 percent. Genetic studies have shown an X-linked recessive inheritance pattern with mutations in the gene G 4.5 on the Xq28 chromosomal region associated with INLV. However, the occurrence of INLV in women suggests a possible non-X-linked inheritance pattern.

Patients have been identified ranging in age from 1 week to 71 years. The onset of symptoms, commonly related to depressed left ventricular function, frequently develops during adulthood. The diagnosis in adults is often delayed because the symptoms, which are nonspecific, are similar to more frequently diagnosed conditions such as congestive heart failure. Patients can also present with various arrhythmias. The arrhythmias can be associated with Wolf Parkinson White Syndrome, bundle branch blocks, or ventricular arrhythmias. Some patients present with embolic events that include transient ischemic attacks, stroke, and pulmonary embolism. INLV has specific echocardiographic findings, and it is not until this test is performed that the diagnosis is confirmed.

Isolated noncompaction of the left ventricle is a rare congenital cardiomyopathy affecting both sexes through a wide range of ages, has non-specific clinical manifestations, and can result in sudden death.

Isolated Noncompaction of the Left Ventricle, Spongy Myocardium, Congenital Cardiomyopathy

G75 Trauma-Related Hemorrhage vs. Spontaneous Rupture of Vascular Malformation: Three Case Reports Illustrating Medico-Legal Aspects

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In medicolegal practice, cutaneous and visceral hematomas are often caused by trauma. In some cases spontaneous rupture of a hemangioma can mimic trauma-related hemorrhage. Three case-reports illustrate this issue.

In medicolegal practice, cutaneous and visceral hematomas are often caused by traumas. However, in some cases, a hemangiomas/vascular malformations can be involved. These can be overlooked if histology is not performed. The matter is further complicated by the fact that rupture of hemangioma can be provoked by slight trauma. Three autopsy case-reports are presented to illustrate medicolegal aspects of this issue.

Case 1: A 6-month-old boy was found dead in his bed by his parents. The GP who examined the body found the child's anus enlarged and considered the death suspicious. At autopsy, the anus was considered normal, but there was an ecchymotic area at the surface of the left ventricular epicardium, 2 cm in diameter. No resuscitation attempts had been performed. There were no rib fractures or any other cutaneous or visceral hemorrhages. Histology revealed a small hemangioma in the anterior left ventricular wall. Such vascular malformations have been reported to cause sudden cardiac death in infants and older children.

Case 2: A 5-year-old boy was found dead in his bed by his parents. The cause of death was found to have been a tamponade due to a hemopericardium. The right atrium was found ruptured. There were no rib fractures or any other hemorrhages. Histology showed a ruptured hemangioma in the right atrial wall. Such vascular malformations have been reported to cause death in infants and older children. This localization has been reported to be the most frequent.

Case 3: An 18-year-old man was found dead in jail. During the days prior to the death, he had complained of various neurological symptoms, including headache and difficulty in standing and walking. He reported that these symptoms developed in the days following a dispute, when he had been punched to the face. Neurological examination showed no objective abnormalities. At autopsy there was a meningeal hemorrhage surrounding the cerebellum and the upper part of the brain stem. Edema in the underlying parenchyma caused death. Histologically, there was a ruptured hemangioma in the cerebellum.

In conclusion, hemangiomas are rare causes of hemorrhages. Rupture can be spontaneous (cases 1 and 2). However, in medicolegal practice, the question often arises of whether a slight trauma may have facilitated the rupture (case 3). Histology is essential in revealing the hemangioma and dating lesions.

Hemangioma, Heart, Brain

G76 Esophageal and Pharyngeal Injury Associated With the Esophageal-Tracheal Combitube®

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The goals of this paper are to present a series of cases of esophageal and pharyngeal laceration associated with the use of the Combitube®.

The esophageal-tracheal combination tube or Combitube® is a ventilatory device used for the intubation of patients in a number of different clinical settings. Its basic design consists of a twin lumen tube with proximal and distal inflatable cuffs. This design allows for placement of

the device in either the trachea, or more commonly, the esophagus, and through appropriate inflation of the proximal and/or distal cuffs provides a conduit for ventilation. The major benefit of the Combitube® is that its design and function allow for non-laryngoscope-assisted or blind insertion into the oropharynx. Therefore, it is frequently used in emergency situations such as cardiopulmonary resuscitation in both the hospital and pre-hospital setting. As with any invasive procedure, intubation using the Combitube® is not without complications. The majority of complications is relatively minor and includes sore throat, dysphagia, upper airway hematoma, and a more pronounced hemodynamic stress response. A rare and serious complication reported primarily in the anesthesiology literature is rupture of the esophagus. However, this reportedly rare injury is increasingly seen by medical examiners/coroners in the forensic setting.

A series of three cases of esophageal rupture and a single case of laceration of the hypopharynx associated with the use of the Combitube® that were identified at the time of medico-legal autopsy at the Milwaukee County Medical Examiner's Office between 1997 and 2002 will be presented. The cases involved patients between the ages of 15 and 78. The cause of death in three of the cases was determined to be sudden cardiac death due to atherosclerotic and hypertensive cardiovascular disease while acute asthmatic attack was the cause of death in one case. All individuals were intubated in the field by emergency medical personnel during cardiopulmonary resuscitation. The Combitube® was inserted in the esophagus in the three cases of esophageal rupture and in the hypopharynx in the case of pharyngeal laceration and placement of each was confirmed at postmortem examination.

A review of select literature is also presented. This includes a review of the development of the Combitube®, its design and function, and the manufacturer's recommendations for its use. Case reports from the anesthesiology literature are also provided. In addition, the presentation will review information regarding possible mechanisms of injury focusing on recent reports that investigate the importance of anatomic location, cuff volume, esophageal and tracheal distortion, and mucosal pressures in the development of esophageal rupture.

By providing this information, it is hoped the awareness of the forensic community to the esophageal and pharyngeal injuries associated with use of the Combitube® and how they occur is raised. The authors stress the importance of thorough investigation of the perimortem events including review of resuscitation records/reports as they aid in defining the extent to which the injury contributes to the cause and manner of death. In addition, this work demonstrates the vital role the medical examiner/coroner plays in identifying existing or potential problems with current or emerging medical devices. By fulfilling this role, the medical examiner/coroner can provide clinicians and emergency medical personnel information that can be used to prevent similar injuries in the future.

Esophageal Rupture, Combitube®, Complications

G77 Determination of Time Since Death—Cardiac Troponin I

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This presentation will describe the development and utility of cardiac Troponin I (cTnI) as a time since death marker. Estimates of time since death in the early postmortem interval 0–7 days are currently performed using different temperature based methods and other physical parameters that lack the desired forensic reliability. The qualitative and semi-quantitative analysis of the degradation of cTnI as a time since death marker will be discussed using a bovine tissue model followed by postmortem human cardiac tissue samples.

The importance of determining the time since death is crucial to criminal, civil and forensic cases. Time since death markers have lagged behind the advances in technology of the past century. Knight explains, ‘regrettably, the accuracy of estimating the postmortem interval (PMI) has by no means kept pace with the enormous strides made in technological sophistication.’ Early documented works on time since death focused on temperature measurements postmortem and possible algorithms to model the behavior of postmortem cooling of the body. Current technology is based on postmortem temperature methods similar to those described back in the 1800s. Marshall, an expert in this area, best summarizes the general issues with temperature measurements as follows, ‘It would seem that the timing of death by means of temperature can never be more than an approximation.’ Biochemical markers investigated to estimate time since death include protein fractions, urea, creatinine, glucose, iron, potassium, calcium, enzymes, immunohistochemical detection of insulin in pancreatic β -cells, myo-albumin fraction and Strontium-90 calcium analogue levels. Postmortem muscle proteolysis has been researched to explain the muscle relaxation following rigor mortis. Temperature, as a time since death marker, remains a leading marker after many years of investigations and limitations.

Cardiac Troponin I emerged as the leading serum marker for myocardial infarction (heart attack) in both the U.S. and Europe in the mid 1990s. It has become the gold standard serum marker for cardiac damage. This research is focused on a technique exploiting the postmortem tissue degradation of cardiac Troponin I to determine the time since death.

The technique consists of isolating and separating troponin I and its proteolytic fragments from cardiac muscle tissue (myocardium). This is accomplished by using magnetic microparticles that capture this protein from a 1.0 g cardiac tissue homogenate extracted with a buffer that inhibits proteolytic activity. The capture microparticles are incubated for 1 hour and washed several times with extraction buffer. The proteins bound are eluted from the microparticles using a low pH buffer. The proteins are separated by sodium dodecyl sulfate polyacrylamide gel electrophoresis (SDS-PAGE) and transferred to paper using a semi-dry Western blot protocol. The proteins transferred are probed with monoclonal antibodies specific for cardiac Troponin I. The blot is then incubated with goat anti-mouse antibody labeled with alkaline phosphatase (GAM-ALP). The blot is developed after incubating with a precipitating colored substrate. The bands of cTnI and most of its proteolytic degradation products that retain the antibody-binding region (epitope) are visualized by this technique. Digitization of the Western blot is performed using a scanner and software that can integrate the area of the peaks for qualitative and semi-quantitative analysis.

Cardiac troponin I exists as an intact protein when sampled from fresh human cardiac tissue. The experiments focused on a model of bovine cardiac tissue followed by human cardiac tissue with known time since death. The samples were frozen until the analysis was performed to avoid proteolysis during storage. The results indicate a consistent cTnI banding pattern amongst different human cadavers and a pseudo-linear relationship between percent cTnI degraded and the log of the time since death with a coefficient of correlation, $r > 0.95$. The unknown time since death degradation pattern can be qualitatively compared to a “reference heart” incubated under controlled conditions. The analysis matches the cTnI degradation pattern of the cadaver in question to the “reference heart” degradation pattern incubated at different time points. Thus, the extent of cTnI degradation serves to estimate time since death. Overall, this technique offers advantages over current methods such as wider postmortem interval, measurable degradation pattern and a temporal semi-quantitative relationship. In addition, at lower temperatures the postmortem prediction interval can be extended to provide a wider range. The degradation pattern of tissue cTnI is useful in the determination of the early postmortem interval (0 to 7 days), which is difficult to estimate with current technology.

Cardiac Troponin I, Time Since Death Marker, Postmortem Interval

G78 Quantitative Measurement of Ribonucleic Acid Degradation as a Possible Indicator of Postmortem Interval

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After attending this presentation the participant will understand that RNA degradation is time-dependent, can be quantified by reverse transcription and polymerase chain reaction and may serve as indicator of postmortem interval.

Ribonucleic acid (RNA) research is a major topic in molecular biology and medicine. RNA is less stable than DNA in vivo and in vitro and therefore is believed to undergo rapid postmortem degradation. This may be the reason why RNA analysis did not obtain significant attention in forensic science up to now. However, due to the nucleic acid structure small amounts of mRNA can be amplified by polymerase chain reaction after synthesis of complementary DNA (cDNA) by reverse transcription (RT-PCR). The poly-A-structure at the 3'-end of most mRNAs allows exact imaging of the mRNA pattern by oligo(dT)-primed reverse transcription including differences in fragment size due to degradation. Primers designed for sequences near the 5'-end of the mRNA should provide weaker amplification results than primers located near the 3'-end in degraded samples because the average mRNA size is expected to be smaller after RNA degradation so that less full-size transcripts will be generated during reverse transcription.

The objective of this study was to investigate whether quantitative measurement of RNA degradation could be helpful in determining the time of death in bodies. Blood taken from healthy volunteers was stored under various conditions and for variable time periods. Blood from bodies with exactly known time of death was taken from the femoral vein. After counting leucocytes RNA and DNA were extracted using standardized protocols. For estimation of the degree of degradation the 260/280 nm UV absorption ratio and the ratio of 28S to 18S ribosomal RNA of the RNA samples were determined. To assess the integrity of messenger RNA competitive RT-PCR using a synthetic competitor mRNA, one-step duplex RT-PCR with simultaneous amplification of a short and long fragment of the same mRNA (β -actin), multiplex RT-PCR with amplification of four fragments located between the 3' and 5'-end of the mRNA (fatty acid synthetase, FAS) and comparative RT-PCR of house-keeping genes (glycerin aldehyde-3-phosphate dehydrogenase) were performed. The amplification products were visualized with agarose gels or automated capillary electrophoresis. For quantification the staining intensity in ethidium-bromide stained agarose gels or the peak area in electropherograms generated with laser-induced fluorescent capillary electrophoresis were calculated.

The results show, that RNA degradation is gradually increasing up to 5-6 days postmortem depending on the ambient temperature. The in vitro as well as the postmortem assays demonstrate that the in vitro/postmortem time interval can be estimated by quantitative measurement of RNA degradation during the first week within a range of 1-2 days. Multiplex RT-PCR of the FAS-mRNA provided the most consistent results because the degradation of long (>4kb) mRNAs is measured showing a significant decrease of the amount of 5'-sequences that require full-size transcripts for detection relative to 3'-sequences which are close to the origin of reverse transcription.

Beside the forensic implications this study has high relevance for clinical and experimental RNA research because the exact time-course of postmortem or in-vitro RNA degradation is largely unknown. In forensic pathology quantitation of RNA degradation seems to close the gap between early postmortem interval (< 24 h) and the beginning of putrefaction. Further evaluation studies are currently performed with autopsy cases to enhance the significance of statistical calculations.

RNA Degradation, RT-PCR, Postmortem Interval

G79 Experimental Evaluation of Rigor Mortis: The Influence of the Breaking (Mechanical Solution) on the Development of Rigor Mortis

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The learning objective consists in presenting the influence of the breaking (mechanical solution) on the development of the intensity of rigor mortis.

Although little is still known about its development over time, rigor mortis is routinely used to estimate the time since death. In order to further knowledge on this phenomenon the authors have developed a method for the objective measurement of the intensity of cadaver rigidity in rats.

The principle of the method is to determine the force required to cause a movement of small amplitude (4 mm) in the limb under examination. Since the movement doesn't break rigor mortis, serial measurements can be conducted. The apparatus measures the resistance caused by rigor mortis in the knee and hip joints of rats. This method was formerly used to evaluate the influence of several antemortem and postmortem factors (i.e. body weight, muscular mass, age, physical exercise, ambient temperature, various causes of death, electrocution) on the development of rigor mortis. Present investigations address a very poorly known phenomenon in the development of rigor mortis, which consists in the return of the rigidity after mechanical solution. In fact, observations on human cadavers have shown that if early rigor mortis is "broken" (by forcing a limb to bend), it may reappear. However information based on standardized experiments is lacking concerning this phenomenon.

Experimentation: Question addressed:

- reappearance
- intensity after reappearance
- rapidity of reappearance
- time limit of reappearance
- rigor mortis time span after reappearance

Animals: male albinos rats, approx. 300 g
Method to break rigor mortis: the paw is vigorously pulled twice in order to completely straighten the limb.

Breaking time points: 1, 2, 4, and 6 hours p ostmortem.

Measurement time points: 10 min, 1h, 2h, 3h, 4h, 5h, 6h, 8h, 12h, 16h, and 24 h postmortem.

Results: The maximal values of the intensity of rigor mortis are reached between 4 and 5 hours postmortem in the control group with a plateau of the intensity between 4 and 8 hours postmortem. If the breaking takes place at 1 hour postmortem, the curve representing the intensity of rigor mortis has the same shape, i.e., maximal values are attained at the same time, but values are significantly lower. A breaking point at 2 hours postmortem gives similar results: maximal values are obtained at the same time as in the control group but values are significantly lower. If breaking occurs after 4 or 6 hours no significant rigidity reappears.

Conclusion: Rigor mortis may reappear if it is broken during the early phase of its development, but its intensity is significantly lower. The time course of rigidity after breaking is the same as in the controls. If the breaking intervenes after the full development of rigor mortis, it doesn't reappear. These results offer a better understanding of the phenomenon of rigor mortis and, further, of the estimation of time since death, a fundamental element in forensic medicine.

Rigor Mortis, Breaking of Rigor Mortis, Development of Rigor Mortis

G80 Evaluation of a Putative Snuff Film

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The attendee will understand how to critically evaluate computer animation from a medicolegal perspective.

So-called "snuff films" are films, which purport to show an actual killing as entertainment. The killing is done for the purpose of the film, as distinguished, for instance from compilations of executions and killings from news reports or taken by observers. The existence of "real" snuff films or whether they are an urban myth is an occasional source of debate.

This is a case report of a putative snuff film that was presented to investigators as evidence of a possible homicide. In this animation, a young woman was tied to a chair and shot. The investigators were skeptical, and before expending resources to search for a body asked for an evaluation of the imagery. This presentation will detail some of the findings, and provide an approach to the evaluation of such imagery.

A copy of the data was provided to the Digital Image Processing Laboratory, and the cine was evaluated on a frame-by-frame basis. Analysis focused on two primary areas:

1. Internal inconsistencies (features in the image that were not appropriately constant), such as inappropriate optical flow, evidence of image manipulation, etc.
2. Factual inconsistencies (features which did not fit natural laws), such as inappropriate bloodstain patterns.

In this particular instance, a number of internal inconsistencies were found in the imagery, including inconstant positioning of the entrance wound, inappropriate firing of the weapon, inaccurate bloodstain patterning, and others. A computer search was performed to determine the provenance of the animation, and was successful. The film was traced to its original release on the internet a few years ago and to the production house that made it. A Canadian special-effects company that specializes in "fantasy violence" had made the film as a publicity effort.

A number of points can be made from this analysis, including the importance of a multidisciplinary approach to integrating scene and medical information, the effects of image quality and compression method, and the use of the internet as a source and repository for these kinds of films and resource for their investigation. In this particular case, the use of JPEG compression placed severe limitations on the analysis of optical flow, since the details necessary for such evaluation were obscured by the JPEG blocking effect, which becomes increasingly problematic if contrast enhancement is used.

As digital imagery becomes increasingly integrated into the current culture, forensic pathologists and physical anthropologists should expect to receive more and more images for medicolegal evaluation. The evaluation of these images requires both an understanding of the medical aspects of the scene being analyzed but also a comprehension of how to approach imagery and how to handle digital evidence. In cases of digital imagery, the media containing the data may well be itself a piece of physical evidence to be analyzed separately than the data contained therein. A number of groups, including the Scientific Working Group on Digital Evidence are promulgating guidelines for handling evidence that is provided in digital format, while other groups, such as the Scientific Working Group on Imaging Technologies in the U.S. and similar groups in the international arena are developing guidelines for the acquisition and evaluation of digital data. A short discussion of the handling of digital evidence and the place of the medical examiner in handling such evidence will be provided.

In this particular instance, a determination that this image was not of an actual killing was made rather quickly, and a more intense examination

was not necessary. Possible further approaches to evaluation will be discussed.

A short review of the snuff-film urban legend and its variants, and an introduction into some of the material easily available through modern distribution methods of imagery, including the internet, will be provided.

Video Analysis, Image Analysis, Snuff Film

G81 Analysis of Electric Injury Patterns in Human Skin by Magnetic Resonance Microscopy

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The goals of this presentation are to gain a greater understanding of emerging diagnostic technologies; to develop correlations between magnetic resonance microscopy and light microscopy for electrical injuries; and to better recognize the histopathology and pathophysiology of electrical damage to the skin.

Introduction: The pattern observed for an electric injury depends on the strength and frequency of the electric field, the path of the current, and the histoarchitecture of the tissues. Tissue trauma results from (a) electric field effects and (b) Joule heating due to the passage of electricity. To characterize the electric injury pattern in skin a variety of techniques, ranging from histology to scanning electron microscopy, have been applied. These techniques give detailed information about changes to cell morphology in sections taken at the site of the entrance and exit wounds, but provide little information about the extent of tissue damage in peripheral and deep tissues. Clinical MRI studies can provide some information about vessel patency and muscle necrosis, but the injury pattern is lost due to limited spatial resolution. In this work, MRM was used for the first time to characterize the microanatomy of an electric injury pattern in human skin.

Materials and Methods: Skin specimens, with visible epidermal lesions, were dissected from the left and right foot of a human cadaver that had received a fatal electric shock. Fixed skin samples were rehydrated in phosphate buffered saline prior to imaging. All experiments were performed on a Bruker Biospec spectrometer (Bruker Instruments, Inc. Billerica, MA) coupled to horizontal magnet operating at 7T (300 MHz for protons). Quantitative 2-D images had a slice thickness of 2 mm and an in-plane resolution of 120 mm. 3-D images were acquired with a RARE imaging sequence. The microanatomy of the resulting electric injury pattern was characterized by MRM and images were validated against histologic sections taken through the wound site.

Results and Discussion: On gross inspection, electric lesions were found to be composed of three zones: a central zone, an intermediate zone, and a peripheral zone. In the central zone the epidermal layer was completely destroyed and the underlying dermis was thermally damaged. In the intermediate zone, dermal necrosis was observed under the detached epidermis and in the peripheral zone there was little evidence of damage to cutaneous tissues.

Three-dimensional MRM images of formalin-fixed skin specimens were found to provide a complete view of the damaged tissues at the site of an electric injury as well as in neighboring tissues, consistent with histologic reports. The signal intensity of the dermal layer in the central zone was reduced due to thermal damage and increased in the intermediate zone because of cellular necrosis caused by the electric field. A subjacent blood vessel with extensive intravascular thrombosis supports the hypothesis

that electricity traveled through the vascular system before arcing to ground. MRM images of intact skin samples confirm that the resulting electric injury pattern was comparable to that of a vascular lesion.

Forensic Science, Electric Injury, Magnetic Resonance Microscopy

G82 Coins as Intermediate Targets: Reconstructive Analysis With Body Models

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The attendee will learn about intermediate targets and body models in wound ballistics.

Introduction: The phenomenon of intermediate targets is well known in wound ballistics. Intermediate targets are materials that receive some kinetic energy from the striking bullet. The result is that the intermediate target may be set into motion and become a secondary projectile. The injury analysis involving intermediate targets is often difficult. Therefore in forensic science, models are used to reconstruct injury patterns to answer questions regarding the dynamic formation of unusual injuries. In ballistic research glycerin soap and ordnance gelatin have been well established as soft-tissue substitutes. Recently, based on previous experiences with artificial bone, a skull-brain model was developed. The goal of this study is to create and analyze a model-supported reconstruction of a real forensic case with a coin as an intermediate target. A man with multiple bullet wounds was admitted to the hospital, where they found, by computed topography of the head, two foreign bodies. The man died several hours after admission to the hospital. At autopsy two foreign bodies in the brain were identified: a .380 caliber Winchester Silvertip bullet and a deformed, 1970, Mexican 50-centavo coin. There was no evidence of close-range firing and a through-and-through gunshot wound at the base of the left index finger suggesting that the bullet passed first through the hand, picking up the coin as secondary projectile before entering the head. Since it wasn't clear exactly how this unusual injury pattern came about, a reconstruction was attempted.

Materials and Methods: Gunshot experiments were made at the "Ballistic Missile Trauma Laboratory and Range" of the Armed Forces Medical Examiner at the Armed Forces Institute of Pathology, Washington D.C. For the first experimental set-up 10% gelatin blocks were used (size 36 x 15 x 15 cm) at 4° C. For the reconstruction of the ballistic process, a gelatin block with a thickness of 1.5 cm was used to represent the left index finger of the victim; a gelatin block of 0.5 cm was used to simulate the skin of the head. In some gelatin block experiments "Lauan Plywood" with a thickness of 6 mm (Home Depot, USA) was used to simulate the bony skull, which was placed between the finger and skin simulants. For the second experimental the artificial skull-brain-model was used (Thali, et al. *Forensic Science International* 125 (2002) 178-189). The artificial

skull is a layered polyurethane sphere 19 cm outside diameter and 6 mm thick) constructed in a specially designed form with a inner table, outer table and a porous diploe sandwiched in between. The brain itself is simulated with ordnance gelatin. Ammunition (Winchester 380 Automatic (85 GR) Silvertip Hollow point – muzzle velocity 1000 fps) similar to the real case was used. The bullets were fired by a Llama .380 pistol. As intermediate target 1970, 50- centavo Mexican coins were used. The coin was positioned between the simulated finger and the body simulant.

First the authors fired directly into three gelatin blocks, then fired into two “finger-coin-gelatin-block”-models, then into five “finger-coin-wood-gelatin-block”-models and finally into two skull-brain models. The gunshots were documented with a high-speed digital black and white camera PHANTOM V4.0 (Photo-Sonics, Burbank, CA) frame speed of up to 32,000 pictures per second. All gelatin blocks were examined by a digital mobile C- arm unit Compat 7600 (OCE, Salt Lake City) at the Office of the Armed Forces Medical Examiner in Rockville, MD. The CT scans of the head models were done at the National Naval Medical Center in Bethesda, MD with a GE Light Speed multi-slice helical scanner (General Electric Medical Systems, Milwaukee, WI). Using this cross-sectional modality 3D volumetric data was acquired which gave the possibility to do further post-processing with 3D virtual reconstructions (VoxelView, Vital Images, Inc., USA). After the radiological examination the gelatin blocks and the head models were dissected to analyze the bullets and the coin as an intermediate target.

Results and Discussion: With this model of an intermediate target simulation it was possible not only to demonstrate the “bullet-body (finger) interaction”, but also to recreate the wound pattern found in the victim. It could be demonstrated that after the primary projectile has struck the simulation materials, that the bullet and the coin traveled through the tissue simulants.

This case demonstrates that using ballistic models and body-part substitutes can reproduce gunshot cases simply and economically, without conflicting with ethical guidelines.

Thus, model set ups with body-part substitutes, in many scenarios, are ideally suitable diagnostic aids for the purpose of solving reconstructive ballistic questions.

Forensic Science, Ballistic, Intermediate Target

G83 Two Gunshots to the Head: Suicide or Homicide? A Biomechanical Study

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This presentation will use of a finite element head model to demonstrate the lack of incapacitation following a shot with a .22 bullet, demonstrate the importance of crime scene elements, and discuss the consequence of three shots : one to the chest and two to the head.

A 20-year-old man was found dead in his bedroom by his younger brother, in the family house. Investigators found the body lying on the ground, near the bed, with a handgun and a box of bullets at his beside. Examination of the body showed three gunshot wounds: one to the chest and two to the head (between the eyes and above the right ear respectively). Entrance wounds were all contact wounds. The handgun was a single-shot revolver and the box of bullets contained “super x”, .22 caliber bullets. Both the box of bullets and the handgun belonged to the victim who used to practice shooting in a club. Investigators found blood spots

on the victim’s bed aiming towards the cupboard where the deceased used to store his gun. Prior to autopsy, X-Ray examination of the body showed that Bullet A was stuck in the dorsum sellae, Bullet B in the left temporal bone, and Bullet C in the spine.

Bullet A penetrated the skull through the ethmoid, crossed the sphenoid sinus and ended in the Dorsum Sellae, close to the external part of the dura mater. This shot was associated with hemorrhage surrounding the two optic nerves. Bullet B penetrated the right temporal bone, crossed the brain and ended in the left temporal bone. Bullet C penetrated the sternum, touched the right side of the heart, crossed the aorta and the 11th dorsal vertebrae and ended in the medulla. Bullet A caused a blindness of the victim. Bullet B led to an immediate incapacitation of the victim. Bullet C caused an internal hemorrhage and a paraplegia. The possibility of a suicide was discussed. Bullet B leading to immediate incapacitation was certainly the last fired. Bullet C was possibly fired just before. But did bullet A led to an incapacitation of the victim or could he still rearm his weapon and shoot twice? The bullet did not penetrate the neurocranium, therefore there was no crush or stretch mechanism involved that could lead to incapacitation. But was a commotio cerebri generated? Commotio cerebri is a matter of sudden acceleration of the skull, which by means of inertia of the brain, results in wounding at coup and contrecoup. The .22 bullet has a mass of 2.5g, measures 5mm diameter and has a muzzle velocity of approximately 230 m/s. This results in an ultra short time span during which the projectile is acting upon the skull. Because of inertia, the skull will not essentially move during transfer of impulse. A high transfer of momentum and energy will result in perforation of the skull without acceleration of the head. To confirm this theoretical approach, a biomechanical study using a finite element model of the head and brain was done. The authors used the ULP model a validated finite element model developed in Strasbourg. The geometry of the inner and outer surfaces of the skull was digitized in the Strasbourg laboratory from a human adult male skull. The data given in an anatomical atlas by Ferner, et al. 1985 was used to mesh the human head using the Hypermesh code. The ULP model includes the main anatomical features: skull, falx, tentorium, subarachnoid space, scalp, cerebrum, cerebellum, and brain stem. Falx and tentorium have a layer of shell elements, skull is simulated by three-layered composite shell and the others were constituted by brick elements. This skull modeling permits simulation of the bone fracture introducing material discontinuity and then to analyze its effects on the head response in case of head impacts involving skull fracture.

The finite element mesh is continuous and represents an adult human head. The subarachnoid space was modeled between the brain and the skull to simulate the cerebral-spinal fluid. This space is constituted by a layer of brick elements and surrounds entirely the brain. The tentorium separates the cerebrum and cerebellum and the falx separates two hemispheres. A layer of brick element simulating the cerebral-spinal fluid surrounds these membranes. The scalp was modeled by a layer of brick elements and surrounds the skull and facial bone. Globally, the present human head model consists of 11939 nodes and 13208 elements divided in 10395 bricks and 2813 shells. Its total mass is 4.5 kg.

This study shows a very slight movement of the head (less than 1mm) and no shearing injuries to the brain, providing no argument for an incapacitation of the victim following the shot of bullet A. The shot between the eyes could therefore have been the first, followed by a shot to the chest and a final shot to the head, the latter penetrating the two cerebral hemispheres and rapidly leading to death. The localization of blood spotting could be the consequence of a movement of the victim towards the cupboard to seek for his box of bullets to rearm his weapon. The victim was right handed. Important gunshot residues were found on both hands of the victim but mainly on the right hand. Investigators found that the victim was depressed because of personal and professional conflicts. The authors demonstrate that even if, initially, a homicide could be suspected, the possibility of a suicide cannot be excluded and is likely to be the manner of death in this case.

Head Model, Suicide, Incapacitation

G84 Application of Biomechanics to the Interpretation of Pathology Data

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The presentation will demonstrate how biomechanical analysis aids in the interpretation of pathology data resulting from a fatal fall.

A female university student was found dead in the early morning on the pavement four stories below her dormitory window. Both the university and the local police conducted investigations of the incident. An autopsy was performed. The autopsy report and photographs were provided to a consultant forensic pathologist in anticipation of wrongful death litigation. The complaint alleged that the student had accidentally fallen from a "loft" built by a third party and out of the bottom of the swung open window in the room. The "loft" was a bed raised upon two by fours, above the height of the window, to provide more floor space.

The body displayed multiple blunt trauma consistent with the fall, fractures of skull, spine, sternum and ribs with posterior displacement of the lumbar spine. Striated abrasions of the anterior inferior thorax and upper abdomen were prominent. The initial problem was how to correlate these injuries with egress from the window, the windowsill and a 30-inch concrete overhang located above the first story presumed by police as undisturbed.

A 3-dimensional mock-up of the loft and the window was created to investigate possible fall mechanisms. A subject with the same anthropometric characteristics as the deceased was labeled with reflective markers before testing began. Sagittal plane kinematic data were acquired and evaluated with a Peak Performance Technologies Motion Analysis System (Englewood, CO). The position of the whole body center of gravity (CG) was derived in the sagittal plane. There were no accidental fall scenarios that resulted in the CG extending beyond the window ledge; the only possible scenario involved the subject crawling over the ledge and out the opening. An evaluation of the fall trajectory was consistent with this latter scenario – there was no evidence of a push or other source of substantial horizontal velocity. The striated abrasions were consistent with the scenario supported by the biomechanical analysis. The fractures were also consistent with the fall distance.

In this case, the pathologist required further data than originally provided at autopsy to decipher the mechanisms of injury and death. The biomechanical analysis provided the necessary data to interpret the autopsy findings.

Biomechanical, Fall, Autopsy Interpretation

G85 Evaluation of Iron and Macrophages in Meninges of Infants Dying Suddenly and Unexpectedly

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The goals of this research project are to assess the significance of iron and macrophages in the leptomeninges and dura of infants and young children dying without evidence of head injury.

As potential pathological markers for occult head injury, the presence of iron and macrophages in the meninges of infants and young children who died of various causes and without evidence of head injury were evaluated. This preliminary study was conducted in order to develop criteria for assessing whether these markers are reliable

indicators for head injury when identified microscopically in the leptomeninges and dura of infants dying suddenly and unexpectedly.

For this study the authors evaluated 18 deaths involving infants and young children ranging in age from 0 to 2 years old, with a mean age of 23 weeks. These included 4 deaths of Sudden Infant Death Syndrome (SIDS), 6 additional natural deaths, 2 unintentional deaths, 1 homicidal death, and 5 deaths due to undetermined causes. None of the cases had history or anatomic evidence of head injury. They selected 3 samples of leptomeninges from each infant and, in 12 of the 18 cases, one sample of dura. They examined tissue sections stained by hematoxylin and eosin (H&E), trichrome, an iron stain for hemosiderin, and an immunocytochemical stain for the macrophage marker, CD68. Under a 40x objective lens, they graded the microscopic features of each section semi-quantitatively for the presence and quantity of iron and macrophages. An "iron score" of 0 to 4 was ascribed to each section as follows: no staining for iron (score 0); occasional staining with most fields negative (score 1); focally abundant staining with most fields showing no staining (score 2); focally abundant staining with most fields showing positive staining (score 3); prominent staining throughout the section (score 4). Because there were 3 sections of leptomeninges examined, they calculated a "total leptomeningeal iron" score from 0 to 12 by simply adding the individual scores from each section of leptomeninges from the same case. As only one section of dura was examined, possible scores for the "total dural iron" ranged from 0 to 4. The "total macrophage" scores from both leptomeninges and dura were derived using the same procedures.

Eleven of the 18 cases showed a total leptomeningeal iron score of zero (of 12 possible); i.e., no iron was observed in any of the three sections. Four of the eighteen cases received a total iron score of 1/12; one case had a score of 2/12; one case had a score of 3/12; and one case had a score of 4/12. The dura (n=12) showed slightly higher total iron scores with only three of the 12 cases having total iron scores of 0 (0/4). Four of the cases had a score of 1/4; 3 cases had a score of 2/4; and one case each had scores of 3/4 and 4/4. All 18 cases had positive macrophage staining on all sections with individual section scores ranging from 2 to 4. The total leptomeningeal macrophage score was 8/12 on 2 of the 18 cases; 9/12 on 4 cases; 10/12 on 3 cases; 11/12 on 5 cases; and 12/12 on 4 cases. The dural macrophage score was also positive on all 12 cases, with scores ranging from 1 to 4. Three cases had a score of 1/4; 4 cases had a score of 2/4; 2 cases had a score of 3/4; and 3 case had a score of 4/4.

These data indicate that macrophages and small amounts of iron are a common finding in the leptomeninges and dura of infants and young children who have died suddenly and unexpectedly. However larger amounts of iron deposits may indicate either birth injury or occult traumatic brain injury. As a continuation of this preliminary study, we are evaluating additional cases of sudden infant deaths in order to establish a "normal" basis of iron and macrophages in the leptomeninges and dura of children with respect to age, birth history, and cause and manner of death. The ultimate outcome of these efforts is to develop objective criteria for markers of occult head injury.

Child Abuse, Traumatic Brain Injury, Meningeal Hemosiderin

G86 Extent and Distribution of Retinal Hemorrhages in Abusive and Non-Abusive Head Injury

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The goals of this presentation are to present the differences between the extent and the distribution of retinal hemorrhages found in abusive compared with non-abusive head injury.

Outcome: Attendees may know differences in retinal findings which can be used to help distinguish between abusive and non-abusive head injuries.

Observations from ocular examination of 80 head-injured infants and children identified a statistically significant greater extent and different distribution of retinal hemorrhages in those with abusive head injury compared with those with non-abusive head injury.

A prospective ocular and systemic study of infants and children was undertaken at the Southwestern Institute of Forensic Sciences between 1981 and 1989. The study group included 169 infants and children. Death was attributed to head injury in 80 of the children. Review of investigations, medical records, and follow-up investigations was used with gross and microscopic findings from autopsy examinations which included ocular examinations. Most of the deaths were attributed to abusive head injury, 62 cases, while 18 of the deaths were attributed to non-abusive injury. The latter included five children involved in motor vehicle collisions. Five more were run over by motor vehicles. One was thrown from a motorcycle. Four children fell: one went out a second story window to a concrete patio, one fell from stairs to a conglomerate patio, the third was standing on a washing machine and fell onto his head, the fourth was standing on tall bed above a concrete floor and fell onto his head. One child was riding on a bicycle with an adult who fell on top of her when the bike hit an obstacle. A child's stroller rolled downhill and collided with a wall; a respiratory tract infection contributed to that death. The eighteenth child suffered a gunshot wound of the head and the ipsilateral eye was examined; no hemorrhages were seen in that eye.

Retinal hemorrhages were found in nine of the eighteen children with non-abusive injuries (50%) compared with 53 of the 62 children with abusive head injuries (85%). The Yates-corrected p value was 0.004 with Greenland, Robbins 95% confidence limits $1.07 < \text{Relative Risk} < 2.74$. Looking at the presence of retinal hemorrhages at the retinal periphery, hemorrhages were found in three of the 18 with non-abusive injuries (17%) compared with 47 of the 62 with abusive injuries (76%). The p value was <0.001 with confidence limits of $1.60 < \text{RR} < 12.90$. Hemorrhages at the macula were found in six of the eighteen children with non-abusive injuries (33%) while 48 of 62 with children abusive injuries (77%) had such hemorrhages. The p value was 0.001 with confidence limits of $1.19 < \text{RR} < 4.53$. Posterior hemorrhages near the optic disk were found in nine of eighteen children with non-abusive injuries (50%) and 50 of 62 with abusive injuries (77%). The p value was 0.02 with confidence limits of $1.00 < \text{RR} < 2.60$. Looking at the presence of hemorrhages in the superficial retina, hemorrhages were found in four of the 18 children with non-abusive head injuries (29%) while 47 of the 62 children with abusive head injuries (76%) had such hemorrhages. The p value was <0.001 with confidence limits of $1.42 < \text{RR} < 47.85$.

Microscopic grading of the extent of retinal hemorrhages allowed further differentiation between the two groups. Hemorrhages of 4+ markedly distorted the retinal architecture, 3+ slightly distorted the retinal architecture, 2+ were visible at low power (20x), and 1+ were only visible at high power (100x). The distribution of the hemorrhages was described with reference to the ora serrata, the equator, the macula, and the posterior retina including the disk at the nasal and temporal sides of pupil-optic nerve sections of the eye. The hemorrhages were also described with respect to the superficial and deep retina as well as subretinal hemorrhages.

Only one child among non-abusive head injury group had as much as a 3+ hemorrhage and that in one eye only. It was found at the subinternal limiting membrane (superficial retina) at the temporal equator. The child was unrestrained sitting on the lap of a back-seat passenger in a car broad-sided in a motor vehicle collision. The child also had 2+ hemorrhages at the macula, the posterior, and both sides of the ora serrata. Two had more extensive 2+ hemorrhages. One of these children had 2+ hemorrhages extending from the posterior retina to the equator in

one eye, the other eye was uninjured. A car rolled over this child's head at low speed. The other child with slightly more extensive hemorrhages had them present posteriorly and extending to the equators bilaterally; hemorrhages were also seen at the ora serrata in one eye. This child had an unwitnessed fall while playing on concrete stairs over a conglomerate patio. The patterned injuries from the conglomerate were helpful in reconstructing the event. All six of the other children with hemorrhages had 2+ hemorrhages in at least one area, usually the posterior or equatorial retina. The superficial retina was involved infrequently.

In contrast, children with abusive head injuries had more extensive retinal hemorrhages which more often were found in the superficial retina and the retinal periphery. Hemorrhages graded as 3+ and 4+ were found in 38 of the 62 children with abusive injuries (61%) as opposed to 1 of 18 of those with non-abusive injuries (6%). The children with at least 2+ hemorrhages tended to have them more widely distributed and to involve the superficial retina more than the children with non-abusive injuries. There was only one child with but a single microscopic 1+ posterior hemorrhage; nine had no hemorrhages.

The presence and extent of superficial and peripheral hemorrhages were good discriminators of abusive head injuries when present. No 4+ hemorrhages were seen in non-abusive head injuries in this population. Only one 3+ hemorrhage was seen in an uncontested non-abusive injury death. Only three children with non-abusive injuries had hemorrhages at the retinal periphery. Two were unrestrained back-seat passengers in motor vehicle collisions; the third fell from concrete stairs.

Extensive superficial and peripheral hemorrhages are part of the constellation of abusive head injuries. The absence of such hemorrhages increases the need to identify the other parts of the constellation before making a diagnosis of abusive head injuries.

Retinal Hemorrhages, Abusive Head Injury, Retinal Periphery

G87 Perimacular Retinal Folds and the Shaken Baby Syndrome: Critical Appraisal Testing of the Current Medical Literature

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The goals of this presentation are to discuss the limitations of the current medical literature regarding specificity and presumptive causal mechanism of perimacular retinal folds in Shaken Baby Syndrome.

Perimacular retinal folds accompanying retinal hemorrhages in childhood head trauma are considered virtually pathognomonic of Shaken Baby Syndrome by many ophthalmologists, pediatricians and forensic pathologists. The postulated mechanism is that these traumatic retinal findings result from vitreoretinal traction during cycles of acceleration-deceleration (shaking). Bilateral severe retinal hemorrhages and perimacular retinal folds observed clinically had been attributed to abusive head trauma in a 14-month-old child and a 7-month-old infant with severe acute intracranial injuries. Forensic autopsies confirmed the ocular findings but subsequent investigations concluded that the fatal injuries were non-intentional from static or quasi-static loading.

Design: Case reports, observational

Testing: Critical appraisal testing was performed on 35 medical journal articles and book chapters published from 1966-2001 that discussed presence, specificity and/or causal mechanism of perimacular retinal folds in abusive childhood head injuries.

Results: Publications discussing specificity or formative mechanism of perimacular retinal folds concomitant with retinal hemorrhages observed in childhood abusive head trauma consist of case reports (2), clinical and/or autopsy case series (8), unsystematic review articles (8),

and book chapters (2). Two case controlled studies were found; however, one exhibited bias in control selection and the other only discussed the postulated formative mechanism. The remainder of the publications indicated that perimacular retinal folds were present in some cases of childhood abusive head trauma.

Conclusions: Perimacular retinal folds accompanying retinal hemorrhages in childhood head trauma cannot be regarded as diagnostic of Shaken Baby Syndrome based on the current medical literature due to study type, design bias and lack of appropriately controlled studies. Well-designed clinical and autopsy studies with suitably matched controls must be done before causative mechanism and specificity can be assigned to perimacular retinal folds when observed in children with acute intra-cranial injuries.

Perimacular Retinal Folds, Shaken Baby Syndrome, Child Abuse

G88 Neuropathology of Abusive Head Injury

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The goals of this presentation are to 1) appreciate the differences between traumatic and hypoxic diffuse axonal injury; and 2) to understand the basis of traumatic unconsciousness.

This presentation will describe the neuropathology of a large series of abusive head injury in infants and young children as well as a group of control cases. The brains were examined by a forensic neuropathologist and subjected to a protocol for sectioning with sections from 16 sites including parasagittal white matter, 3 levels of corpus callosum, brain stem, cerebellum, distal optic nerves, and cervical spine. Sections were stained by H & E and β -amyloid precursor protein (β APP) and graded for the presence of β APP reactivity using a 4 grade classification. The abusive head injured children ranged from 3 weeks to 8 years old and the controls were of similar ages. Head injury is the most common cause of death in children dying from inflicted injuries. There is great interest in understanding the neuropathology in young children with abusive head injuries and correlating the pathology with the biomechanics of the injury. Clinically, these children most often present an immediate change in their level of consciousness following injury which may consist of impact, shaking, or a combination of the two mechanisms. These mechanisms have been proposed to cause rotational or angular acceleration injuries of the brain accounting for the presence of thin layers of subdural hemorrhage, retinal hemorrhages, and brain swelling in those who survive some period. The question of whether traumatic diffuse axonal injury is the basis of the loss of consciousness (traumatic unconsciousness) and other findings in these children is an important issue. A recent study by Geddes (Geddes et al, Brain 2001, 124:1299-1306) reported that severe traumatic axonal damage is rather rare in infant abusive head injury unless there is considerable impact and that the diffuse brain damage responsible for loss of consciousness in most cases is hypoxic rather than traumatic. This presentation will demonstrate findings from a large series of abusive child head injuries which finds that traumatic diffuse axonal injury occurs more frequently than reported by Geddes. It is important to recognize hypoxic brain damage and to distinguish those changes from traumatic diffuse axonal injury as frequently the two findings occur together and these distinctions will be discussed. The study also found differences in the appearances of acute traumatic DAI and older injury as demonstrated by β APP.

Abusive Head Injury, Traumatic Diffuse Axonal Injury, Child Abuse

G89 Pediatric Injury Evaluation: A Clinical Forensic Pathology Program in Georgia

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The goals of this presentation are to describe the authors' consultative experience in the evaluation of physical injury in children.

Child abuse is a common cause of physical injury in children. It is estimated to occur in one million children each year in the United States. The majority of cases of child abuse do not result in fatal injury. It frequently becomes the responsibility of a medical professional to recognize and accurately interpret the nature of injuries in suspected child abuse. An accurate diagnosis is critical in protecting the child and in providing medical-legal information. Thus, it is necessary to develop expertise in the field of child abuse through extensive experience or specific training in a forensic medicine program. The authors have established a child abuse investigative support center to address the critical need to accurately interpret injuries in children and to train more forensic pathologists in this field.

The Child Abuse Investigative Support Center (CAISC) is a clinical forensic medicine program at the Georgia Bureau of Investigation (GBI) Division of Forensic Sciences (DOFS) that was established in August 2000. The center was established to address the needs of agencies involved in investigations of child maltreatment. The center performs dual functions of providing consultative assistance and educational training throughout the state of Georgia. Physician members of the center consist of forensic pathologists of the GBI Medical Examiner's Office who possess expertise regarding injury causation. They are requested for expert consultation in suspected child abuse cases and are available for court testimony. An investigative division of the center provides consultations by criminal analysts who possess expertise in reference to crimes involving children. The center is also an integral part of the forensic pathology fellowship at the GBI and serves to train fellows in the field of child abuse and neglect. The center operates under state and federal grants and provides services free of charge to consulting agencies.

Since its inception, 103 cases (mean age 2.7 yrs; range 19 days to 16 yrs; 58M:45F) of pediatric, predominately non-fatal, injuries have been referred to the center for evaluation. Various law enforcement agencies presented the majority of the cases and the Department of Family and Children Services requested the center's service in 33% of the cases. The interpretation of injuries was based upon the evaluation of pertinent documents depicting and/or describing the injury. These included medical records, photographs, case files and radiographs. In four instances the object implicated as the source of the injury was evaluated and on two occasions the acutely injured child was evaluated while hospitalized.

A spectrum of injuries was represented in the cases we evaluated including bone fractures (35%), dermatologic injuries such as bruises and abrasions (31%), burns (24%) and cranial-cerebral injuries (22%). Only 3 cases involved injuries to regions involving or near the genitalia and were presented to evaluate for possible sexual abuse. Overall, 56% of the injuries were interpreted as abusive in nature. Nine cases were interpreted as representing discipline but not clearly abusive in nature and injury causation was inconclusive in eight cases. In the majority of cases a written consultation report was provided at the time of the evaluation. So far, courtroom testimony has been necessary in only three cases.

This review of the child abuse investigative center has yielded useful information. The authors identified that the service is particularly of value to rural areas that lack the resources and medical expertise that are typically available in large metropolitan areas. They recognized that

in many cases there is a long delay in the investigation and prosecution of child maltreatment. Their goal is to improve marketing of their services and to evaluate more acutely injured children. They have experienced difficulty in interpreting injuries on some occasions because of sub-optimal documentary material (i.e. photographs).

Overall, this study reveals that forensic consultative teams can perform several functions related to child abuse crimes: 1) provide expertise in evaluation of the injuries, 2) provide training opportunities in the field of child abuse, 3) provide expert court testimony.

Child Abuse, Clinical Forensic Medicine, Georgia Bureau of Investigation

G90 Physical Findings in Confessed Homicidal Suffocation of Children: A Case Series

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The goals of this presentation are to review the physical findings, and lack thereof, in homicidal suffocation of young children.

Investigation of death and injury in children requires attention to detail of subtle injury patterns and careful, thorough case history review and scene investigation. As seen in various individual anecdotal cases, intentional suffocation of children may have relatively few findings. To have a more comprehensive understanding of the physical findings in suffocation, the authors undertook a retrospective review of cases of confessed suffocations of children age 5 years or less in which the first author performed the post-mortem examination or a living forensic examination prior to the child's death. In all cases presented herein, a parent entered a guilty plea in criminal court. In four of the five events, the parent gave a formal confession to law enforcement, and later entered a guilty plea in criminal court. In the 5th event, the mother allegedly confessed to cellmates, and entered an Alford Plea in criminal court. The case series consists of 8 children age 5 or less who died at the hands of 5 perpetrators. In 2 of the events, multiple children were killed on the same night.

Event #1 - Fraternal twins, age 6 weeks were reportedly discovered dead in their crib by their parents one morning. Despite initial denial of the parents of use of the in-home apnea monitors, the investigators collected them at the time of the initial scene investigation. Post-mortem examination revealed no injuries whatsoever on the boy, and a small superficial abrasion on the eyelid of the girl. Downloading of the apnea monitors revealed a record of the double homicide. Confronted with the evidence, both parents confessed to suffocating the infants with pillows. The father told investigators that he did it because he "couldn't take" the continuous crying of both infants. Both entered guilty pleas and accepted "life" sentences. Interestingly, during a previous marriage five years earlier, the mother had "lost a baby to SIDS."

Event #2 - A previously healthy baby girl was admitted to the hospital for a reported apneic episode at 4 months of age. Over the next four months, she was repeatedly admitted to the hospital for recurrent apnea, and underwent a Nissn fundoplication in an attempt to alleviate GE reflux thought to be contributing to the apneic events. At eight months of age, the infant was admitted in full arrest following another in-home apneic event. At the request of the treating physicians and police, she was evaluated as a "forensic medicine" case at the time of the last admission. There were no injuries to the baby at the time of the final admission, and there had been no injuries documented on previous admissions for apnea. She did not recover, and died 2 weeks later. The immediate cause of death was hypoxic encephalopathy, but the underlying cause and manner remained unknown. Later, the mother

(a juvenile) spontaneously came forward and admitted to repeatedly suffocating the baby, who was the alleged result of an incestuous event. The case was resolved in juvenile court.

Event #3 - A four-month-old infant was brought to the OCME as a "suspected SIDS" case after being found dead on a couch. At autopsy, findings included a faint abrasion surrounding the ala nasa, erythematous areas over the neck, and a geographic pattern of cutaneous petechiae involving the head, neck, and right upper extremity. The investigators re-interviewed the mother following the preliminary autopsy findings report. The mother, a teenager, admitted to suffocating the baby against her chest and shoulder to stop his incessant crying. She avoided a jury trial by pleading guilty to reckless homicide, and was sentenced to five years.

Event #4 - A two-year-old boy with diagnoses of hyperactivity and probable autism was found dead following a nap. His position at body discovery was described as prone, with his head "face down" in the pillow. The child had no petechial hemorrhages, no intraoral trauma, and no identifiable injuries to any body surface. The preliminary autopsy report listed "no anatomic cause of death." Two days later, investigators received a call from a relative claiming to be an eyewitness to the child's homicidal suffocation. The father admitted to suffocating the child by holding his face into the pillow "until he went to sleep." The case was adjudicated without a trial.

Event #5 - Three young girls (ages 5 years, 28 months, and 17 months) were allegedly discovered dead together in a standard adult bed. Complete autopsies and detailed scene investigation and case history review failed to reveal any natural disease, environmental hazard, or toxicologic substance to explain their deaths. All facial trauma was mild, and increased with the age of the child. But even the 5 year old displayed only small maxillary gingival contusions and abrasions, rare bulbar conjunctival petechial hemorrhages. The girls' baby sister (age 2 weeks) had died 4 ½ months earlier - death in that case was initially attributed to SIDS, although a disclaimer had been included in the final opinion, stating that the age was not "typical." The three older girls' deaths were attributed to suffocation, with the manner ascribed to homicide. Fifteen months after the deaths, the mother pleaded guilty to four counts of murder by means of an Alford Plea.

In reviewing cases of pediatric death, all aspects of the investigation must be integrated to draw conclusions regarding cause and manner of death. The physical findings of asphyxia (accidental or homicidal) are often subtle, and may range from no evidence of injury to minor facial trauma. Additional clues to the cause of death may be found in a careful case history review and integrated scene investigation. These findings may initially seem to be small details that seem "out of kilter," and thus direct the investigation further. In many cases however, because of the paucity of findings in these cases, only admission by the perpetrator will allow determination of a homicide.

Child, Suffocation, Homicide

G91 Escalated Homicide: Cultural Changes Produce a New Type of Child Death

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The goals of this presentation are to present results from a study of abuse related child deaths in Memphis, TN, using hospital records, Medical Examiner reports, homicide police investigation files, and court transcripts; to evaluate the validity of the battered child syndrome and the impulsive homicide as a framework of analysis for child abuse related fatalities; and to propose the additional analytical category of escalated homicide to the existing conceptual tools of analysis.

The clinical tableau of abuse leading to child death has traditionally been classified as either manifestations of the battered child syndrome, or as evidence of impulsive homicide. The battered child syndrome first described by Tardieu¹ in the 1860s in France, and again by Kempe² in the 1960s in the USA typically involves a long term pattern of physical abuse creating a series of injuries over time, often coupled with symptoms of deprivation and neglect. Impulse homicide is presented as a single event of lethal violence, most often from blunt trauma injuries, with little or no evidence of any sequence of severe prior injuries or deprivation³.

It is the contention of this paper that, although both types are valid and useful description of abuse, they do not provide an adequate explanation for all cases. As a result of the studies, the concept of escalated homicide is introduced as a tool for assessing, recognizing and describing the changing nature of patterns of child abuse.

Medical and forensic treatment of violence against children gives primacy to physical injuries, and is essential to the understanding, diagnosis and documentation of abuse. But looking at the tree should not hide the forest. Circumstances produce injuries, not vice versa. The physical injuries of child abuse occur in a social/cultural context, for the most part a household, or care facility, the structure, composition and function dependent upon larger social forces. They are places where complex and often dysfunctional interpersonal relationships are acted out. Unfortunately, these environments are also the first lines of failure under stress, and their weakest and most silent members often the first victims.

This study integrates the forensic and social findings in such a way as to allow for the discrimination of the social and cultural forces leading to the abusive event. Of the 30 cases reviewed as part of the initial study and drawn from a prior study of 1,451 child deaths investigated by the Medical Examiner in Memphis, TN, in the past ten years, 5 were categorized as impulse homicides, 6 as battered child cases, and 12 as escalated homicides. One case involving a 20 month-old girl abused separately by mother, showing battered child signs, and mother's boyfriend, killing the child as an escalated homicide was classified as a combination example. Finally 5 cases were atypical in regard to perpetrators and setting.

Of the 12 escalated homicides, eleven involved the victim being murdered by the victim's mother new paramour, and only in one case was the child killed by the biological father. Typically, the ultimate assault takes place within a fit of anger deceptively reminiscent of the impulsive homicide. The pathognomonic differences are definite. What differs is the fact that in all cases there were premonitory and warning signs of abuse, ranging from observed behavioral responses of the young victim towards the aggressor, to unexplained bruises, bite marks, black eyes, and even unexplained and/or unobserved broken bones were present. Although escalated homicides reveal patterns of injuries over time, the motivation leading to the production of injuries differs because the relationships of authority vary between abused and abuser.

In a battered syndrome context, relations of authority are legitimate, or perceived as legitimate, and articulated in terms of parental rights. Typically a father takes over the task of disciplining a child either for the general purpose of "showing him the way," or for a specific purpose such as toilet training. Most often, physical punishment is not secretive, and the level of external interference limited. In instances of escalated homicide, boyfriends do not possess any legitimate authority over their girlfriends' kids, and are often being reminded so. Here, physical abuse is hidden and excuses are made to explain the injuries and scars. Most importantly though, beating the child has nothing to do with disciplining him, or teaching him to become a man. In most cases, it is a venting of anger, frustration, and resentment over the current living situation, and ill feelings towards their partners. This gradual escalation of frustration and anger, generated by household dynamics leads to repetitive acts of increasing violence eventually culminating in a deadly blow.

Recognizing variation in the behaviors that create child abuse is the first step in establishing profiles of perpetrators of violence against children. The forest is made up of a variety of trees.

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Battered Child Syndrome, Impulsive Homicide, Escalated Homicide

G92 Magnetic Resonance Microscopy as an Adjunct in The Evaluation of Infant Rib Fractures

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The purpose of this presentation is to explore the use of magnetic resonance microscopy in the evaluation of infant rib fractures, and to compare the findings with traditional anterior-posterior radiography, axial radiography, and histologic evaluation.

Following the second infant death in a family, the autopsy findings in the first infant death were reviewed at the request of the Naval Criminal Investigative Service (NCIS). Original autopsy radiographs from the first infant revealed multiple healing fractures that had previously been overlooked. Exhumation was recommended, and permission for exhumation ultimately granted. Re-interview of the mother, coordinated with the timing of the exhumation, prompted a confession as to how the children were killed.

The body of the first infant was exhumed, and healing posterior rib fractures were resected *en bloc* with the adjacent vertebral body and contralateral normal rib. Axial radiographs of each vertebra-rib pair were obtained. Magnetic resonance microscopy (MRM) was performed on each sample. Specimens were whole-mounted and cut in the axial plane for histology.

MRM provides microanatomic images of both hard and soft tissue. Images were acquired on a Bruker-Biospec system operating at 7 Tesla (300 MHz for ¹H). The 3-D images were acquired with a fast spin echo imaging sequence. The datasets were processed for visualization using the AVS/Express development environment, and 3-D images were rendered using a direct composite algorithm.

The ability to view and rotate the fractures in 3-D space allowed visualization of fracture morphology in ways unobtainable by standard radiography or histology. Fracture dimensions, the fracture line, the uninjured bony cortex, and the trabecular bony architecture were readily discernable by MRM. Histologic examination provided details of various aspects of bony healing that were not readily visible by MRM.

While MRM is currently an expensive imaging modality, limited to a few institutions and restricted to specimens of small size, it has great potential as an adjunct in the evaluation of healing fractures. With continued advances in technology and computing power, MRM will likely become widely available as an adjunct to, or perhaps a replacement for, histologic examination of some specimen types.

Infant, Magnetic Resonance Microscopy, Fracture

G93 Mother/Infant Co-Sleeping/Bed-Sharing and Sudden Infant Death Syndrome

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The goals of this presentation are to present to the forensic community a review of mother-infant co-sleeping and bed-sharing practices; to differentiate "safe" from "unsafe" co-sleeping conditions; to understand that, when done safely, bed-sharing/co-sleeping may actually be protective against death due to SIDS.

Deaths which remain unexplained after a thorough medicolegal death investigation can be the source of great frustration for forensic pathologists. Several categories of unexplained deaths are known within the forensic community, but for many, no category of deaths is as frustrating as Sudden Infant Death Syndrome (SIDS) cases. SIDS remains one of the great mysteries within the world of medicolegal death investigation. As such, theories as to the underlying cause or causes of SIDS have been and remain plentiful. Many risk factors have been identified, but most forensic pathologists know of several cases of SIDS occurring in infants with no identifiable risk factors. Whether or not a particular risk factor actually plays a role in SIDS can be controversial, and the implied blame that can accompany the identification of a particular risk factor can lead to feelings of guilt in the parents or other caregivers.

Within the forensic community, one of the most widely acknowledged potential causes of a SIDS-like death is overlay, an accidental asphyxial death related to another person lying on top of or wedged against the infant. Consequently, whenever an infant death occurs where the infant is sleeping with or next to another individual, it is important to consider the possibility of death by overlay. Depending on the forensic pathologist certifying such a death, a case where overlay is a possibility (but not necessarily proven) may be certified as a death due to overlay, SIDS, undetermined causes, or some other variation.

Because of the potential risk for overlay, there has recently been a national campaign against "co-sleeping/bed-sharing" with infants. Although the prevention of overlay deaths is an appropriate and worthwhile goal, the unconditional implication that any form of adult-infant co-sleeping is harmful is inappropriate, untrue, and not supported by scientific research. Part of the problem clearly stems from a lack of understanding of the terminology used in this debate. For example, "bed-sharing" is a form of co-sleeping, but there are other forms of co-sleeping that do not involve bed-sharing.

Another very important factor that is frequently overlooked is the nature of the maternal-infant relationship, including whether or not the mother is breastfeeding her infant. With respect to maternal-infant wake/sleep patterns, maternal and infant attentiveness and response, and similar parameters, it is inappropriate to consider the breastfeeding mother-infant night-time relationship equivalent to a nonbreastfeeding mother-infant relationship. Add to the latter relationship such factors as maternal drug or alcohol use and inappropriate sleeping conditions (such as a sofa) and it becomes clear that there are two ends of a spectrum when it comes to co-sleeping (and bed-sharing). At one end, there are the breastfeeding mothers who tend to be very attentive to their babies' needs, while at the other end, there are the mothers who are not so attentive and may, in fact, be careless. In other words, there are unsafe ways in which to co-sleep/bed-share, and there are safe ways in which to co-sleep/bed-share. A categorical condemnation of every form of co-sleeping/bed-sharing may indeed prevent accidental overlay deaths in certain infants; however, such a policy might also adversely affect infants who are otherwise a part of a safe co-sleeping/bed-sharing relationship. Data from previously-reported and ongoing studies of

mother-infant sleep patterns will be presented, showing that in otherwise safe sleeping conditions, co-sleeping/bed-sharing may actually protect against SIDS. As the debate continues within the forensic community about how to certify SIDS-like cases in the setting of co-sleeping/bed-sharing, it is important that forensic pathologists be aware of all available information regarding this topic.

Sudden Infant Death Syndrome, Co-Sleeping, Bed-Sharing

G94 Death Certification in Sudden Infant Death Syndrome and Related Infant Deaths

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Upon completion of this presentation, attendees will become familiar with a newly-proposed method for certifying SIDS and SIDS-like deaths and to become involved in the dialogue concerning certification of such deaths.

For an infant death to be considered due to "Sudden Infant Death Syndrome" (SIDS), a complete death investigation and autopsy, including toxicology, must be negative, and the infant must be less than 1-year-old. The "classic" SIDS scenario involves an infant, typically less than 6-months-old, who is found dead in his/her crib. Known risk factors include low socioeconomic status, parental smoking, prone sleeping position, formula-feeding, and a history of prematurity. Within the past 10 years, a campaign by public health agencies and pediatricians to advocate a supine sleeping position has purportedly resulted in fewer SIDS deaths. Amongst forensic pathologists, a trend has been noted that there are fewer and fewer "classic" SIDS cases. Whether this is related to the sleep position campaign, better information-gathering, different methods of death-certification, or a combination of these is not known. Be-that-as-it-may, many SIDS-like cases occur where certain known risk-factors are clearly identified. A potentially unsafe sleeping environment is a factor that is increasingly being recognized as a possible cause in some of these deaths. Ultimately, these and the other known risk factors for SIDS may cause potential interpretive difficulties for forensic pathologists, thus creating death certification dilemmas.

A recent proposal in the National Association of Medical Examiners' "A Guide For Manner of Death Classification" (in draft form) relates to the certification of SIDS and SIDS-like deaths. In this proposal, it is suggested that various items from the scene investigation/history which cause potential interpretive difficulties (such as bedsharing or being found face down on a soft pillow) should be listed in part II of the death certificate, with part I listing "Sudden Infant Death Syndrome" or "Findings consistent with SIDS." In this presentation, a series of cases will be presented, ranging from classic SIDS to accidental overlay, with many cases including one or more items causing interpretive difficulty. In each, the circumstances of death, the autopsy findings, and the death certification using the newly-proposed method will be presented. Discussion will include the potential controversies concerning which items/risk factors warrant inclusion in part II of death certificate; other options for relaying information about these items/risk factors will also be addressed. Through the presentation of a series of example cases, the authors hope to foster more discussion and dialogue about this very important issue.

Sudden Infant Death Syndrome, Death Certification, Cause of Death

G95 Pediatric Mortality in the Cook County Medical Examiner's Office, 1 to 4 Years: 2000-2001

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The goal of this presentation is to present statistical data on causes of death in the pediatric group between 1 and 4 years of age in the Cook County Medical Examiner's Office cases. The authors examined case records of the Cook County Medical Examiner's Office (CCMEO) over the two-year period from January 1, 2000 through December 31, 2001.

The number of deaths investigated by CCMEO between 1 to 4 years of age totaled 148 cases in the two-year period. Eighty-six cases involved males and sixty-two involved females. Specific causes of death were identified in 97% of all cases. Leading causes were accidental injuries, natural deaths and homicides. This report highlights the impact of violent death mortality in early age. Accidental injuries are related to automobile accidents, pedestrian injuries, drownings, asphyxias, house fires, falls and overdoses. In natural deaths, diseases of the heart and infection predominate. Infection includes bronchopneumonia, lobar pneumonia and sepsis. Homicides include blunt trauma injuries, gunshot wounds, stab wounds, drownings, suffocations, starvations and arson fires. The cause of death was undetermined in 3% (5/148) of the cases. By manner of death, there were 70 accidents, 42 naturals and 27 homicide cases, respectively. Undetermined manner is 6% (9/148) of all cases. Those that were of undetermined manner included two cases of fire and two cases of drowning, and 5 cases where the cause of death was undetermined.

Mortality, Cook County, Medical Examiner's Office

G96 Suicide in Children: A 12-Year Retrospective Study

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Suicide in pre-adolescent children (ages 6-12), although unusual, present unique causes, risk factors and potential prevention strategies which serve a specific public health need in the prevention of this unique form of violence.

Methodology: Case files for all deaths in children ages 6 to 12 ruled suicide or undetermined from the Milwaukee County Medical Examiner's computerized case records were reviewed from 1989 through June 2002. In addition, case files for all adolescent suicides reported in the corresponding time period were reviewed. Detailed demographic information, social history, behavioral history, and death scene investigation, autopsy findings, individual and family medical and psychiatric conditions and characteristics has been abstracted and analyzed. Review of the pertinent medical and psychiatric literature, including collaboration with a pediatric psychiatrist treating children and survivors of suicide attempts has been undertaken.

Results: The authors identified trends, frequently occurring factors and consistent findings within characteristics, and in doing so a way to observe the predictive indicators for suicide "prone-ness" in any or all cases. Specific factors will include behavioral factors such as previous suicide attempts, verbalization of suicidal ideation, the presence of depression, parental and family psychiatric history, impulse control history, history of abuse and other factors. Medical factors include: substance abuse disorders, attention deficit hyperactivity disorder, enuresis, parental and family medical history.

Discussion: The Milwaukee County Medical Examiner's office has identified an issue with suicide in children, ages 6-12 and has determined that this is a public health significance do to it being such an unusual phenomenon. Although suicide in the childhood age group is a rare phenomenon, it is encountered in normal practice of medical examiners and child psychiatrists. Characteristics of suicide in children are different than those found in the teenager age group. Identification of the risk factors, personality and behavioral characteristics in completed suicides will provide a framework for the development of prevention strategies. The barriers to consistent death certification and reporting across jurisdictions will also be evaluated, in an effort to develop strategies to increase consistency and improve data comparability and meta-analysis capacity across multiple jurisdictions.

Suicide, Childhood, Pediatric

Pathology/Biology

G1 Overview of Suicide Cases in Geneva, Switzerland During a Twenty-five Year Period (1971-1995)

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The goal of this research project is to provide demographic information regarding people who committed suicide in Genève.

The purpose of this study is to provide demographic information regarding people who committed suicide in Genève between January 1, 1971, and December 31, 1995.

In this period (25 years), the forensic institute of Genève, Switzerland examined all the cases of suicide (2,074) committed in Genève by individuals, who were between 13 and 97 years of age.

The average number of such cases per year is 83. The mean annual suicide rate is 22.52/100,000 population, and the rate has remained relatively stable over the years. The average age of the decedents is 48 years. The sex ratio is 1.5 : 1 (1,261 males and 813 females).

The most common cause of death is by firearms (19%). A high incidence of men (91%) could be explained by an easier access to weapons (In principle, every Swiss man must enrol in the army; furthermore, he is asked to keep his gun at home.) Entry wounds are most frequently localised within the cranium and the face (78%). Jumping from height is the second most common cause of death (18%). This method (43% of men) doesn't require any special material and is frequently chosen by the elderly. Hanging (17.5%) is chosen especially by men (73%). The weak proportion of women could be explained by a misunderstanding of the exact cause of death ("soft" death by vascular compression and not suffocation). Intoxication (16.5%) is a well-known cause of death predominant in women (only 42% of men), because it's a soft death and because women often have easier access to drugs such as benzodiazepines or anti-depressors. Drowning (16%) is chosen by men and women in the same proportion (50%), It's the principal means of suicide of women exiting a psychiatric hospital. Suicides by carbon monoxide poisoning is relatively rare (4.5%). In 1978, town gas, which contained carbon monoxide, was replaced by natural gas (methane without CO). Therefore, carbon monoxide poisoning, previously a suicide method of choice, has now become very rare and completed especially by men (72%) in their car. The other causes of death (train fatalities, asphyxias, electrocutions,) are very rare. Women predominantly commit attempts by cuts on wrists. Death by cuts on wrists (2%) are predominantly committed by men (73%).

In conclusion, we can say that the incidences of suicide cases in Genève, Switzerland, which are among the highest in Europe, are, of course, underrated since an unknown number of these cases are mistaken for deaths of another nature (mostly accidental and natural deaths).

Suicide, Death, Genève

G2 An Unusual Presentation of a Rare Entity: Exsanguination by Ruptured Left Subclavian Aneurysm

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The goal of this research project is to present an unusual case of a ruptured left subclavian artery aneurysm with formation of a subclavian-esophageal fistula, and to review the associated literature.

The case presented represents an unusual entity with an even more unusual history. The decedent, an 88 year-old white male, lived at home with his wife of 70 years who suffered from severe Alzheimer's disease. The decedent's past medical history was only significant for hypertension. Police records indicated a number of calls to the residence in the recent past because the wife had mistaken her husband for a "prowler" in the yard. On this occasion, the wife left her residence to cross the street and tell her neighbor that she had seen the prowler and "hit" him. The decedent was found face down and unresponsive on his front porch. He was noted at the scene to have small incised wounds of the hands and wrists, but no other injuries were noted at that time. The neighbor called 911, and resuscitative efforts were initiated at the scene by EMS. On arrival to the emergency room, resuscitation was still in progress, but continued efforts were unsuccessful.

Scene investigation revealed the decedent's blood on the door handle leading into the residence. The wife told officers at the scene that she had tried to hit the "prowler" with a candy bowl, and that he had blocked it with his hands. A fragmented glass candy bowl was found at the scene, also with the decedent's blood. Questioning the neighbors revealed that a similar incident had occurred one week prior, but the incident had not been reported. At that time the wife had confronted the husband within the house with a kitchen knife, but he was apparently uninjured and the authorities were not notified.

At autopsy, the external examination confirmed superficial incised (defense) wounds of the hands and wrists. Also noted were scattered, healing superficial incised wounds of the left chest, presumed to be related to the previous unreported knife incident. Examination of the scalp, skull, and brain was unremarkable. Internal examination revealed moderate to severe atherosclerotic disease of the aorta and its main branches, as well as mild narrowing of the coronary arteries by atherosclerotic plaques. There was also marked narrowing of the vertebral, basilar, and internal carotid arteries. Examination of the heart showed a single focus of fibrosis in the posterior wall of the left ventricle which suggested a small remote infarct. The most notable finding was a mildly dilated left subclavian artery that contained a large intimal defect near the aortic arch. This defect opened into a saccular aneurysm, surrounded by thin adventitia and periaortic tissue. The aneurysm contained a large thrombus, which abutted the posterior aspect of the esophagus. Examination of the esophagus demonstrated an associated rupture site through an area of ulcerated mucosa, forming a subclavian-esophageal fistula. Greater than 1500 cc of clotted blood was discovered within the stomach, suggesting acute exsanguination into the gastrointestinal tract.

Aortic aneurysms as a complication of severe cardiovascular disease are frequently seen at autopsy, but aneurysms of the arch vessels exclusively are uncommon. Of the cases reported, the majority of subclavian-esophageal fistulae present as a complication of aberrant subclavian arteries. One of the few reported cases of subclavian-esophageal fistula associated with normal subclavian vessel distribution occurred as a result of an esophageal foreign body. In our case, the arch vessels were appropriately positioned, a history of previous trauma or surgery was not elicited, and no foreign bodies were discovered. This suggests that this case was exclusively related to the decedent's cardiovascular disease.

Under certain circumstances, the manner of death in a number of cases of myocardial infarction has been ruled a homicide. If we were to assume that in this case, the decedent's aneurysm finally ruptured due to an acute stressful event (the assault), then this case could be considered a rare case of homicide by subclavian aneurysm. Given the circumstances, the manner of death in this case was eventually called natural. We present this case and review the associated literature.

Subclavian Aneurysm, Subclavian-Esophageal Fistula, Atherosclerosis

G3 An Unusual Cause of Sudden Death in Infancy: Histiocytoid Cardiomyopathy, Report of an Autopsy Case

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The goals of this research project are to remind participants of the following: 1) be aware of an unusual form of cardiomyopathy which may cause sudden death in infancy or early childhood; 2) know the clinical features of histiocytoid cardiomyopathy; 3) recognize the gross and microscopic features of this rare cardiac disease; and 4) be able to select the appropriate special stains to differentiate this entity from glycogen storage disease and from infiltrates of inflammatory origin.

Methods: Report of sudden death, autopsy findings, and histopathologic examination, including special stains and immunoperoxidase studies.

Clinical History: An otherwise healthy, full-term 22 month old female was at home in her crib when she began to cry. Her father picked her up and noticed that she was having trouble breathing. She subsequently became unresponsive and stopped breathing. EMS was called and the father began CPR. Upon arrival of EMS, the child was found to be in agonal respirations and without pulse. A cardiac monitor was placed, and it showed ventricular fibrillation. She was intubated and transported to the hospital. CPR was continued, and upon arrival to the Emergency Department, she was pulseless and not breathing. The cardiac monitor showed agonal rhythm, and ACLS was begun. Despite medical intervention, she displayed extended periods of asystole without pulse, and her pupils were fixed and dilated. Resuscitative efforts were discontinued and she was pronounced dead.

Autopsy Findings: At autopsy, the body was that of a well developed and well nourished 22 month old white female, who weighed 27 pounds and measured 34 inches in length. Her growth and development were appropriate for age. There were no signs of trauma. All internal organs were in their normal anatomic relationship. The heart, in the fresh state, weighed 70 grams (average weight for age = 56 grams), and it was structurally unremarkable. Upon sectioning, the myocardium was red/brown, without fibrosis, hemorrhage or distinct lesions. The interventricular septum was intact. The atria were unremarkable, and no interatrial defects were present. The coronary ostia were normally located, and the distribution showed right dominance with a circulation pattern within normal limits. The valves were thin and unremarkable. Microscopic examination of hematoxylin and eosin (H+E) stained sections of the heart revealed multiple myocardial and subendocardial clusters of clear histiocytoid cells with an associated minimal chronic inflammatory cell infiltrate. Special stains and immunoperoxidase stains were performed, and the histiocytoid clusters showed focal PAS positivity, weak positivity for actin, and negative staining for the histiocyte marker CD68. Based on these results, a glycogen storage disease (which would show diffuse PAS positivity) and a histiocytic process (which would show CD68 immunopositivity), were ruled out. The positive immunohistochemical staining for muscle actin supported a myocytic origin of the clear cells. The remainder of the autopsy, including microscopic evaluation, was unremarkable.

The clinical data together with the results of the autopsy, including H+E, PAS, and immunohistochemical microscopic examination of the heart, support the diagnosis of histiocytoid cardiomyopathy.

Discussion: Histiocytoid myocardiopathy is a rare cardiac disorder of infants and young children, presenting under two years of age, and it generally affects females. The clinical presentation is characterized by severe and eventually fatal, cardiac arrhythmias. Less frequently, the

presenting feature is sudden death. Gross morphology of the heart shows hypertrophy, tan/yellow myocardial nodules, but it may be grossly unremarkable. In most cases the heart weight is increased for age. Characteristically, the microscopic examination reveals focal collections of rounded, pale, vacuolated, or granular cells with centrally placed, round nuclei. These cells can be found in a diffuse or focal pattern throughout the myocardium, but they have been described to follow the course of the conduction system. Ultrastructural studies in reported cases demonstrate myofibrils, consistent with cardiac muscle origin, and abundant mitochondria. In some reported cases, malformations of the nervous system have been described. These have included hydrocephalus, agenesis of corpus callosum, malformations of cerebellum, and microphthalmia. In extracardiac viscera, some patients have had prominent oncocytes in glandular tissue. Rare other associations have included ovarian or renal cysts, and renal calcinosis.

The etiology of this disorder is uncertain. The ultrastructural observation of numerous mitochondria has raised the possibility that this is a mitochondrial cardiomyopathy, associated with abnormalities of the oxidative phosphorylation system. However, there are reported instances of successful surgical excision of histiocytoid foci, with survival to at least 6 years after surgery, and such a cure would not be expected in genetic mitochondrial disorders, which are usually characterized by steady degenerative changes. Another leading hypothesis is myocardial or Purkinje cell hamartoma, which is supported by the observation that the histiocytoid cells occur in locations in the heart where myocytes are normally found, and by the fact that the cells morphologically resemble muscle. These findings may also suggest that this entity is caused by a developmental anomaly of the conduction system of the heart. Some pathologists favor the consideration of postviral injury, either limited to the heart or systemic, which could explain the rare associated extracardiac abnormalities. Finally, it has been proposed that this disorder may have a genetic basis. The higher incidence in females suggests that it may be an X-linked dominant trait. This is an important consideration as genetic counseling may be indicated for affected families.

This condition should be considered in the differential diagnosis of SIDS, necessitating a careful cardiovascular examination in every case.

Conclusion: Histiocytoid cardiomyopathy is a rare cause of cardiac arrhythmia of uncertain etiology, affecting infants and young children, and it may lead to sudden death. The recognition at autopsy of the characteristic histologic appearance of the histiocytoid cells and the selective use of special stains and immunostains permit correct diagnosis.

Sudden Death, Arrhythmia, Cardiomyopathy

G4 The Changing Faces of the Medico-Legal Autopsies at the Office of the Chief Medical Examiner of the State of Maryland—A Decade of Experience

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The goal of this research project is to review the autopsies performed at the Office of the Chief Medical Examiner of the State of Maryland in the last 11 years.

A review of the autopsies performed at the Office of the Chief Medical Examiner of the State of Maryland, in the last 11 years, is presented to the forensic community to share our experience.

This poster will present the work of a team from the Office of the Chief Medical Examiner (OCME), State of Maryland and the National Study Center for Trauma and EMS.

Over the last eleven years the number of the medico-legal autopsies increased significantly, especially after 1997, from 2,997 autopsies performed in the year 1997 to 3,757 autopsies performed in the year 2000, a 25% increase. The increase is in comparison with the other types of cases performed by this Office, such as field inspections, OCME inspections, and approvals, which all showed a decline.

None of the protocols governing which bodies are autopsied vs. inspected have been altered during this time frame.

A look at the manner of death in our cases shows a dramatic increase (49%) in the autopsies classified as natural (from 959 in the year 1997 to 1,431 in the year 2000) and a significant increase (31%) in those classified as undetermined (from 531 in the year 1997 to 698 in the year 2000). The cases classified as accidents showed an increase of 22% and the suicides showed an increase of 5%. The homicides showed a 30% decrease after the peak from the early 1990s (641 cases in 1993 comparing with 473 cases in 2000). Because the most significant increase was in the cases classified as natural and undetermined, we further examined these categories.

In the cases in which the manner of death was classified as natural, the most significant increase was from 1997 to 2000, especially for atherosclerotic cardiovascular disease (from 313 in 1997 to 396 in 2000), hypertensive cardiovascular disease (from 6 in 1997 to 186 in 2000) and cardiac arrhythmia (from 53 in 1997 to 94 in 2000). There were no significant age, race or sex related differences. When we compared the data for all the counties that form Maryland, we noted that the greatest increase was in the cases from the most populous counties, Baltimore County, Prince George County and Montgomery County and the independent City of Baltimore.

We continued our study with a detailed view of the cases classified undetermined as manner of death. There were no significant age, sex or race related differences. Looking at the causes of death in this category we saw an increase in the cases related to drug use, drowning, and sudden death of an infant. Comparing the counties, the largest increases were in the City of Baltimore and in Baltimore County.

In conclusion, we consider that the significant increase in the number of the medico-legal autopsies in the State of Maryland is due to an increase in the number of the cases classified as natural and undetermined. The most important contribution to this increase is due to the death toll taken by the cardiovascular diseases, without respect to age, sex, or race.

Maryland, Autopsies, Increase

G5 Malaria Deaths in the United States: Case Report and Review of Deaths, 1979-1998

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The goal of this research project is to review the deaths in the United States caused by malaria and, through a case report, raise awareness to the potential of malaria-related deaths in the forensic setting.

This poster will review all the deaths due to malaria in the United States between 1979 and 1998 paying particular attention to epidemiological factors provided by the Centers for Disease Control (CDC). Through a combination of both gross and microscopic images, it will then present a unique case of malaria diagnosed only at the time of medico-legal autopsy.

Malaria is the world's most important parasitic disease, accounting for an estimated 300-500 million new cases and between 1.5 and 2.7 million deaths annually. The majority of these deaths occur in sub-Saharan Africa where malaria is endemic and are the result of infection with *Plasmodium falciparum*. The number of deaths related to malaria in the United States is comparably much lower and involves so-called "imported" cases in which U.S. travelers acquire the infection upon travel

to endemic areas and subsequently return to the U.S., or in which infected foreign citizens travel to the U.S.

There were a total of 115 deaths due to malaria in the United States between 1979 and 1998 with an average of 5.8 deaths per year. Specific epidemiological data provided by the CDC regarding the 40 deaths that occurred between 1992 and 1998 revealed the following: Deaths occurred in patients ranging from 9 months to 85 years of age (median, 53 years). Thirty-eight (95%) of these were due to *P. falciparum* and two (5%) to *P. vivax*. Anti-malarial chemoprophylaxis was used in 40% of cases, not used in 45% of cases, and unknown in 15% of cases. Twenty-four (60%) of the cases involved U.S. travelers to endemic regions, of whom 59% traveled to Africa, 25% to South America, 8% to India, 4% to Haiti, and 4% to unspecified areas. The remaining cases included 11 foreign travelers to the U.S. (27.5%), 3 induced cases (7.5%), and 2 undetermined cases (5%). Thirty-nine (98%) of the cases were diagnosed ante-mortem and only one case was known to have come to the attention of the medical examiner/coroner.

An illustrative case report demonstrates many of the features associated with fatal malaria infections in the United States. The case involves a U.S. student who was studying in Ghana and who, by report, had not taken anti-malarial chemoprophylaxis. Despite being seen at the student health clinic upon returning to the U.S., the diagnosis of *P. falciparum* infection and cerebral malaria was not made until the time of medico-legal autopsy where the classic gross and microscopic features of cerebral malaria were identified.

This case represents one of the few cases of *P. falciparum* infection not diagnosed ante-mortem. Given the worldwide prevalence of the disease, increasing international travel, and rapidly developing drug-resistance, malaria will continue to be an important disease and should be considered in cases of sudden, unexplained deaths. By reviewing the major epidemiological features of malaria deaths in the United States and by presenting the major gross and microscopic findings of cerebral malaria, an attempt is made at raising the awareness of the forensic community to the potential of malaria related deaths.

Malaria, Plasmodium Falciparum, Deaths

G6 North Carolina's Death Investigation Database

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The goal of this research project is to demonstrate the ease of use of a centralized statewide database to compare selected data fields with the US Census data to determine homicide victim profiles with shifts in population.

Searchable databases have long allowed for the comparison of data fields relating multiple groups. The North Carolina Office of the Chief Medical Examiner (OCME) maintains a database concerning its investigation of all deaths in North Carolina that fall under its jurisdiction. The database is maintained "in house" which allows quick and reliable information retrieval on cases in contrast to actual case files which may be archived in distant locations. The OCME database has case information dating back to 1973 and stores greater than thirty data fields on each case allowing for detailed comparisons within a group of interest. The data search can be restricted to specific fields thereby tailoring the search to data of interest and reducing the volume of data to be retrieved and compared. The ease of use and the ability to provide specific data of interest is demonstrated by the following search, which compares homicides in North Carolina in the years 1990 and 2000.

Six data fields are selected for comparison: Age, Race (including Hispanic), Sex, Date, Cause of Death (fifteen categories), and County of

death. This information is then compared to the US Census for North Carolina for the same years. The objective is to determine if shifts in population are reflected in the homicide victim profile.

The results demonstrate that the homicide victim profile tracks along with the shift in population. For example, the typical homicide victim in 1990 was a 27 year-old Black male who was shot, representing 55% of homicides while the population of Black males in 1990 was 22%. In 1990 the Hispanic population was 1.04% while the Hispanic homicide victim represented 1.34% of all homicides. In the year 2000 the typical homicide victim was a 27 year-old Black male who was shot, representing 51.4% of homicides while the population of Black males was 21.6%. The Hispanic population in 2000 was 4.7% while the Hispanic homicide victim represented 8.11% of all homicides. The actual number of homicides decreased by 141 cases while the percentage of homicides by gunshot rose from 63% in 1990 to 71% in 2000. Blunt force trauma cases remained about the same while sharp instrument cases decreased from 158 (19.3%) to 67 (10%).

The OCME database is a reliable source of information concerning death investigations in North Carolina, thereby allowing statewide comparisons within a group of interest to be compared to general census data.

Searchable Database, Homicide Victim, North Carolina

G7 “Homicide by Heart Attack” Revisited

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The goal of this research project is to review the criteria for ruling a death as “homicide by heart attack,” with illustrative examples from a metropolitan medical examiner’s office.

The term “homicide by heart attack” is used by some persons to describe sudden death due to underlying cardiac disease with an arrhythmia precipitated by the physical and/or emotional stress associated with the criminal activity of another person. Physical contact and/or injury may or may not occur in such scenarios. “Homicide” is an acceptable and appropriate manner-of-death ruling in such cases. Davis has published a set of criteria for pathologists to use when attempting to establish cause-of-death and manner-of-death rulings in cases where physical injury or contact does not occur. The criteria are as follows: 1) The criminal act should be of such severity and have sufficient elements of intent to kill or maim, either in fact or statute, so as to lead logically to a charge of homicide in the event that physical injury had ensued. 2) The victim should have realized that the threat to personal safety was implicit. A logical corollary would be a feared threatening act against a loved one or friend. 3) The circumstances should be of such a nature as to be commonly accepted as highly emotional. 4) The collapse and death must occur during the emotional response period, even if the criminal act had already ceased. 5) The demonstration of an organic cardiac disease process of a type commonly associated with a predisposition to lethal cardiac arrhythmia is desirable. Although Davis’ criteria specifically deal with cases in which there is no physical contact or injury, the authors apply similar criteria to all cases where sudden death due to heart disease is precipitated by the stress associated with another person’s criminal activity, whether or not physical contact or injury occurs. This is easily accomplished by leaving out the phrase “in the event that physical injury had ensued” for those cases where physical injury actually does occur. In this report, the authors present a series of five cases ruled as homicides using these criteria.

Case 1: A 40-year-old male was arguing with his girlfriend outside of his apartment when she started to strike him with a 2-3 foot long, light-weight, carved wooden statue. He was reportedly struck multiple

times in the head prior to his escape into the apartment, where he locked the door. Witnesses immediately called 911. Emergency Medical Services (EMS) personnel found him dead, in a chair in the living room. Autopsy revealed multiple superficial abrasions of the face and chest, along with a left periorbital contusion and two small lip lacerations. No skull, brain, neck or other internal organ injuries were identified. Other significant findings at autopsy included cardiomegaly (685 grams) with left ventricular hypertrophy, moderate coronary artery atherosclerosis, severe nephrosclerosis, and a remote pontine infarct. Toxicology tests revealed the presence of cocaine and its metabolites. Cause of Death (COD): Part 1: Cardiac arrest associated with stress and physical assault; Part 11: Cardiomyopathy; end stage renal disease; cocaine abuse; remote pontine infarct. Manner of Death (MOD): Homicide.

Case 2: The wife of a 74-year-old man arrived at his place of business just as an intruder was fleeing from the location after having robbed and assaulted the man. The man had sustained a punch to the jaw and was noticeably shaken, but refused transportation to the hospital via ambulance because he felt his injuries were limited to his jaw, which he presumed was broken. He went into the bathroom to clean-up and was then found unresponsive by his wife. She summoned EMS, who transported him to the emergency department, where he was pronounced dead. Autopsy revealed a fractured mandible, but no intracranial injury. The heart, which weighed 350 grams, had mild to severe coronary artery atherosclerosis, with near-complete occlusion of the right coronary artery. Toxicology was negative for drugs of abuse. COD: Blunt force head injuries associated with coronary artery disease. MOD: Homicide.

Case 3: A 66-year-old woman with a history of remote coronary artery bypass graft (CABG) surgery was suddenly awakened from sleep by an intruder who had broken into her home and was demanding money. After the woman became emotionally upset, the burglar fled. The victim was able to phone for help before she collapsed. She did not mention if the intruder had assaulted her. At autopsy, the decedent had multiple areas of senile purpura on her arms, as well as contusions of the right chest and left temple. No other injuries were identified. All resuscitative efforts failed. Autopsy also confirmed the presence of severe coronary artery atherosclerosis, with remote CABG surgery. Her heart weighed 510 grams. COD: Cardiac dysrhythmia due to atherosclerotic cardiovascular disease during an emotionally-stressful event (victim of robbery). MOD: Homicide.

Case 4: A 67-year-old woman was walking in a parking lot on her way from her car to the grocery store when she was stopped by a teenage male who demanded her purse. She refused, and the boy struggled with her for the purse, threatening to kill her if she did not comply. She was able to break away from him, run into the store, and relate what had happened to her prior to collapsing to the floor. All resuscitative efforts failed. At autopsy, there was no evidence of acute injury other than that which was considered related to resuscitative efforts. Other findings included hypertensive and atherosclerotic cardiovascular disease, with cardiomegaly (565 gm), severe coronary artery atherosclerosis, and a remote anterior left ventricular myocardial infarct. COD: Cardiac dysrhythmia due to hypertensive and atherosclerotic cardiovascular disease during an emotionally stressful event (victim of robbery attempt). MOD: Homicide. Adjudication: The teenager and an accomplice were charged with and tried for **, at which time they were found guilty of **.

Case 5: An obese, 52-year-old, diabetic man was involved in a physical altercation with a younger man. During the fight, the older man “acted as if he was having a heart attack.” He subsequently fled from the other man and attempted to drive himself to the hospital, but was so debilitated, that he stopped his car and had to ask for assistance. EMS responded and transferred him to the Emergency Department, where resuscitative efforts continued but eventually failed. Death occurred 30 minutes after EMS initiated treatment. Autopsy revealed rare superficial abrasions of the face, hemorrhage of the left sclera, and a small occipital contusion, but no other injuries. Hypertensive and atherosclerotic cardiovascular disease was present, with marked cardiomegaly (660 gm), severe

coronary artery atherosclerosis, and histologic evidence of remote, subacute, and acute myocardial infarcts. Well-developed coagulation necrosis with associated neutrophils was present focally. COD: Part I: Myocardial infarct due to hypertensive and atherosclerotic cardiovascular disease; Part II: Obesity, diabetes mellitus, and stress associated with a physical altercation. MOD: Homicide.

In each of the cases presented, the modified Davis criteria, as described above, were fulfilled. In most of the cases, physical contact definitely occurred, although in some, no injury was inflicted, and in none were the inflicted injuries considered life threatening in and of themselves. Case 3 is the best example in the series of a case where no definite physical contact occurred between the assailant and the victim. Although she had some minor injuries, none could be clearly associated with the criminal activity. In each case, the victims clearly feared for their safety, and the events were of a highly emotional nature. Also, in each case, the collapse and subsequent death occurred shortly after the initiating event, but it occurred during the emotionally volatile period of time immediately following the event. Finally, autopsy revealed significant underlying cardiac pathology in each victim, such that each was a prime candidate for experiencing a stress-induced cardiac dysrhythmia.

Cardiac deaths precipitated by physical and/or emotional stress occur frequently. When the stress is precipitated by criminal activity directed against the victim by another person, it is appropriate to consider these deaths as homicides. In order to appropriately certify such deaths, strict criteria as set forth by Davis should be satisfied. Complete autopsy, including histologic examination and toxicology, coupled with detailed reconstruction of the events with particular attention paid to their timing, is essential in order to appropriately certify such deaths. Appropriate certification may lead to successful prosecution of criminals. Failure to appropriately certify such deaths may result in failure to appropriately adjudicate such cases.

Homicide, Heart Attack, Manner of Death

G8 The Significance of Pulmonary Interstitial Emphysema in Fetal and Infant Autopsies

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The goals of this research project are to provide participant with the capability to distinguish "florid" from "equivocal" pulmonary interstitial emphysema on routine H&E-stained lung sections and to understand the value of the histologic finding of florid pulmonary interstitial emphysema in distinguishing live born infants from stillborns.

The most commonly documented cause of pulmonary interstitial emphysema (PIE) is the mechanical ventilation of infants with respiratory distress syndrome, but known causes also include vigorous resuscitation efforts by those not accustomed to small infant lung volumes, forceful respiratory efforts against inspissated mucus or a foreign object, and spontaneous PIE related to cystic lesions or infection.

We have previously commented on the importance of the histologic finding of PIE in the determination of live birth in two infants whose bodies were discarded shortly after birth. Because of the implications of the distinction of live birth from stillbirth in criminal proceedings, we undertook the current study to further elucidate the importance of the microscopic finding of PIE.

Sixty-five cases of infant deaths were retrieved. The infants ranged in age from birth to 11 months (mean 2.4 months). The causes of death in these cases included sudden infant death syndrome (28), sudden unexpected death, manner undetermined (8), homicidal or accidental asphyxia (3), congenital anomalies (13), infection (5), prematurity (1), head injury (2) and non-asphyxial trauma (5). Microscopic sections of the lungs were

compared with those of 21 third trimester stillborn infants ranging in gestational age from 28 to 40 weeks (mean 35 weeks). The number of lung sections ranged from 1 to 10 per case (mean 4). The slides were examined for evidence of PIE, defined as the presence of non-endothelial-lined spaces in the interstitium and subpleural zones. "Florid PIE" was defined as the presence of expanded and dilated interstitial spaces coalescing with subpleural cystically-dilated areas. This finding was distinguished from the more subtle finding of focal distinct but non-distended interstitial and subpleural spaces, which we termed "equivocal PIE." Immunohistochemical stains utilized to highlight endothelial cells (Factor VIII and CD 31) have been previously reported as being useful in the distinction of dilated lymphatic spaces from PIE. However, because of the cellular disruption frequently seen in postmortem bronchial and endothelial structures which can compromise the interpretation of these immunohistochemical studies, we relied upon conventional H&E-stained sections to evaluate the morphologic presence or absence of PIE.

Sixteen cases of florid PIE were identified. All were live born infants. An additional 46 cases of equivocal PIE were seen, including 35 live born infants and 11 stillborns. In 24 cases, no PIE was identified, including 14 live born infants and 10 stillborns. The causes of death in the cases of florid PIE included sudden infant death syndrome (9), homicidal asphyxia (1), hemorrhage and inattention at birth (1), congenital anomalies (2), and sudden unexpected death, manner undetermined (3). Twelve of these infants had received cardiopulmonary resuscitation and/or mechanical ventilation. In the cases of homicidal asphyxiation and hemorrhage and inattention at birth, no resuscitation attempts were made. In the remaining two cases, information concerning resuscitation was unavailable. Equivocal PIE was seen in 32 live born infants, all but 3 of whom had been resuscitated. Eleven resuscitated live born infants had no evidence of PIE. Of the 11 stillborns with equivocal PIE, resuscitation had been performed in two cases. Causes of death in both live born and stillborn cases with equivocal PIE were widely variable, as were the cases in which PIE was not identified. We attempted to correlate the presence of PIE in live born infants with sleeping position and with co-sleeping or non-co-sleeping. No consistent association was found.

In conclusion, the finding of florid PIE supports our previous observation of the association of PIE with live birth. However, no direct correlation between the presence of PIE and cause of death could be determined.

Interstitial Emphysema, Live Birth, Stillbirth

G9 Motor Vehicle Collision-Related Death Due to Delayed-Onset Subarachnoid Hemorrhage Associated With Anticoagulant Therapy

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The goal of this research project is to describe a death related to delayed-onset subarachnoid hemorrhage following craniocerebral trauma in a person receiving anticoagulant therapy, and to alert the medical and forensic communities to this potentially lethal complication related to trauma and therapy.

Death due to craniocerebral trauma sustained in vehicular collisions remains a common cause of unnatural death in the United States. In many cases seen by forensic pathologists, death occurs at or shortly after the injuries are sustained. In some individuals, death occurs following hours, days, or weeks of medical intervention. Others die as a result of complications of their injuries months or even years following the initial

trauma. Various medical interventions may be considered contributing factors in these and other deaths. In this report, we present a case of a death due to delayed-onset subarachnoid hemorrhage associated with anticoagulant therapy which was administered to the victim of a motor vehicle collision because of an underlying prosthetic aortic valve.

On a sunny Texas afternoon, a restrained, 40-year-old woman was driving a late- 1980's model automobile on a dry, 2-lane asphalt, rural highway when an oncoming pick-up truck turned in front of her, resulting in a head-on collision. The woman was conscious, but required prolonged extrication, as she was pinned in her vehicle. She was transported to the nearest hospital, where she was found to have fractures of the right tibia, fibula, and calcaneus, as well as a laceration of the chin and multiple cutaneous contusions of her trunk. Past medical history was significant for a remote aortic valve replacement (at age 16 years for rheumatic heart disease), for which she was receiving chronic anticoagulant therapy. During her entire hospitalization, she remained on anticoagulant therapy for her underlying prosthetic heart valve. A cardiology consultation with echocardiography revealed no acute problems. She underwent surgical fixation of the tibia and fibula fractures at the local hospital prior to being transported to a metropolitan trauma referral center, where she was to undergo repair of the calcaneus fracture. Ten days after the accident, the victim developed altered mental status and agonal respirations, requiring emergency intubation. A computed tomography scan of the head and brain revealed acute basilar subarachnoid hemorrhage. The clinical impression was that the patient had suffered a possible ruptured cerebral artery aneurysm. Since brainstem function was absent, "do not resuscitate" status was established, and the victim died, 11 days after the automobile collision. Because of the nature of the incident, the case was referred to the medical examiner's office where an autopsy was performed.

Autopsy revealed the presence of surgically-fixed tibia and fibula fractures, cardiomegaly (450 gm), a prosthetic aortic valve, multiple cutaneous contusions, and a healing laceration of the chin. Head examination was significant for the presence of approximately 15 ml of patchy subdural hemorrhage over the cerebral convexities and in the posterior fossa, as well as moderate to extensive subarachnoid hemorrhage, most prominent over the cerebellum and inferior right temporal lobe. No cerebral artery aneurysms or vascular malformations, skull fractures or subscalpular hemorrhage were identified. Sections of the formalin-fixed brain revealed a hemorrhagic discoloration of the right medial temporal cortex which, on microscopic exam, proved to be a cerebral contusion. The subarachnoid hemorrhage was most voluminous immediately overlying the contusion. Histologic exam revealed no evidence of fat or bone marrow embolism. The cause of death was ruled "complications of blunt force injuries." Based on the autopsy findings and the clinical history, the final mechanism of death in this case was related to the subarachnoid hemorrhage. Since no grossly-evident vascular abnormality could be identified, the hemorrhage was most likely related to the underlying brain contusion with anticoagulant therapy contributing to the hemorrhage.

Deaths related to complications of traumatic injury are not rare. The causal relationship between the initial trauma and death may or may not be readily evident in such cases. In fact, clinicians and others may initially attribute the death to an unrelated natural disease process, as occurred in this case. The present case serves to remind clinicians and pathologists that any death following a traumatic injury must be considered a possible injury-related death. It also serves to remind physicians of the potentially deleterious effects of anticoagulant therapy, particularly in persons who have been injured.

Forensic, Complications of Therapy, Subarachnoid Hemorrhage

G10 A Comprehensive Analysis of Forensic Science Training in Forensic Pathology Fellowship Programs

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The goal of this research project is to summarize current forensic science training in the nation's forensic pathology fellowship programs.

The forensic sciences are significantly impacting criminal investigations more and more each year. The advances in DNA identification technology alone have revolutionized the daily practice of forensic pathologists. For example, it is now commonplace for forensic pathologists to spot blood standard cards from all bodies for possible future DNA analysis. Other specialized fields in the forensic sciences, such as toxicology, arson analysis, firearm analysis, trace evidence and fingerprint examinations, also aide the forensic pathologist, as corroborative studies, to finalize the cause and manner of death in a wide variety of cases. Therefore, fundamental training in the forensic sciences is necessary to appreciate the complexities inherent in each field. To what extent are the trainees in forensic pathology fellowships around the country obtaining forensic science training?

This presentation will outline survey results regarding forensic science training from the 44 Accreditation Council for Graduate Medical Education (ACGME) accredited forensic pathology fellowship programs under the auspices of the College of American Pathologists (CAP) Forensic Identity Committee. The survey will assess the extent of training in the forensic sciences that fellows in forensic pathology are currently receiving. A formalized survey such as this has not yet been conducted and should provide a wealth of useful information about forensic-specific graduate medical education. The information gleaned from the study may aide members of the National Association of Medical Examiners (NAME) Ad Hoc Committee of Forensic Pathology Training in subsequent revisions to their recent training program guideline recommendations.

The first component of the survey pertains to the characteristics of the forensic pathology fellowship. How many fellows does the program train each year? Is the fellowship affiliated with a medical examiner or a coroner system? Is the medical examiner's or coroner's office accredited by the National Association of Medical Examiners? Is the office affiliated with an academic university or teaching hospital? This section is simply to obtain general information about each training program.

The second component of the survey is geographical. Is the medical examiner's office physically connected with the crime lab, or if not, how far from each other are they located? Specifically, with which components of the region's crime lab (i.e., DNA, toxicology, etc.) is the medical examiner's or coroner's office associated? The purpose of this section is to gain an understanding of the extent to which forensic pathology training programs are integrated with the crime lab.

The third component of the survey is qualitative. Questions in this section pertain to the nature of the involvement of the forensic pathology fellow in each of the areas of the crime lab. How much time is spent in each discipline? Is the exposure to the forensic laboratories simply a tour or does the fellow actually spend time training in each lab for a defined period of time? Are fellows encouraged to undertake independent research projects in the forensic sciences other than forensic pathology? These inquiries will further define the nature of education in the forensic sciences that today's forensic pathology fellows receive.

The presentation will summarize the results of all participating forensic pathology fellowship programs and discuss any trends that are

observed. The information gained from this study should prove valuable for assessing the current state of forensic pathology training with respect to the crime lab, and for formulating goals to strive for in the future as forensic pathology continues to become increasingly more integrated with other disciplines of forensic science.

Crime Lab, Forensic Pathology Fellowship, Training Program

G11 Postmortem Microbiology: Friend or Foe?

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The goal of this research project is to give participants a heightened sense of the various modern-day postmortem bacterial organisms, their relevance and their presence/absence based on sample site.

Introduction: Postmortem microbacteriological culture results are frequently difficult to interpret. Many organisms are cultured but the significance in the postmortem state is unknown. This can create dilemmas for forensic pathologists, particularly in those cases where a distinct anatomical cause of death is lacking. Many different culture techniques have been employed over the years and many different sites have been cultured, all with varying results. The emergence of new and resistant strains of bacteria prompted the investigators to establish what contaminants are present in the modern day and to compare the organisms cultured based on specimen site, relevance when compared to tissue sections and their presence based on time since death.

Methods: In this study, the authors obtained microbacteriological cultures from autopsies over a two-month period in the spring in a southeastern state. Bodies in a state of advanced decomposition were excluded from the study, resulting in a total of 34 cases. Five sites were sampled in the majority of the cases: subclavian blood, heart blood, spleen, right lung and left lung. Sterility was obtained either through searing of the tissues or the use of betadine, depending on the site being cultured. In addition, microscopic sections of the lungs were taken directly adjacent to the culture site to enable correlation of organisms cultured to the presence/absence of inflammation seen histologically. Pediatric blood culture bottles were utilized for both the subclavian and heart blood samples. Culturette swabs were utilized for the lung cultures and a small portion of spleen was removed in situ, and then ground with a tissue grinder. The latter three specimens were streaked onto three types of agar: 5% sheep blood, chocolate and MacConkey. Positive blood cultures (as determined in the BacT automated system) were also plated onto these three types of media. Gram stains were performed on every organism grown and then additional testing was instituted to further identify the organisms as needed.

Results: As one would expect, the majority of postmortem bacterial organisms cultured are contaminants. However, many common antemortem pathogens are also frequently cultured in the postmortem state, but are without histologic evidence of inflammation and are therefore felt to represent contaminants as well. Tissue sections are absolutely critical in determining the relevance of these particular organisms. In the cases where organisms were cultured that were felt to be a contributing factor in the person's death, there was histologic evidence of inflammation. All specimen sites sampled within a single case produced similar findings. Therefore, postmortem microbacteriological cultures can be useful tools in the process of death investigation, when used appropriately and in the full context of the case.

Microbiology, Bacterial Organism, Postmortem

G12 Sufentanil Toxicity in Healthcare Professionals

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The goal of this research project is to provide to the forensic community an awareness of two recent cases of sufentanil toxicity involving healthcare professionals.

We have observed two deaths involving sufentanil toxicity in healthcare professionals in a period of less than two months. This presentation demonstrates two autopsy cases from the Harris County Medical Examiner's Office involving sufentanil toxicity among healthcare professionals. Sufentanil citrate is available under its generic name of sufentanil and is often used in the surgical suite by anesthesiologists as an adjunct to general anesthesia. Sufentanil is available in Dosette ampules of 50-mcg/1 ml, 100-mcg/2 ml, and 250-mcg/5 ml. It is a Class II controlled synthetic narcotic, which is about 5 to 7 times as potent as fentanyl and 500 to 800 times as potent as morphine. The usual adult dose is 1 to 2 mcg/kg. Supplemental doses of 10 to 25 mcg may be given as needed. Profound analgesia is achieved with doses of 2 to 8 mcg/kg. Deep general anesthesia is achieved with doses of 8 to 30 mcg/kg. Sufentanil easily crosses the blood-brain barrier and is quickly routed to body tissues. After 24 hours, approximately eighty percent of the drug dose is excreted in the urine. Sufentanil is metabolized into N-desmethylsufentanil and O-desmethylsufentanil. Approximately thirty percent of a dose metabolizes as conjugates in both urine and feces. Sufentanil has a number of toxic effects including respiratory depression, acute respiratory arrest, seizures, hypotension (also sudden hypotension), euphoria, dizziness, muscle rigidity, drowsiness, nausea, vomiting, bradycardia, and irregular heartbeat. The literature reports of two deaths in adults after self intravenous administration of sufentanil indicating blood levels of 1.1 and 7.0 mcg/L and liver levels of 1.8 and 3.4 mcg/L. It is not clear if these adults were healthcare professionals.

The following are details of two cases involving sufentanil toxicity which have occurred in less than a two-month period. Case One is a 41 year-old Caucasian male anesthesiologist who was found in the bathroom, sitting on the toilet with his pants on and unresponsive. An empty syringe was found inside a dry beer can. A small vial of sufentanil 50 mcg, three-fourths empty, was found in the bathroom. The autopsy findings included a recent injection site in the left antecubital fossa with a 3/8 inch hematoma, cardiomegaly (450 grams) with moderate atherosclerotic cardiovascular disease, bilateral pulmonary edema and congestion, hepatomegaly (2550 grams), and erosions of the gastric mucosa.

Case Two is a 34 year-old Caucasian male registered nurse who was found at work in the ladies' bathroom face down on the floor with his pants and underwear down around his ankles. Fifteen (15) different ampules, vials, and bottles of medications were found in the bathroom which included one opened ampule of sufentanil. In addition, one previously used syringe with needle and cap was found at the scene. The autopsy findings included bilateral injection sites on the medial thigh, cardiomegaly (550 grams) with right ventricular dilatation and concentric left ventricular hypertrophy, and hepatomegaly (2400 grams).

Sufentanil can be assessed in the laboratory by multiple methods including gas chromatography with nitrogen specific detection, radioimmunoassay, and gas chromatography-mass spectrometry (GC-MS). The blood analysis for sufentanil was identified and quantitated by GC-MS method. Biological specimens were made alkaline (pH 13) using 2N, NaOH. Sufentanil was extracted using a mixture of hexane:ethanol (19:1). D5-fentanyl was used as an internal standard. The dried extracts samples were injected onto the GC-MS and the ions 250, target ions, 194, 195, 151 for D5-fentanyl and 250 (target ion), 290, 291, 140 for sufentanil were monitored. Postmortem blood in Case One was positive for ethanol

0.12 g/dL and sufentanil 2.95 mcg/L. The syringe wash was also positive for sufentanil. No other drugs were identified. In Case Two, sufentanil was the only compound in concentration of 2.63 mcg/L. The cause of death was sufentanil toxicity for both cases. The manner of death was ruled as accidental for both cases.

In conclusion, these two deaths resulting from sufentanil toxicity in Harris County Medical Examiner's Office in less than two months are warning signs of the popularity of this potent, narcotic substance among healthcare professionals with substance abuse problems.

Sufentanil, Healthcare Professionals, Harris County Medical Examiner Office

G13 Oxycodone (OxyContin) Related Deaths in Maryland 1998-2000

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The goal of this research project is to examine the prevalence and features of oxycodone-positive deaths in the State of Maryland over a three year period from 1998 through 2000.

Oxycodone is an opioid agonist with a high oral:parenteral potency ratio relative to most other opioid analgesics. This is due to the presence of a methyl group on the aromatic hydroxyl group, which prevents its conjugation by glucuronic acid in the liver. Because oxycodone is less potent than morphine in its analgesic properties and has adverse effects that limit the maximum tolerated dose, oxycodone is frequently employed clinically in formulations containing aspirin or acetaminophen. In recent years, the number of deaths related to the abuse of oxycodone has appeared to be increasing.

We examined case records at the Office of the Chief Medical Examiner of the State of Maryland (OCME) over a three year period from 1998 through 2000, where toxicologic studies showed the presence of oxycodone in the samples submitted. The laboratory identifies oxycodone as part of its routine abused and therapeutic drug testing procedures.

The number of oxycodone-positive cases investigated by OCME has increased steadily from 1998 to 2000. In 1998, there were a total of 27 oxycodone-positive cases; in 1999 a total of 41 oxycodone-positive cases, and in 2000 there were 69 oxycodone-positive cases. Of these, the large majority of cases were in individuals between the ages of 32 and 49. In 1998, 67 percent; in 1999, 68 percent; and in 2000, 69.6 percent of oxycodone-positive deaths occurred within this age range. Most cases were in white individuals: In 1998, 85.2 percent; in 1999, 85.4 percent; and in 2000. Oxycodone-positive deaths in men outnumbered those in women. From 1998 through 2000, the percentage of oxycodone-positive deaths occurring in men were 70.4 percent, 70.1 percent, and 60.1 percent respectively. 41.6 percent of all oxycodone-positive cases were in the urban areas of Baltimore City or Baltimore County, while the remaining 58.4 percent occurred in Maryland's suburban and rural counties combined.

Of all oxycodone-positive cases from 1998 through 2000 (n=137), 41.6 percent of deaths (n=57) were attributed to oxycodone. Of the latter, 35.1 percent of deaths (n=20) were attributed to oxycodone alone, while the remaining 64.9 percent (n=37) were attributed to oxycodone in combination with alcohol and/or one or more other drugs.

This data suggests that oxycodone, especially when used in combination with alcohol and/or other drugs, contributed significantly to the number of deaths in Maryland from 1998 through 2000. Moreover, the use of oxycodone has increased significantly over this brief time period.

Oxycontin, Oxycodone, Death

G14 Deaths Related to Conduction System Pathology

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The goal of this research project is to inform the forensic community of fatal cases related to conduction system pathology.

It is not rare for pathologists to be confronted with the apparently natural deaths of young subjects without any prior medical history. Sometimes the exact cause of death remains unknown even after a complete autopsy and full toxicological analyses. In some of these cases examination of the cardiac conduction system can demonstrate pathological lesions which are described in the literature as a possible explanation of the fatal issue. On the other hand, rhythm disturbances are not always lethal. But, according to the circumstances in which they occur, they can lead to death. For example they can have dramatic consequences if the victim is driving or swimming. For these reasons the evaluation of the cardiac conduction system cannot be overlooked in forensic medicine.

Since 1998, the conduction system of the heart is systematically analyzed in our institute. A simplified and evaluated method is used. Samples of the conduction system are collected from the left approach to the ventricular septum. The initial block is cut into 5-7 blocks about 2-3 mm wide. From each block (always sectioned from the anterior face) at least 1-2 histological sections are prepared and stained with hematoxylin-eosin or with Masson trichrome. If suspicious lesions are noticed, more sections are made.

In this presentation, 25 cases are reported: 12 cases of sudden unexpected death and 13 cases of fatal accidents.

In the group of sudden unexpected death, the ages ranged from 11 to 52 years. For most of them the reports of the very last moments of life suggested a possible cardiac origin of death. Most of the time clinical data was unknown or insignificant. In the group of the lethal accidents which included cases of drowning, paragliding and road accidents, the police investigation strongly suggested a sudden sickness. The ages of the victims ranged from 15 to 70 years.

In the 25 cases, the macroscopic study of the heart (heart weight, examination of valves, coronary arteries, cardiac chambers and great vessels), as well as histological examination of working myocardium, were normal. The toxicological analyses were negative. However in all the cases, microscopic examination of the cardiac conduction system allowed to detect different pathological changes. Thus, lesions such as an abnormal small muscle entrapped into the bundle branches or in the interventricular septum, fatty infiltrations of the bundle of its branches, a replacement of the conduction tissue by empty spaces, the accessory pathways between conduction structures and myocardium, a stenosis of the arteries supplying the conduction system, and fibrosis of the septum with occasionally compression of the branches were detected. Such findings are described in the literature and reported as possible causes of rhythm disturbances and death.

Nevertheless, in cases of deaths which seem to be conduction system related, conclusions should be prudent, especially in forensic practice. Even if histological examination reveal pathological lesions, the death can be attributed to cardiac rhythm disturbances only if no other cause is found after a complete autopsy and toxicological analyses. Moreover, it is not possible to exclude that the pathological findings of the conduction system are not responsible for the sudden death, and that the cause of death is related to another unknown origin.

Microscopic examination of the cardiac conduction system, even with a simplified technique, is laborious. Moreover, the interpretation of the histological findings is difficult. However, the evaluation of the conduction system should be more systematically carried in routine forensic practice as it can explain not only the cause of sudden unexpected deaths, but also it can help to elucidate the circumstances of fatal cases initially supposed to be accidental.

Cardiac Conduction Systems, Sudden Death, Accident

G15 *Commissio Cordis Intermedius: Digital Interposition Between Projectile and Thorax*

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The goal of this research project is to present the forensic community with a description of novel variation of a recognized mechanism of sudden cardiac death.

A 21-month-old male child along with his father and uncle were attending a stock car racing event on a somewhat muddy track. The vehicles repeatedly splattered hardened chunks of the dirt into a short protective wall at the curved edge of the roadway and, on occasion, into the spectators sitting in the adjacent bleachers.

As the uncle, who was sitting in the top row, was passing the child to the father who was in the seat below, a "whoosh" sound followed by a "pop" was described by the two adults. The uncle was struck in the dorsum of the third left finger at the proximal joint, having his hand placed over the chest of the child while transferring him to his father. The finger showed a "black, grainy" area as well as a "red mark", both gone when he reached the hospital. X-rays revealed no fracture. Upon later scene investigation, several irregular, hardened mud clods were found in and under the nearby seats, some approximating the dimension of a golf ball. The uncle had commented that the object that struck him felt about this size.

Following the "pop", the child immediately let out a cry, jerked his head back, appeared to have lost consciousness, and became limp. Breathing was said to be irregular with a rapid pulse noted. EKG initial rhythm showed approximately 270 beats per minute. The respiratory rate varied between 3 and 10 breaths per minute and the pupils were dilated. Soon the pulse weakened and efforts to resuscitate him at the field and continuing in a nearby hospital were unsuccessful. Agonal vomiting had occurred and some was present on the clothing. A small "red mark" was seen on the left side of the baby's lower ribs when his shirt was removed by the paramedics, and was also noted at the hospital. EKG now revealed asystole and he was pronounced dead one hour following the incident. There was a previous history of asthma with medications prescribed. He had been hospitalized two months earlier for otitis media and pneumonia, which cleared after antibiotic treatment.

Postmortem examination two days later revealed no bruising of the chest skin, underlying musculature, ribs, sternum, pericardium, or heart. The "red mark" on the chest observed at the track was not now evident. Microscopic examination of multiple heart sections and other tissues were essentially normal. There were no pulmonary changes indicative of asthma. Evidence of gastric aspiration was not observed. The only other injury was a small, patterned bruise on the lateral left forehead, noted on the day following the autopsy. The underlying skull and brain were grossly and histologically unremarkable.

The interposition ("intermediate object") in this instance may have accounted for the lack of a discrete injury on the chest or in the musculature of the child, although "hyperemia" of this area as well as on the uncle's finger were initially documented. A relatively high velocity impact to the thorax, however, remained as the lethal mechanism to a presumably vulnerable heart. Additional studies attempting to clarify the cardiac status will be described. The possible distribution of forces due to the interposed digit will also receive comment.

Sudden Death, Commissio Cordis, Intermediate Object

G16 Genetics of Sudden Cardiac Death: Prothrombotic Mutations of Blood Platelet Glycoprotein Receptors are Common Among Men Who Die of Prehospital Myocardial Infarction at Early Middle Age

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The goal of this research project is to present new insights into the pathology of sudden cardiac death and to draw attention to the importance of genetic prothrombotic factors as predictors of sudden prehospital coronary death.

The knowledge on predicting and predisposing factors of sudden cardiac death (SCD) at early middle age has remained limited: only smoking and family history are known to be associated with SCD. Following the decline in the rate of myocardial infarction worldwide, sudden cardiac death has remained the most important unresolved factor in the mortality of coronary heart disease (CHD). As much as 90% of CHD mortality in individuals under 55 years occurs out-of-hospital. A key event in the development of acute myocardial infarction and sudden cardiac death is the rupture or erosion of a thin-walled atheromatous plaque distant from the site of the culprit stenosis leading to the development of fibrin-rich occluding thrombosis. When an atheromatous plaque is fissured or its fibrous cap is ruptured, platelet glycoprotein Gplb-DC-V (HPA-2) receptors are activated and start the binding of platelets to subendothelial collagen. At the same time, GPHb/Ma (HPA-1) fibrinogen receptors are also activated and begin binding fibrinogen, connecting platelets to each other, leading ultimately to the formation of coronary thrombosis. A mutation (CM) in the leucine-rich region in the Gplb receptor gene binding site leads to an alteration in the amino acid sequence (Thr/Met) and alteration in the binding activity. Another mutation (pIAI/A2) in the exon of Gp Hla gene with replacement of one amino acid (leucine with proline), resulting in a change in the protein conformation and in the spatial orientation of the fibrinogen-binding region of the receptor, affects the efficacy of platelet aggregation. There have been no detailed autopsy studies on the occurrence of these mutations among victims of sudden cardiac death.

The aims of the present project were to study the associations of the Thr/Met mutation of the Gp Ib-DC-V collagen receptor and the pIAIIA2 mutation of the Gp IIb/IIIa fibrinogen receptor with coronary thrombosis and MI in a carefully characterized autopsy series and to examine the possible age-dependency of this association.

The study series comprised 700 men (mean age 53.1 yrs, range 33 to 70) of the Helsinki Sudden Death Study (HSDS) subjected to a detailed medicolegal autopsy in 1981- 1982 (n=400), and in 1991 - 1992 (N=300). This series comprises all sudden unexpected cardiac deaths of men below 55 years living in the Helsinki city area (500 000 inhabitants) and also all violent deaths within this area during 2.5 years. Life style and various risk factors were ascertained by interviewing the spouse, a relative, or a close friend of the deceased. The interview succeeded in 500 (71.4%) cases. The presence or absence of acute MI and/or coronary thrombosis was confirmed by macroscopic and histological examination of the myocardium. The Thr/Met and pIAIIA2 polymorphisms were detected by PCR and restriction digestion.

The genotype frequencies of the Thr/Met polymorphism were 77.1% for ThrThr, 21.3% for ThrMet and 1.6% for MetMet genotype.

Respectively, the genotype frequencies of the plAIIA2 polymorphism were 73. 1% for plAIIA1, p,Al/A2 24.2% for and 2.7% for PIA'JA2.

Men with an acute MI (n=75) and coronary thrombosis (n=6 1) were more likely to be carriers of the Met allele of the Thr/Met polymorphism of the Gp Ib-IX-V collagen receptor (OR 2.5 and 4.0, respectively, p<0.005 for both) compared to controls who died of non-cardiac causes (n=340). In men under 55, Met allele carriers were over represented (OR 1.9) among victims of SCD (n=97) compared to controls (n=249). In men under 55, 14/28 (50%) of men with acute MI and 16/23 (69.6%) of men with coronary thrombosis were carriers of the Met allele compared to those 50/249 (20. 1%) who had died of non-cardiac causes (ORs 4.9 and 9.0, respectively). Similar associations were observed in the separate analysis of both individual autopsy series.

Our results suggest that prothrombotic mutations in blood platelet collagen and fibrinogen receptor genes occurring normally in 20-25% of the population are found in 60-70% of victims of acute fatal myocardial infarction below 55-60 years. This suggests that they are major risk factors predicting coronary thrombosis and early prehospital coronary death.

Sudden Cardiac Death, Coronary Thrombosis, Myocardial Infarction

G17 Under Reporting of Fatal Child Abuse by State Vital Statistics ICD-9 Codes

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The goals of this research project are to learn how to identify the difference in the incidence of fatal child abuse cases as reported by ICD-9 codes versus state child death review boards, to establish awareness of underreporting of fatal child abuse cases, and to discuss recommendations for improvement.

The purpose of this study is to document the difference in the incidence of fatal child abuse cases as reported by the International Classification of Diseases, Ninth Revision, codes versus that reported by state child fatality review boards. The ICD, designed to promote international comparability in the collection, processing, classification, and presentation of mortality statistics, includes translating reported conditions into medical codes. The coding rules consolidate conditions, and systematically select a single cause of death from a reported sequence of conditions. State child death review teams are comprised of multi-agency, multi-disciplinary members, who meet periodically to examine circumstances surrounding the deaths of children. State child review teams are comprised of members such as law enforcement, coroners, social services, physicians, educators, legal community and members of the Department of Health and Environment, who bring a variety of experience and perspectives on children's health and maltreatment issues. Under the ICD-9, category E967 is Child Battering and Other Maltreatment. For a homicide to be coded E967, the decedent must be younger than eighteen, and the death certificate must list evidence of prior abuse or the certifier must specify abuse, beating or other maltreatment. The general definition of child abuse by medical examiners and child fatality review boards is death of a child under the age of eighteen by the willful act of a person responsible for the child's welfare.

We retrospectively studied child abuse fatality data from New Mexico, Arizona, Kansas, and North Carolina for the year 1997. The incidences of death resulting from child abuse published in the 1997 annual report for state child death review boards and the deaths attributed to state vital statistics code E967 were compared. Preliminary review reveals a high percentage of under reporting by ICD-9 codes. This can be attributed to failure of the coding system to recognize fatalities due to abuse, inexperience of the coder, interpretation of the code (more than one code for similar conditions), and incomplete or inaccurate reporting on

death certificates. For example, a homicide due to an injury sustained from a single isolated incident of a child under the age of eighteen would not be coded as E967 (Child Battering and Other Maltreatment) due to the fact that there was no history of previous child abuse, beating or maltreatment. Problems occur with varying definitions of what constitutes abuse or neglect, and the failure to categorize neglect deaths as homicides.

We will present suggestions to improve upon the current system of recognizing and reporting fatal child abuse. Improvements in the recording of incidences of child abuse fatalities are crucial in the development of prevention strategies. Recommendations to improve data may include revising the format of death certificates, training coders or restructuring the coding system to include new codes specifically for medical examiner cases. An improved approach to reporting child abuse may require training of coroners, medical examiners and physicians to properly and universally complete death certificates. Items that may help to obtain a higher overall level of recognition of child abuse cases would include education and certification of those individuals responsible for investigating deaths. Standardization of scene investigation and autopsy protocols may be helpful, as well as stringent statutes requiring that autopsies be performed on all children under the age of two. Improvement to the current underestimated mortality figures will require cooperation and collaborative efforts between multi-disciplinary agencies including state vital statistics, child fatality review teams, medical examiners, law enforcement, and the legal system.

Mortality figures determined by ICD-9 coding alone was found to significantly underestimate the incidence of fatal child abuse in four states for the year 1997 when compared to medical examiner/coroner statistics and data from state child death review boards. Accurate recording of fatal child abuse is crucial to determine the true incidence of child homicide, to establish trends, and to allocate resources for prevention strategies.

Child Abuse, ICD-9, State Child Death Review Boards

G18 Venous Air Embolism— A Difficult Postmortem Diagnosis

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The goals of this research project are (1) to report a series of cases where circumstantial evidence and autopsy findings helped determine the cause and manner of death; (2) to illustrate through cases that, though an uncommon complication of a common procedure, venous air embolism can cause sudden and unexpected death; and (3) to bring home the point that awareness of this phenomenon is paramount in making the right postmortem diagnosis.

Case 1. A 59-year-old male on Methadone program for chronic drug abuse was found unresponsive in his hospital room. His central line catheter appeared to have been cut or melted. Suspicion of foul play was entertained initially until the County Sheriff's police ruled it out.

Case 2. While sitting on a chair in preparation for discharge, a 71-year-old female with a history of hypertension and scleroderma developed mental status changes soon after removal of central venous catheter. A family member witnessed this incident.

Case 3. While being detained by police for shoplifting, a 29-year-old female with a history of chronic renal failure on dialysis pulls out her central line catheter and collapses to the floor. The store security cameras recorded this incident.

Case 4. A 40-year-old male with chronic renal failure was found unresponsive in his motel room in a pool of blood with a dislodged dialysis catheter. He had a history of depression and suicidal tendencies in the past.

Central Venous Catheterization is performed frequently in the management of a variety of medical and surgical illnesses. The commonly

recognized complications of insertion and removal of a Central Venous Catheter (CVC) include thrombosis, infection both systemic and local, pneumothorax and hemorrhage. Venous Air Embolism (VAE) is another complication that is preventable, and carries with it a high incidence of morbidity and mortality. The risk of VAE associated with removal of CVC is not widely known, as is demonstrated by Case Two. Several factors known to predispose to the formation of VAE such as failure of spontaneous collapse of the catheter tract due to duration of catheter insertion, diameter of the indwelling catheter, upright position of the patients, deep inspiration or coughing while catheter removal or disconnection, played a significant role in these persons' demise.

The cases being described illustrate that postmortem diagnosis of VAE is difficult at best, but not impossible if one takes into account the medical history and circumstances surrounding death, and has a high degree of suspicion and awareness of this phenomenon.

Venous Air Embolism, Central Venous Catheter Removal, Sudden Death

G19 Virtopsy—New Horizons in Forensic Radiology: Documentation and Analysis of Gunshot Victims With Postmortem Multi-Slice Computer Tomography and Magnetic Resonance

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The goal of this research project is to study the full-body documentation of seven gunshot wound victims, with multi-slice spiral computed tomography (MSCT) and magnetic resonance (MR), and subsequent comparison with the findings of the standard forensic autopsy.

Virtopsy - New Horizons in Forensic Radiology: Documentation and Analysis of Gunshot Victims with Postmortem Multi-Slice Computer tomography and Magnetic Resonance

Goal: The use of the new radiologic modalities in forensic science promises to be a great help for forensic pathologists. This paper will present the full-body documentation of seven gunshot wound victims, with multi-slice spiral computed tomography (MSCT) and magnetic resonance (MR), and subsequent comparison with the findings of the standard forensic autopsy.

Materials and methods: MSCT was performed on a General Electric Light Speed QX/i. The scan time for 350 axial slices of the head (high-quality data and overlapping data acquisition) was 40 seconds, and for the rest of the body we required only 20 seconds (high-speed data acquisition; 70 axial slices). The MR examination was performed on a 1,5 Tesla General Electric machine. Post processing (2-D and 3-D reconstructions of CT data sets) was performed with the GE Advantage Windows workstation. Then a classical forensic autopsy was made.

Results: With the spiral CT and MR examination and the subsequent 2-D multi-planar reformation / (MPR) and 3-D shaded surface display reconstruction (SSD), all the gunshot-created complex skull fractures and brain injuries (such as the wound channels and the deeply-driven bone splinters) could be impressively documented in complete and graphic detail. With the CT / MR examination it was also possible to document and demonstrate some signs of vital reaction to the gunshot: air emboli in the upper thoracic veins and the heart and the classic pattern of blood aspiration in the lungs.

Discussion: We agree with B.G. Brodgon, who says in his book, *Forensic Radiology*: "The sad truth is, that a century after the first x-ray was introduced as evidence in a court law, there is no general appreciation of the extent of the radiology potential in the forensic sciences." To the best of our knowledge this paper is the first study that compares prospectively the results of postmortem MSCT and MRI with the findings of forensic autopsies. Utilizing the modern methods of MSCT and MR it was possible to document the relevant forensics injuries. An advantage in comparison to the classic autopsy is that the data collection of the radiological examination is produced non-destructively. In addition, this radiological data, including the 2-D and 3-D reconstructions, can be archived, in contrast to the real injuries of the corpses. In summary, the radiological documentation has some significant advantages in comparison to the classic forensic autopsy and documentation. In the future this documentation and analysis process with MSCT and MR and magnetic resonance opens the door for a "Digital Autopsy" or a "Virtual Autopsy" in selected forensic cases.

Forensic Radiology, Computed Tomography, Magnetic Resonance

G20 Evaluation of 122 Forensic Autopsies of Unprotected Victims Killed in Traffic Accidents

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The goals of this research project are to present the results of 122 autopsies of unprotected victims killed in traffic accidents. Proposals are made to improve the efficiency of the forensic procedure which is very complex.

Unprotected road users, such as pedestrians, bicyclists and motorcyclists, are not shielded by the body of a vehicle and are therefore at a high risk of being killed in a traffic accident. If it is impossible to undo the tragedy in a fatal accident, one must address the severe consequences it has on the family of the victim and on the drivers and their families as well. It is thus extremely important to establish the precise sequence of events in an accident and to assign clear responsibilities. If the police and the technical experts are primarily responsible for elucidating the circumstances surrounding an accident, a careful post-mortem forensic examination can provide significant and important evidence.

Because a forensic autopsy of a victim of a fatal traffic accident is a complex, laborious and time-intensive task, we wished to analyze the results from such work with the following objectives in mind:

- to evaluate the contribution of forensic investigations to the elucidation of the circumstances of an accident and of the responsibilities of the involved parties;
- to evaluate the efficiency of forensic investigations taking into account the significant time expenditure and efforts necessary to complete this work;
- to identify and propose preventive measures to reduce the frequency and gravity of traffic accidents; and
- to identify and propose improvements in the forensic investigations carried out in fatal traffic accidents.

Our study was conducted on 122 traffic accidents that occurred in Switzerland between 1979 and 1996 and which required the expertise of the University Institute of Forensic Medicine of Lausanne. To evaluate the autopsy findings, standard questionnaires were employed that addressed the following variables:

- age and gender of the victims,
- classification of victims as a function of their mode of transportation, survival,
- vehicles involved in the accident,
- speed of vehicles involved in the accident,
- location and circumstances surrounding the accident,
- visibility: lighting, weather conditions, color of clothing of the victims,
- cause of death,
- observed lesions,
- primary lesions,
- medical history, and
- toxicological analyses.

Our results are in agreement with those reported in the literature with respect to the following findings:

- the largest proportion of accidents involve elderly persons;
- elderly victims are most likely to survive the accident and succumb later from accident-related complications that would not be lethal for younger, healthier individuals;
- private automobiles constitute the largest category of vehicles involved in accidents;
- a high proportion of accidents occur within towns or villages;
- a high proportion of accidents occur in darkness;
- the prevalence of crano-cerebral lesions, polytraumatism, thoracic lesions and spinal chord lesions as the cause of death;
- the nature of the primary lesions;
- the role of alcohol consumption.

Based on the data published in the literature and on our own results, the forensic examination can provide very important information in establishing the degrees of responsibility of both the drivers and the victims of traffic accidents. The forensic examination is clearly an efficient approach; the information can often be obtained only by this means and its value is very significant. Such examinations must be conducted irrespective of constraints linked to time, cost, and efforts deployed by forensic scientists.

We make a series of proposals to increase the safety of unprotected road users and to improve the efficiency of forensic examinations in fatal traffic accidents.

Traffic Accidents, Unprotected Victims, Usefulness and Efficiency

G21 Undefeated by Surgery: The Utility of Post-Surgical Foot and Ankle Radiographs as a Basis for Identification

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The goals of this research project are to demonstrate to participants how 1) radiographic comparisons for positive identification can reliably be made in some cases, even if there has been an alteration in the anatomy; and 2) what may be done to quantitatively evaluate the "matchability" of a postmortem radiograph to a premortem film.

Foot and ankle radiographs can be utilized as the basis of identification in forensic investigations involving decomposed, mutilated, or

fragmented remains (1-6). The lower extremity may be better preserved in both aquatic and terrestrial environments than other anatomical regions (7). The structural complexity of the foot and ankle facilitates identification by providing potentially unique skeletal features and/or configurations.

The process of radiographic comparisons for identification is intuitively understood, but not easily represented in an algorithmic fashion. While the result of the comparative evaluation may be easily verbalized ("match" or "no match"), the process by which that determination is made may not be as easily described. Qualitative factors addressing the reliability of that match may also be difficult to convey. The authors evaluated the possibility of developing a numerical representation of the reliability of a match evaluation.

Experimentally, 30 sets of pre-surgical (premortem) and post-surgical (simulating postmortem) radiographs of the foot and ankle were obtained from a tertiary care medical center simulating a postmortem identification. Up to three different views were used, including, anteroposterior (AP), medial oblique (MO), and lateral projections. All sets were prepared by one author (JR), and included both real matches and actual mismatches to provide a potential false positive result. Premortem and simulated postmortem radiographs were separated by a surgical event to simulate the effects of an alteration in anatomy. The time lapse between the premortem and simulated postmortem radiographs ranged from 2 to 36 months.

The reliability of the match results was evaluated and graded by a numeric system. As a first approximation and as evaluated in the experiment described herein, we considered 10 characteristic skeletal features in the simulated postmortem radiographs. We then looked for the same radiographic features in the premortem films and scored the results as follows:

- +1: If the feature was present and matched.
- 0: If the feature was either not present or its presence could not be determined.
- 1: If the feature was present, but did not match, or if the trait was present in either the pre- or postmortem radiographs but not in both.

For each set, we added the score. The radiographic sets were independently evaluated according to the medicolegal standard, "with a reasonable degree of medical certainty, these radiographs came from or did not come from the same individual." Additionally, we noted if we could not determine with a reasonable degree of medical certainty whether or not the films came from the same person.

Examiners included a forensic pathologist, forensic anthropologist, physician-coroner, and musculoskeletal radiologist who graded the radiographs according to the 10-feature scheme noted above. As a second exercise, we evaluated the set for a match. A correlation between the score and whether or not there was a match was determined. Simulated postmortem radiographs were evaluated for mean and standard deviation of the "matchability" score. Similarly, the match reliability score was evaluated and finally the correlation coefficient between the two was calculated.

Preliminary results indicate that at least two matching characteristics are necessary for determining that two radiographs have come from the same person. At least two characteristics must be present in the films that do not match each other to determine that two radiographs are from different individuals. The three most useful traits of the ten skeletal features examined were a) the overall shape of the calcaneus and the cortical bone of the metatarsals, b) the trabecular pattern of the calcaneus and the metatarsals, and c) osteophytes.

It is anticipated that the approach described in this study may evolve into a radiograph scoring system allowing a quantitative variable to be considered in addition to a "yes or no" match result with regard to forensic investigations.

Human Identification, Radiographs, Surgical Modifications

G22 Paraphyly in *Lucilia Cuprina* (Diptera: Calliphoridae) Mitochondrial DNA: Implication for Forensic Entomology and Evidence for an Ancient Hybridization Event

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The goal of this research project is to learn about the large number of recent published papers and important conceptual issues concerning DNA and insect evidence.

The closely related species *Lucilia* (=*Phaenicia*) *cuprina* (Meigen) and *L. sericata* (Meigen) are widespread, common, and extensively sympatric blow flies. Both may be collected as evidence during an investigation of human death. Taxonomic identification of insect evidence is usually an essential first step in a forensic entomological analysis, because different species can have different habits, growth rates, etc. Recently several authors have proposed the use of DNA sequence data for identifying forensically important insects. This is because fly larvae (also called maggots) and eggs are often difficult or impossible to identify using anatomical features. Furthermore such specimens are often dead or dying by the time the entomologist receives them, and they cannot be reared to the more easily identified adult stage. An implied assumption of most authors who advocate this DNA-based approach is that the genetic locus used has an evolutionary history identical to that of the organism as inferred from traditional taxonomic characters. In the language of systematic biology, the morphological and DNA evolutionary trees are assumed to be concordant.

This assumption was tested using a global molecular systematic survey of *L. sericata* and *L. cuprina*. Specimens from Europe, Africa, North America, Australasia and the Hawaiian island of Oahu were each classified as one of these two species based on bristle patterns and male genitalia. For each specimen we obtained DNA sequence data from a nuclear locus, a 2.2 kb region of the large subunit of the 28S ribosomal RNA gene (28S), and a mitochondrial locus, a 2.3 kb region of the first and second subunits of cytochrome c oxidase (CO). The DNA extraction, PCR, and sequencing methods used were described in previous publications (Stevens & Wall. *Forensic Sci Int.* 2001. 120:116-23; Wells & Sperling. *Forensic Sci Int.* 2001. 120:110-5).

Polymorphic base positions within the 28S gene were largely confined to three distinct portions within the D domains, while those within CO were evenly spread across the region.

Phylogenetic analyses of the data using the calliphorids *Lucilia caesar* (L.) and *Calliphora vicina* Robineau-Desvoidy as outgroup species found a significant lack of concordance between the most parsimonious tree (also called a cladogram) based on the nuclear 28S sequence and that based on the mitochondrial CO sequence (Kishino-Hasegawa test, $P < 0.0001$). The 28S tree included monophyletic lineages corresponding to each of the species as defined by morphological criteria. In contrast, the CO tree strongly supported a paraphyletic *L. cuprina*, with specimens from Hawaii as the sister group (i.e., the most closely related lineage) of *L. sericata*. Prior to this study CO sequence analysis of an *L. cuprina* larva or egg from Hawaii may have misidentified the specimen as *L. sericata*. While that particular mistake is no longer possible, our results suggest that widespread geographic sampling and/or a multi-gene approach may be needed before DNA-based identification of carrion insects can be considered a reliable technique in all situations. It is most important to survey genetically isolated populations such as on remote islands.

A possible explanation for this evolutionary pattern is that the Hawaiian *L. cuprina* are descended from a hybridization event between a female *L. sericata* and a male *L. cuprina* with the subsequent loss of *L. sericata* nuclear alleles. Both flies were probably introduced to Hawaii by

human activity, and small initial populations would make the above scenario more likely. However, the observed genetic distances were about 0.9% sequence divergence between the Hawaiian *L. cuprina* lineage and the *L. sericata* lineage compared to about 0.2% sequence divergence within each of these lineages. This suggests that the *L. sericata* and Hawaiian *L. cuprina* CO diverged long before humans first reached the islands. Given the Pacific island route by which humans colonized Hawaii, as well as the fact that samples from other Pacific islands were not included in this study, we suggest that islands occupied earlier in the geographic expansion of Polynesian humans be surveyed for the possible origin of the Hawaiian *L. cuprina* clade.

Forensic Entomology, Non-Human DNA, Molecular Systematics

G23 Investigation of Italy's Deadliest Building Collapsed: Forensic Aspects of a Mass Disaster

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The goal of this research project is to respond to mass fatalities: Investigation and morgue operations.

In the early morning hours (approximately 3:00 a.m.) of November 11, 1999 a six-story apartment building, approximately 30 years old, collapsed before dawn in Foggia (viale Giotto, 120), Italy, killing many of the residents while sleeping and others trying to escape. Minutes before the structure crumbled some tenants were awakened by a loud cracking sound. Consequently, they knocked on doors, trying to wake other tenants and escaped just moments before the building collapsed. It took literally seconds for the building, which was in a working class suburb, to fall on itself floor atop floor. The collapse reduced the apartment building to a pile of rubble no more than one story high and a blaze soon broke out in part of the ruins. Search and recovery operations were immediately set up with the help of the local fire departments and military rescue divisions. Using trained dogs, emergency crews rescued approximately 17 people injured and trapped inside the structure. Most of the people who survived the crash were residents of the top floor.

Immediately after the crash the state attorney engaged two different groups of experts. He assigned to a group of engineers the task of establishing the cause of the event and to a group of forensic pathologists the task of identifying all the victims and determining cause and manner of death. For this purpose a Medical Examiner Team, composed of five forensic pathologists familiar with anthropological procedures for personal identification, was set up. Between 70 and 75 people were in the building when it collapsed but the number of the victims was unknown. The mass fatality morgue was established at the Pathology Division of the local hospital, just a few miles from the incident site. In the morgue, autopsy tables, coolers for body storage and medical facilities with X-ray and dental stations were available. The environment was divided in three sections: the first section was established at the catholic chapel next to the morgue for receiving the human remains and exhibiting them to the families; the second area was for inspection and removal of personal effects, photographing the remains and medico-legal autopsy; the third area was the final holding area for aftercare of the bodies before their release.

From 11 to 14 November, 1999 61 cadavers (31 males and 30 females), ages ranging between 3 to 86 years old, were recovered beneath the ruins of the building. All the victims were well preserved except for two cadavers largely burned by the explosion of gas pipes with missing body parts. Most of the victims wore night-dress clothes or were partly dressed, suggesting that they were overcome in the process of sleeping or getting clothes; only seven cadavers were fully dressed and several of them were found in the stairways as they were unable to get out in time as the building came down around them. Most of the victims (thirty people)

died almost immediately due to the severity of the multiple regional injuries observed during the examination; only four people died a slow death, trapped in the mass of pillars with air oxygen running out (asphyxia by confined space). Fourteen people died due to an asphyxia by mechanical fixation of the chest. For the rest of the victims (eleven people) the cause of death was an association of regional injuries and mechanical asphyxia by fixation or compression of the chest. Most of the victims were identified by visual recognition and/or clothing, personal belongings and body features (i.e., scars); for two bodies the positive identification was achieved respectively by dental comparisons with ante-mortem data and by DNA analysis.

The Engineers Team finally determined that the cause of the mass fatality was a structural collapse as the building's foundation was built with cheap materials. The above disaster was Italy's deadliest building collapse since 1959, when a falling building crushed at least 58 people a few miles from Foggia.

Mass Disaster, Building Collapsed, Personal Identification

G24 Differential Decomposition I: Partial Ground Contact

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The goal of this research project is to give participants the opportunity to achieve a greater understanding of time-since-death variables in this unique crime scene setting.

Purpose: Homicide victims bound to trees are not an atypical crime scene occurrence. In fact, 7% of rural wooded crime scenes involve ligature binding of the victim to a tree, post or other structure. Within the past 18 months, the junior author was requested to provide time-since-death estimations on three such cases long after the remains were autopsied/processed and buried. To date, our shared personal "case-based" events provide the only collective knowledge base about the decomposition rates of these specific victims. Later, i.e., post two weeks, time-since-death estimations come from our generalities of gross morphological change from the more common surface and buried bodies. Not surprisingly, the decomposition rate of above ground victims proceeds differently than surface finds and grave victims. Questions posed by law enforcement agencies regarding time-since-death estimation on bodies found above ground require special consideration when compared to our "collective" knowledge of surface decomposition events.

Materials and Methods: At the outdoor Human Decomposition Facility at The University of Tennessee Forensic Anthropology Center two nude and two partially clothed bodies were harnessed to trees with a variety of bindings to mimic the above mentioned scenario/scene. Of particular value was our ability to mimic the exact season of placement and record decomposition on a longitudinal scale. Five control bodies were placed on the ground surface several hundred yards away so that climatological data would precisely match. The five easily identified visual variables to assess time-since-death include: epidermal slippage, bloating, marbling, discoloration and entomology. No biochemical analyses were performed on any tissues or soil. Accumulated degree days for assessing time-since-death allow us to pinpoint precise time to morphological change.

Finally, the presence of blood from wounds of interpersonal violence was of particular concern as most homicide victims receive some perimortem perforative trauma from sharp-force, blunt-force, ballistic or sexual assault. This factor obviously hastens entomological activity and decomposition in wounds and necessitated our use of human blood during experimentation. Data were collected at 6-hour intervals for five weeks on each body for each variable (defined by Marks et. al., 2000) and correlated/converted to accumulated degree days (after Vass et. al., 1993).

Results: We found the rate of decomposition in above ground bodies to be significantly decreased when compared to our controls placed on the ground. All variables and levels of decomposition were reached at a later time than in those remains placed on the surface. Therefore, the assessment of time-since-death for these special cases cannot be estimated using time-since-death estimations for surface victims.

Time-Since-Death, Rate of Decomposition, Homicide

G25 Are Autopsies Necessary in Centenarians?

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The goals of this research project are to provide the forensic community with the understanding that the elderly are living longer and causes of death are shifting. At the same time, the rate of autopsies is very low, and the interest in geriatric autopsies is even lower. Thus, the prevalent cause of death in this age group remains poorly studied.

Only few necropsies have been performed in patients dying after age 100 years and little attention has been made on the clinical and morphologic features observed in these oldest of the old. For that reason we reviewed 28,312 consecutive autopsies done during a 12-year period (1989 to 2000) at the Institute of Forensic Medicine, Vienna, Austria.

We focused on cases who met our working definition of sudden natural death in very old people: "Unexpected or unexplained deaths of non-hospitalized persons over the age of 100 years, which apparently are due to natural causes that are not explicable with a reasonable degree of medical certainty." In particular, all persons who had not consulted a physician within 10 days before death were included and autopsied. Of the 20 study corpses, 8 were men and 12 were women; all were Caucasian. The age of these out-of-hospital patients ranged from 100 to 108 years.

Without periodical care from relatives or welfare centers, four persons lived alone in their homes. Another six persons also lived alone, but were regularly cared for by neighbors, relatives or welfare workers. 10 lived with at least one family member.

Sudden natural death occurred in all cases in private homes and in 35% of these cases while sleeping. Resuscitation was attempted in 10% of the cases. Sixty percent of the deceased were described as having been previously healthy. 30% had cardiac antecedents such as stable angina pectoris. Only one person had a history of myocardial infarction. Other pre-existing conditions were hypertension (20%), diabetes mellitus (15%), respiratory (10%) and gastrointestinal disorders (5%).

25% of the men and 40% of the women had a body mass index exceeding normal range.

The most common cause of death was cardiovascular disease (75%). 20% of the elderly died of respiratory illnesses, and 5% of gastrointestinal disorders.

Myocardial scars or focal myocardial fibrosis were detectable in 2/8 men and in 3/12 women, who died due to cardiac disorders. Three men and five women had acute myocardial infarcts. Calcification of the mitral annulus and of the aortic valves were present in 80%; 15% of the calcified valves were anatomically stenotic.

All deceased had extensive aortic sclerosis, mainly focused in the abdominal part. In all 20 corpses the aorta was dilated in its transverse and longitudinal planes, with aneurysm formation in four cases, two resulted in fatal rupture (1 man, 1 woman). Two cases of sudden death were caused by pulmonary embolism (1 man, 1 woman) emerging from the left femoral veins. Two patients died of bacterial pneumonia. A gastric ulcer caused perforation with acute diffuse peritonitis in one 106-year old man.

Although the quality of life cannot be assessed from the study of pathologic lesions alone, the reduced prevalence of chronic debilitating diseases may indicate that longevity is a desirable goal when medical

resources are available for diagnosis and treatment for acute medical problems. Our study underlines the need for more baseline data of the elderly which can be obtained only by more and well-performed autopsies.

Sudden Natural Death, Oldest Old, Autopsy Study

G26 In-Hospital Deaths for Forensic Autopsy

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The goals of research project are to present reasons, findings, gender differences and in-hospital survival time on in-hospital deaths where forensic autopsies were performed.

We have retrospectively analysed nearly 7000 in-hospital deaths in our forensic pathology department, using the chart review method. In-hospital death cases represent 35% of our total caseload, but there is a wide range in different groups (i.e., it is 70% of our all autopsies on 2-5 year-old age group, and only-quarter of those between the age of 21-30 years of age).

Out of all our in-hospital cases, the group of aging people (60 years and over) represents more than half of the cases. We have performed proportionally more autopsies with natural cause of death in every disease category on in-hospital cases, except for cardiovascular diseases (53% of all in-hospital natural cause of death cases and 82 % of all non-hospital natural cause of death cases were cardiovascular origin).

We have also compared the major natural and unnatural causes of death categories between our in-hospital and non-hospital cases. Interestingly, there were more unnatural cause of death cases on in-hospital cases and more natural causes of death cases from our non-hospital cases. We had more than twice as many male than female with natural cause of death in our non-hospital group and only 20% more males with similar natural cause of deaths in our in-hospital series. Suicide victims showed 2:1 m:f ratio in our non-hospital group, but the same ratio was less than 1 in our in-hospital group. We had more female accident victims from our non-hospital database, but our in-hospital group showed more than twice as many male accident victims coming for forensic autopsy after an accident.

We have also analysed survival time in each cause of death categories, showing age group and gender differences. An ample number of charts will be displayed to explain our findings.

In-Hospital Deaths, Forensic Autopsy, Survival Time

G27 Characteristics of Different Types of Fatal Head Trauma and the Factors That Influence Survival Time and Activity Prior to Death

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The goals of this research project are to teach participants how to recognize and differentiate between different types of head trauma, including those caused by gunfire injuries and sharp and blunt force trauma. Further, participants will appreciate the relationships between the nature of these injuries, amount of blood loss, and role of drugs and alcohol to the amount of activity and time prior to death.

There is a wide spectrum of fatal head injuries, each with unique characteristics. Fatal injuries produced by gunfire, sharp, and blunt force trauma are discussed. The nature of these injuries and the presence of

different types of traumatic cranio-cerebral hemorrhages result in differing survival time (i.e., the amount of time between injury and the time of death) and activity. Importantly, the particular location of each injury, damage to blood vessels, the amount of blood loss, and presence of drugs and alcohol are discussed.

Statistical and descriptive analyses are used. Further, the frequency and type of hemorrhage, the association with the presence of cerebral edema and the demographic profiles of victims within each injury category are described. Variables analyzed include the type of weapon, location of injuries, number, size, and track of the wound(s), amount of blood loss, presence of alcohol or drugs, and amount of activity from time of injury to death. Additional variables specific to gunfire injuries include the distance of the shot and the caliber of the weapon. Finally, the position of the deceased in fatal motor vehicle accidents with resulting blunt force craniocerebral trauma and the use of safety belts are assessed.

Medico-legal cases from 1980-2000 were reviewed from the Lancaster County Coroner's Office in Lincoln, Nebraska, the Cook County Medical Examiner's Office in Chicago, Illinois, and the Knox County Medical Examiner's Office in Knoxville, TN. Information for this study was collected from a variety of documents including autopsy and police reports, medical records, death scene investigator's notes, and death certificates. Further, data is presented on gunfire injuries and blunt and sharp force trauma for over 200 homicide, suicide, and accident cases.

Our test results show that the presence of alcohol and drugs (56.8%) does not directly influence survival time or activity per se, however, they do affect blood loss, which in turn influences survival time and therefore activity. In gunfire and sharp force injuries, internal blood loss measured less than 500 ml, in 60% (6/10) of cases. Further, 55.3% (21/38) of gunfire injuries are single deeply penetrating gunshot injuries to the head, which means that in a small majority of cases, the bullet does not exit the cranium. The most commonly used firearms were .22 and .45 caliber weapons, each occurring in 23.8% (5/21) of cases. The majority of gunfire and sharp force trauma victims are male, at 85% (35/41); whereas, 70% (29/41) of all victims are under the age of thirty years old.

Gunfire Injuries, Blunt Force Trauma, Sharp Force Trauma

G28 Seizure Associated Fatalities: An Analysis of Cases in Milwaukee County

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The goal of this research project is to present the information derived from a review of deaths associated with seizure over a five-year period. Relevant observations are emphasized.

Deaths associated with seizure disorders comprise a relevant proportion of routinely investigated cases by medical examiners and coroners. To better understand the nature and demographics of these cases, we chose to examine these deaths in a major medical examiner system. This work describes the findings of a systematic review of deaths associated with seizures occurring in a five-year period.

The database consists of deaths within Milwaukee County, Wisconsin, certified by the Milwaukee County Medical Examiner's Office (MCMEO) in the years 1995 through 2000. The computerized MCMEO case files were searched for the key word "seizure." All cases in which the investigator's report, the death certificate or the autopsy report contained the term are included in the review. The total number of cases is 164 deaths. Details regarding age, race, sex and other pertinent aspects were recorded.

The majority of cases consist of middle-aged (30-50 yrs.) African-American males. The manner ascribed to most deaths is natural, with accidental being second in frequency. In most cases, the decedents had a

history of a seizure disorder and deaths were attributed to seizure. Cause of the seizure disorders spanned the spectrum of possibilities. Etiological categories included developmental disease, traumatic, vascular lesions, drug-related, infectious, idiopathic, and neoplastic processes.

Several important aspects of seizure related fatalities were identified. Drugs of abuse played a role in a high percentage of deaths. Drugs were isolated in postmortem toxicological specimens and were implicated as causal to the seizure disorder in many cases. Alcohol was the principle drug within both categories. Cocaine was second in prevalence. In patients for whom anti-epileptic medicines were prescribed, a disproportionately high number revealed sub-therapeutic levels in postmortem toxicological analysis. Medical history in many such patients documented prior noncompliant issues. Additional reasons for this observation are a focus of discussion.

Certain determination of seizure as a cause of death is difficult. There are currently no morphological or laboratory tests, which confirm legitimate antemortem seizure activity. The "gold standard" is witnessed convulsion in the setting of a clinically defined seizure disorder. We reviewed the autopsy findings in witnessed cases of seizure related fatalities. Convulsive activity was observed in slightly more than 17% of cases. Several morphologic autopsy findings are noted in these cases. These include tongue bites, minor superficial contusions and abrasions to the face and head, and minor hemorrhage in deep cervical neck musculature. The most consistent finding was tongue bites, noted in over half of the cases. In those without documented tongue bites, many were edentulous or the tongue exam was omitted in the autopsy report. This observation indicates tongue bites are a useful postmortem marker suggesting perimortem convulsive activity.

These findings and additional statistics are presented. Significance of the data will be discussed.

Seizure, Epilepsy, Sudden Death

G29 Homicide by Second Impact Syndrome... or Unfortunate Coincidence?

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The goals of this research project are to understand that the second impact syndrome is a rare and possibly underreported mechanism of death. The present case involves an adult individual who died following two contemporaneous head injuries — one accidental and the other inflicted. The learning objective of this presentation is to understand the various features of the second impact syndrome, and to evaluate the plausibility of the mechanism in fatal successive head injury cases. The importance of this mechanism, as it relates to manner of death, is a focus of this presentation.

The second impact syndrome is a clinicopathologic entity in which an individual sustains a concussive head trauma (with or without loss of consciousness) then, before symptoms of the initial injury have cleared, sustains a second, often relatively mild, head trauma. Closely related temporally with the second trauma, the individual develops uncontrollable cerebral edema, with or without subdural hematoma, and ultimately often succumbs. This form of head trauma has been most often reported in young athletes in collision sports such as football and boxing. The case reported here is a 48-year-old male who was the lone occupant in a single-vehicle car crash, and subsequently, less than 1 hour later, was assaulted and lost consciousness. On admission to the hospital, he had brain edema and bilateral subdural hematomas, which were partially evacuated. He remained comatose for nine days. Neuropathologic examination revealed severe brain edema with cerebellar tonsillar and bilateral transtentorial herniation, and residual bilateral convexity subdural hematoma. The brain had evidence of global hypoxic-ischemic injury, with symmetric necrosis

of deep cerebral nuclei. Microscopically, axonal spheroids were widespread; however, in the setting of global hypoxic-ischemic damage with no gross or microscopic intraparenchymal hemorrhages to indicate significant shear type injuries, the diagnosis of diffuse axonal injury was not warranted. Other autopsy findings were infectious complications of the comatose state, specifically bilateral bronchopneumonia with pulmonary abscesses and empyema. The historic and anatomic findings in this case raise a number of questions. First, "Can the injuries be ascribed to one or the other of the traumatic incidents?" Of themselves, the head injuries have no features to allow specific assignment to one or the other (manner undetermined). Second, "Can the injuries be ascribed to BOTH traumatic incidents?" Second impact syndrome, if established, provides a plausible mechanism by which the answer to the latter question is positive. If the death can be ascribed to both of the injuries (car crash and assault), then the manner of death is homicide. The existence of second impact syndrome has been questioned in the literature. One of the questions that has been raised relates to degree of documentation of both head injuries. In this case, some details of the first head injury are not well established. The vehicle, a pickup truck, had front-end damage, on the driver's side, and had been crashed into a stationary bridge support. An uninvolved party did witness and converse with the subject in the interim between the crash and the assault; the witness stated that the subject had a laceration of the bridge of the nose, indicating a blunt force impact to the face/head. However, the severity of the first "impact," whether the subject was restrained or not, and whether transient loss of consciousness occurred, are not known. Of note, details of the assault, in which the subject received a rapid succession of multiple blows to the head/neck and face, are well documented in congruous witness statements. A review of the literature does not reveal any previous reports of homicide by second impact syndrome.

Adult Head Injury, Second Impact Syndrome, Homicide

G30 A New Technique to Estimate a Postmortem Submersion Interval (PMSI) Using Algal Growth Rates

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The goals of this research project are to present to the forensic community a new technique to establish a post-mortem submersion interval in aquatic habitats using algae on corpses. Attendees will learn that algal growth on corpses changes over time and how this change can be used to estimate a PMSI for a corpse in an aquatic habitat.

This presentation will include a portion of graduate thesis work which focuses on the role of aquatic organisms in pig decomposition in streams. The purpose of this presentation is to evaluate a new technique utilizing algal or periphyton growth on corpses as a method to estimate the postmortem submersion interval. The objectives of this study include 1) the identification and determination of the duration of each stage of decomposition, 2) the comparison of algal growth on pigs to a natural substrate such as ceramic tiles and, 3) the determination if algal growth differs between riffle and pool habitats.

This study was conducted on two 2nd order streams in Lancaster County, Pennsylvania. Stillborn pigs (six pigs per stream) and ceramic tiles were used as substrates for periphyton growth. The duration of each stage of decomposition was estimated in degree days. To examine spatial differences in periphyton growth, pigs and tiles were placed in riffle (high velocity) and pool (low velocity) habitats. Periphyton samples were collected from pigs and tiles every four days for approximately 40 days. Samples were transported to the lab for filtration and preservation. Chlorophyll-a concentrations in periphyton samples were determined through fluorometric analysis. Chlorophyll a comparisons between pigs

vs. tiles and riffle vs. pool habitats were analyzed with a 1-Way ANOVA and Fisher's pairwise comparison test. Regression analysis was used to compare chlorophyll *a* concentration as a function of time.

The literature identifies several stages of decomposition in aquatic habitats: Submerged Fresh, Early Floating, Early Floating Decay, Advanced Floating Decay, and Sunken. As we describe them in this study, they included: Submerged Fresh, Early Floating, Early Floating Decay, Advanced Floating Decay, and; Decay. Total degree days for pigs submerged in riffle habitats were 363.8, while pigs in pool habitats accumulated 773.8 degree days during the decomposition process. The duration of the Submerged Fresh and Floating Decay stages was significantly longer in the pool habitat compared to the riffle habitat. Chlorophyll *a* concentration increased as a function of time regardless of habitat. Chlorophyll *a* concentration was significantly greater on pig carcasses vs. ceramic tiles; whereas, it did not differ between riffle and pool habitats. Although periphyton growth on pigs in riffle and pool habitats was significantly impacted by a spate or rain event during this study, we found that chlorophyll *a* concentrations were still significantly correlated over time.

To date, an accurate measurement of a PMSI has been difficult in aquatic habitats. In terrestrial systems, insects have evolved to feed on carrion, this is not the case with aquatic insects. Aquatic insects essentially utilized the corpse as an extension of their natural substrate. Some species may feed on the corpse or on attached algae. Recent more qualitative evidence suggests that aquatic flora in the form of algae may provide a more reliable approach to estimate the PMSI in aquatic systems such as rivers or lakes. These studies have examined algae and other aquatic flora from a taxonomic perspective in an attempt to correlate species diversity with each stage of decomposition. Our study provides a more quantitative method to estimate a PMSI based on algal or periphyton growth over time. Since pig carcasses were found to have significantly more periphyton growth than ceramic tiles, we suggest that the nutrients leaching from a corpse may provide a more optimum habitat upon which algae may grow. An inherent problem with the use of algae from a qualitative or quantitative perspective is that rain events can change the composition and amount of algae on a corpse. Our study illustrates how a rain event impacts chlorophyll *a* concentration on pigs in riffles and pools in streams.

Postmortem Submersion Interval, Degree Days, Periphyton

G31 Assisting the Living

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The goal of this research project is to present to the forensic community a model of positive communication with grieving family members.

The death of a loved one may be the most difficult and traumatizing situation that a family has to endure. The coroner or medical examiner is thrust into the lives of the decedent's family and is therefore in a very unique position. The medical examiner/coroner need only invest a small amount of time to produce an immense and everlasting effect on the family's ability to accept their loved one's death and promote the healing process.

The relationship between the medical examiner/coroner and the decedent's family begins with the death scene investigation and the notification. But this should only be the beginning. The role of the coroner can extend well beyond determination of the cause and manner of death. There are many opportunities in which the coroner can interact with the family to instill compassion and assist with the grieving process.

A good opportunity for the medical examiner/coroner to interact with the family arises following the autopsy. In our office, the next-of-kin is called immediately after all postmortem examinations, except in cases of homicide investigations where communication is usually through law enforcement. An explanation of the preliminary findings is given and the family is informed if additional studies are pending. Calling the next-of-

kin after the autopsy gives them an opportunity to ask questions, to discuss property disposition and medical history, or just to tell you about their loved one.

Following the completion of the autopsy report, a condolence letter is generated expressing sympathy for the loss of their family member. This letter also gives the medical examiner/coroner the opportunity to review the autopsy findings and include any additional studies or tests that were completed after the initial phone conversation immediately following the autopsy. A short explanation of the cause of death is often helpful to the family. Any types of diseases that may have a genetic component should also be mentioned with directions to consult their family physician. Having this information on paper is also helpful to the family physician, particularly if a genetic or environmental cause of death was diagnosed. The family physician is then able to conduct genetic testing on remaining family members or suggest lifestyle changes. These explanations often reduce future phone calls by anticipating what questions may be asked. In cases of homicides, the letter can be brief and reiterate the information stated on the death certificate, especially if a criminal trial is pending.

Following the initial death investigation and postmortem examination of a possible sudden infant death (SIDs), our office generates a letter to the parents. The letter should include some general information about SIDs and inform the family that additional studies such as microbiologic cultures, metabolic screen, histology, toxicology and other tests may be pending. A final letter will then be sent to the family following completion of the autopsy report.

In difficult and emotional cases such as an infant overlay, possible medical malpractice or an unsuspected suicide, a meeting in the medical examiner/coroner's office may be suggested to the family prior to signing the death certificate. This will give the pathologist an opportunity to explain the final investigative and autopsy findings in a controlled environment. Open communication assures that there are no surprises when the family receives the death certificate.

These actions lend support during a very difficult period and may result in a positive attitude toward the medical examiner/coroner's office from the general public.

Condolence, Communication, Grieving

G32 Some Empirical Data on the Past and Future of the Autopsy

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The goals of this research project are to help participants: 1) become familiar with the history and purposes of the autopsy; 2) examine the causes and significance of declining autopsy rates and uses; and 3) consider suggestions to revitalize the autopsy based on a survey of physicians at a major university hospital.

Background: The autopsy has been an important method of exploration, education, and discovery for hundreds (perhaps thousands) of years. Medicine as a scientific field has progressed in tandem with the acceptance of the autopsy, the precision of its performance, and the accuracy of its results. Recently, however, autopsy frequency has declined from approximately 50% of patients dying in hospitals in the 1950s to a range of 5 to 13% of similar patients today. Reasons given in the literature for this decline include physician belief that modern diagnosis is so accurate that autopsy is not needed, cost (and lack of profit) of the procedure, fear of litigation prompted by autopsy findings, and the difficulty of communicating with families regarding autopsy. Given that individual physician opinions about autopsy are important determining factors in autopsy requests and use of results, it is helpful to understand the nature of these opinions and what influences them.

Methods: This study makes use of a survey on autopsy practices and opinions which was distributed to all attending physicians in a large,

urban, university affiliated medical center. The 10 question survey was distributed to 215 full time attending faculty based at the hospital or the adjacent Ambulatory Care Center. The survey was an anonymous, one page, multiple choice format questionnaire that could be completed in under five minutes. Clinicians first identified their department, years of practice, and approximate departmental autopsy rate. The inquiries then examined, among other topics, physician beliefs about the value of the autopsy for confirming diagnostic results, its possible use in clinical practice, the desirability of medical quality assurance using autopsy data, and the effects of litigation concerns on autopsy requests. Surveys were distributed to 24 individual clinical departments, including Pathology, based in the Medical School.

Results: A total of 53 physicians responded to the survey (24.7%). Departmental response rates varied from a high of 60% to a low of 0. Faculty varied in years of practice from 5 to over 20 years with the largest proportion having practiced for 5 to 10 years. Most (26/48 or 54.2%) respondents reported an estimated departmental autopsy rate of under 10% with the next largest group (17/48 or 35.4%) selecting "don't know." Overall, respondents were split almost equally on the question of whether their departmental autopsy rates were sufficient. Respondents were strongly in favor of the autopsy on questions that pertained to its potential usefulness. Most (36/50 or 72%) disagreed with the statement that current diagnostic procedures were sufficiently accurate to make autopsies unnecessary. Though respondents were more cautious on the question of whether the autopsy should be used for quality assurance, 28/50 (56%) strongly agreed or agreed that they would like to see this application in their departments. Interestingly, responding physicians disagreed (79.1% total) that concerns over litigation affected their decision to request autopsies, rejecting one of the primary causes for the autopsy decline cited in current literature. Responses did not differ significantly among physicians of various levels of experience, but did tend to separate along departmental lines.

Conclusions: The survey data suggest that the responding physicians continue to value the autopsy as a tool for diagnosis and education, even in the face of radically declining autopsy rates. Suggestions for improving the frequency and efficacy of the autopsy range from better standardization of requests and communication of results and reporting to centralization of hospital and forensic autopsies into regional centers. Clearly, a revitalized autopsy can help identify new diseases and environmental problems and improve the contribution of the procedure to the forensic sciences.

Autopsy, Diagnosis, Autopsy Rates

G33 The Postmortem Diagnosis of Skull and Brain Injuries by Imaging Methods (MRI, Multi-Slice CT)

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The goal of this research project is to present to the forensic community a new application of a clinically well-established method in forensic medicine, i.e., the postmortem collection of data by utilizing imaging processes such as MRI and multi-slice CT.

Content: In 20 cases in which the deceased succumbed to skull/brain injuries, a forensic investigation had been ordered and whole body MS-CT and MR examinations were performed. In seven cases the cause of head trauma was secondary to a road accident; and three persons sustained blunt force trauma; in three cases, there had been a fall from a height; and seven persons died following shotgun injuries. MRI studies were performed on a 1.5 T GE Signa system; CT data were acquired with a GE LightSpeed multi-slice scanner. Post processing (2-D and 3-D reconstructions of CT data sets) was performed with the GE Advantage Windows workstation. Subsequently, a standard forensic autopsy was carried out. The radiological data were used to answer the forensically important questions such as the cause of death, the traumatological findings, the differentiation of antemortem inflicted injuries from post-mortem trauma, and the reconstruction of the traumatic sequence. Finally, the radiographically obtained results were compared to those obtained from autopsy findings.

Conclusions: In all examined cases, a forensic reconstruction (impact axis reconstruction, the priority of skull fractures, the direction of impact in traffic accidents, etc.) was possible based upon the radiological data obtained. Forensically important findings, such as scalp hematomas, fracture systems, direct and indirect brain injuries and various forms of intracranial hemorrhaging could be clearly detected and diagnosed. Secondary trauma consequences, such as brain edema, increased brain pressure, and secondary brain stem hemorrhaging, were correctly recognized.

A complete collection and documentation of forensic relevant data can be obtained by utilizing imaging processes. MRI and MS-CT are suitable methods for the post-mortem diagnosis and reconstruction of skull and brain injuries. The data obtained objectively in a non-destructive way showed to complement standard autopsy methods in many respects.

Forensic Radiology, Multi-Slice CT, MRI

G34 Use of Magnetic Resonance Microscopy for Evaluation of Retinal Hemorrhage

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The goal of this research project is to present to the forensic community a novel technology which allows nondestructive three-dimensional assessment of retinal vasculature.

In recent years, magnetic resonance technology has advanced to provide the ability to achieve extremely high-resolution spatial information associated with magnetic resonance spectra. The ability to achieve spatial resolution in the tens of microns through MRI allows the capture of truly 3D anatomic information at near histologic resolution with minimal deformation or registration error. The ability to capture nuclear magnetic spectra at high spatial resolution provides the opportunity to chemically and physiologically characterize those tissues. This has been used to great effect, for instance, in the elucidation of the 3D anatomy in embryos as well as characterization of 3D morphology and relationships in such things as new bone formation and cartilage growth.

The importance of retinal hemorrhage has been of some debate in the evaluation and diagnosis of child abuse. The ability to map perfusion in three dimensions as well as the ability to localize hemorrhage in three-space at high resolution provides the opportunity to map and volumetrically characterize these lesions in known child abuse and non-child abuse cases.

We have created three-dimensional visualizations of whole eyes at between 70 and 100-micron resolution, and are currently bringing on line a coil which will provide approximately 10-micron resolution using

Bruker magnetic resonance microscopes. Non-invasive three-dimensional maps of blood distribution can be achieved on formalin-fixed eyes without serial sectioning. While our current visualizations are striking, there remain nontrivial technical challenges ahead. These include appropriate mounting media. It is extremely important that no water remain on the surface of the globe; we have achieved good results both with embedding the entire eye in paraffin and by placing the eye in fluorocarbon. In both cases, the eye can later be evaluated by conventional means. Another limiting factor is the time necessary to achieve a sufficient signal to noise ratio at high resolution. Current scans require approximately 30 hours per eye. We are currently exploring methods of data reduction using combinations of thicker sections to provide super-resolution at higher speeds. We are beginning work on spectral analysis at high resolution and expect to provide a more certain extraction of hemoglobin distribution.

Visualization challenges include appropriate segmentation and voxel-counting to provide volumetric measurements of hemorrhage. Our current methods are watershed-based, but we expect to transition to the Imagine Toolkit (ITK), a freely-available software toolkit for segmentation and registration currently being developed by the National Institutes of Medicine and the National Library of Medicine Visible Human Project for segmentation of Visible Human tissues. This toolkit is in alpha distribution, but should be in general distribution within a year. We are also exploring the question of validation of volumetric measurements. Standard histologic sectioning can provide a standard whereby localization can be tested, but the choice of a "gold standard" for volumetric measurement of hemorrhage is not obvious.

While we are in the early stage of exploring this technology for this application, the three-dimensional retinal vascular imagery we have gathered provides a measurable visualization not achievable elsewhere. We are currently exploring validation issues, since any volumetric statements about hemorrhage must be matched with more conventional visualization of hemorrhage. This paper will provide a short review of the technology, visualization issues, validation issues, and early results in the three-dimensional characterization of these retinal lesions.

Magnetic Resonance Microscopy, Shaken Baby Syndrome, Retinal Hemorrhage

G35 Phenylpropanolamine and Acute Intracerebral Hemorrhage

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The goal of this research project is to assess the status of current scientific research and literature regarding Phenylpropanolamine and the risk of acute intracerebral hemorrhage.

This presentation reviews the case of a young woman who died from complications of two near-simultaneous, acute, bilateral basal ganglia hemorrhages. Complete autopsy examination, including the examination of the brain by a neuropathologist, and full toxicological examination, failed to uncover an etiologically specific risk factor for the intracerebral hemorrhage. The decedent ingested an over-the-counter cold preparation containing Phenylpropanolamine (PPA) minutes prior to the first intracerebral hemorrhage.

The literature on the toxic and fatal effects of PPA is extensive, spanning many decades. It is mostly represented by single case reports, or presentations of a small number of cases. Scientific study on the effects of PPA consists of a small number of animal studies and a few human studies, which have produced provocative but also highly controversial and contradictory results. There is significant variability in the clinical presentation of these patients. The proposed mechanisms by which PPA is said to produce these clinical results cannot consistently be applied to all of the reported cases. Despite this controversy, this presentation proposes that PPA as the cause of unexplained acute intracerebral hemorrhage in the proposed "at risk" population is a valid consideration.

A publication in the *New England Journal of Medicine* in December of last year and a recent FDA voluntary recall of over-the-counter preparations containing PPA have resulted in much media attention via the lay press and the Internet. As a result, the legal community has responded with media-based efforts to assimilate groups of cases of PPA toxicity, including fatalities, for the purposes of civil litigation. As public awareness increases, and because of the near total omnipresence of these over-the-counter preparations in American households, the forensic pathologist will be asked to consider PPA either as a possible cause of death in cases of otherwise unexplained acute intracerebral hemorrhage in the defined "at risk" population, or as a possible contributing factor in persons who are at risk of acute intracerebral hemorrhage from other diseases or conditions.

A familiarity with the current literature and an understanding of the proposed pharmacological actions of Phenylpropanolamine will better prepare the forensic pathologist in the evaluation of individual cases, and also in the preparation of responsible testimony in relevant litigation.

Phenylpropanolamine, Acute Intracerebral Hemorrhage, Spontaneous Intracerebral Hemorrhage

G36 The Use of Lidocaine to Commit Homicide

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The goals of this research project are to report the first case of Lidocaine being used to commit homicide outside a hospital setting; to pull known cases of iatrogenic homicidal Lidocaine poisoning into the forensic sciences literature; to review and compare the two groups highlighting similarities and differences; and, to distinguish those situations where an elevated Lidocaine level should trigger a more extensive investigation.

Lidocaine is a drug that is commonly used during the course of resuscitating critically ill patients. It is most effective at treating ventricular tachycardia associated with a myocardial infarct. It is therefore a drug commonly found on the toxicology reports of medical examiner cases. It is so common that one could even say that it has become part of the "normal flora" of drugs found in people who die suddenly and unexpectedly along with Cotinine and Caffeine. It is not uncommon for Lidocaine levels to be elevated, even above the "potentially toxic" level because of the grave situations in which the drug is administered. As a result, medical examiners/forensic pathologists can become desensitized to the dangers of this drug. Above therapeutic levels, it can cause severe cardiovascular and neurologic effects, including immediate asystole, apnea, and convulsions. It lowers seizure thresholds and may increase the risk of bradycardia and asystole. Yet the common assumption about Lidocaine is that if it is found in a patient's blood, it was administered by the careful hand of a physician or paramedic with the goal of saving the patient's life. The cases presented here illustrate that this is not always so. One case illustrates how Lidocaine was used as a tool to commit homicide by a non-professional, while the other three show that when used in the medical setting, it is not always with a therapeutic intent. The former case is the first reported of its kind, while the latter cases have been chronicled in the popular press.

In this paper, the cases of iatrogenic homicide are reviewed, characterizing the perpetrators, the victims, the motives, and the keys to recognizing the deaths as homicides. The majority of the focus however, is on the case involving the homicidal Lidocaine poisoning outside the hospital. Similarities and differences between that case and the hospital-based homicides are highlighted with the goal of raising awareness as to when an elevated Lidocaine level should trigger a more extensive investigation.

The majority of known Lidocaine homicides have been committed by so called “Medical Murderers.” These are health care professionals of one form or another who made Lidocaine their weapon of choice. Robert Diaz was a 46 year old nurse who killed 12 patients (and possibly 50 more) by Lidocaine injection while he worked as a nurse at two California Hospitals. His motive stemmed from his desire to appear to have a “doctor’s” knowledge of how sick patients were and to “predict” when they would die. Joseph Dewey Akin was convicted of killing a quadriplegic patient by injecting him with Lidocaine for the “fun of watching him die.” He committed this crime in Birmingham, Alabama but was suspected to have killed 17 others while working at a hospital in Atlanta, Georgia. And finally, Randy Powers was a 26-year-old respiratory therapist who was never convicted of murder but was convicted of “assault with a deadly weapon” and “practicing medicine without a license.” He gave an eleven-month-old child an intramuscular injection of Lidocaine inducing a high fever and seizure activity. He participated in the resuscitation and was originally thought to be a hero. Physicians, however, identified a needle puncture wound on the child’s thigh and toxicology revealed elevated Lidocaine levels. Powers was suspected to have been involved in many other unexplained deaths. The bodies that were exhumed, however, failed to show needle puncture wounds or elevated Lidocaine levels.

The case of homicidal Lidocaine poisoning outside a hospital was perpetrated by the husband of a 69 year old female with a past medical history most significant for Alzheimer’s Disease, schizophrenia, and macular degeneration. He was her sole caretaker but was also an active volunteer at the Red Cross and at a local Michigan hospital. On the day of her death, he found her lying on her bed around 8:00 a.m. She was unresponsive and this prompted him to notify emergency medical personnel. On arrival, paramedics determined that she had been dead for some time and pronounced her dead at the scene. Police and the medical examiner investigator found the scene secured with no evidence of a struggle. The decedent was found lying supine on her bed and on top of her bedding. Her husband reported that she was in her usual state of health and had no complaints when he put her to bed the prior evening (around 11:00 p.m.). The autopsy confirmed the diagnosis of Alzheimer’s Disease and revealed moderate atherosclerotic cardiovascular disease. There was no evidence of injury or needle marks. EKG leads were the only evidence of therapy. Postmortem urine toxicology revealed Lidocaine, Tocainide, Meperidine, Salicylate, and Caffeine. A postmortem blood drug screen (subclavian blood) revealed Lidocaine 12.4 mcg/ml (potentially toxic >8 mcg/ml) and Salicylate (non-toxic levels). Paramedics confirmed that EKG monitoring was the only resuscitative procedure performed on the decedent. The medical examiner investigator confirmed that there was no evidence at the scene of accidental ingestion of topical anesthetics. Subsequent police investigation revealed that her husband had the opportunity, motive, and ability to administer the IV Lidocaine and may have been involved in previous attempts to kill her. Follow up testing (including DNA analysis) confirmed the presence of Lidocaine and ruled out the possibility of specimen mix-up at the laboratory. Based on this information the cause of death was determined to be Lidocaine poisoning and the manner of death was homicide.

This paper is valuable for multiple reasons. It first pulls cases of homicidal Lidocaine poisoning into the forensic literature. Secondly, it highlights how the deaths of elderly people and the severely ill are often treated casually despite the fact that they are precisely the people most likely to be the victims of homicidal poisoning. It highlights how elevated Lidocaine levels are treated with similar benign neglect. This is clearly illustrated in the comment by one forensic pathologist who was asked to evaluate the toxicology report knowing only that it was a case of an elderly person who died at home. He quickly stated “there is nothing here,” automatically attributing the elevated lidocaine level to “an artifact of resuscitation.” This paper illustrates how the hobby or profession of the assailant/caregiver can give important clues as to the cause of death and to the poison used. And finally, it illustrates how doing a thorough scene

investigation including a detailed medical and social history of the decedent and the family can alert investigators to a situation perfect for homicidal poisoning.

Lidocaine, Homicide, Poisoning

G37 Where Do People Die Suddenly and Unexpectedly?

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The goal of this research project is to discuss statistical data and major trends on different places of death of unnatural and unexpected natural death categories along with gender differences.

There is no place like home even when it comes to dying. Home would be an ideal setting, but never possible for all of us. The vast majority of unnatural and unexpected natural deaths occur outside of the deceased’s residence. None can predict the place of death in a sudden lethal event. In the last seven years we have performed nearly 20,000 forensic autopsies in our institution. Using retrospective chart review of this group we analyzed the place of death from many aspects.

We used eight categories to further sub classify the place of death: a person’s own home, someone else’s home, public place, roads, buildings, workplace, ambulance and hospitals. We investigated for age related trends (i.e., only 3.4% of the 16-20 year-old category died in their own home, but almost one third of those over the age of 70 years died at home). We also reviewed our data by investigating manner of death, including natural, homicide, suicide, and accident victims. Our statistical analysis gives data on place of death in major natural and unnatural cause of death categories. We also depict the monthly and the weekday distribution of deaths occurring in different places. Higher work place deaths occur on Monday; higher sudden deaths in buildings on Thursday; high numbers of cases from ambulances on Friday; and, high workplace related deaths in January and October, etc. Further discussion regarding types of cases accepted for forensic autopsy from hospital versus ambulance/home environments will also be highlighted. Very important features of the presentation will be the analysis of gender differences in each of the categories discussed. The high number of cases (nearly 20,000) allowed us to make interesting conclusions on where our forensic cases are coming from.

Place of Death, Home Deaths, Ambulance

G38 The “Holy Crown United” Southern Italian Mafia Organization Homicides

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The goal of this research project is to present to the forensic community the aspects of the homicides perpetrated by “Holy Crown United” (Mafia Organization) in the South of Italy.

The Authors reported all cases of homicides committed from 1986 to the present by the “Holy Crown United” The “Holy Crown United” was a complex and territory infiltrated Mafia Organization operating in the southern part of the Apulia (southern Italian region), well connected with the Albanian Mafia, quite completely routed in 1995-1995. The “Holy Crown United” specialized in burglary, extortions, bank robberies, illicit traffic of drugs and arms, and illegal immigration of boat people. The deep religious significance of the chosen name “Holy Crown United,” the historical origin, the internal organization in eight levels, and the meaning behind the crime rituality are briefly described.

Seventy-five homicides are reported to be victims involved in the illegal activities of the organization, members of the gang who needed to be punished, their family or relatives, and other innocent people.

Cause and manner of death are described. In all cases large calibre firearms were used. Post-mortem treatment of the bodies described the homicides as terrifying. The bodies were usually charred to demonstrate the Organization's strong power and to frighten the remaining population.

All the members of the Organization to be punished were executed; if this proved to be impossible, homicides on their relatives, close friends, family members were performed. Bodies were then hidden by burial on free land, somewhere in Apulia, so no one could cry or have mercy on their graves. All this violence was directed at close relatives or friends of the deviated members to further threaten them so that they would not retaliate on the Organization. All the criminal acts perpetrated by the "Holy Crown United" were performed using a high volume of fire, sometimes including bombs. Those who were killed or who vanished were called "victims of white lupara" (lupara is a shotgun with cut barrels typically used for Mafia crime) The cadaver research modality, the approach and the rescue of these bodies, the personal identification techniques, and autopsy and ballistic results are reported.

In these cases, a body was usually found through information obtained by "pentiti," a "Holy Crown United" member that decided to collaborate with the State Attorney, in order to obtain protection even for his/her relatives and/or a lighter sentence of guilt. In these particular cases, personal identification of the body was extremely important to have proof that all the information given by the informer was correct.

The methods used by the "Holy Crown United" allowing no possibility of finding any cadaver remains are reported. Peculiar cases are described, such as the personal identification obtained by an isolated patella, or the hierarchical position of a victim in the organization resolved by the analysis of a tattoo.

Holy Crown United, Southern Italian Mafia Organization Homicides, Case Report

G39 Homicide Attempt With a Japanese Samurai Sword

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The goal of this research project is to explain to participants the importance of examining all the material evidence to show the mechanism of injuries caused by a Japanese sword.

A 30-year-old man was admitted in the emergency unit of the Hospital of Strasbourg with a right 2.5-cm long low thoracic wound caused by a sharp object. After an emergency thoracic and abdominal CT-Scan, consequent bleeding led to rapid laparoscopic surgery showing a penetrating wound located at the right side of the liver. The wound had crossed the right inferior pleural cavity and the diaphragm. A right hemothorax was treated with a drainage tube, whereas the wound of the liver was clotted and thus needed no complementary treatment.

The victim explained that he had been attacked while sitting in his car in the parking area of a shopping center by another man armed with a Japanese sword with whom he had a quarrel a few months earlier. According to this statement, the perpetrator gave a first blow on the windscreen of the car, a second blow on the front right passenger's car window, and finally a third direct blow which hit him on his right side. The assailant was quickly identified and arrested by the police. He gave another version arguing that he had only given two circular blows and that the second blow had unfortunately hit the victim.

The public prosecutor gave us the opportunity to examine the sword and the victim's clothes. The sword was a sharp, 76-cm long, 2 to 3-cm wide Japanese sword as used by samurais, bought by the assailant during a journey in the French Caribbean and sharpened by himself. A sample of

blood was taken for DNA typing. The clothes worn by the victim were an anorak, a sweater and a polo shirt. On each of these pieces of clothing, a 2 to 3-cm long slit could be seen. This gave evidence of penetration by of the sword.

The CT-Scan showed a deep 4-cm long wound of the liver giving another argument for a penetrating wound. Close examination of the sword, the clothes of the victim, the size of the skin injury, and the aspect of the thoracic and abdominal CT-Scan provided sufficient evidence to confirm the victim's statement.

The use of Japanese swords in homicides is rare. A Japanese samurai sword is a sharp, cutting object which may inflict two different kinds of injuries: penetrating or cutting. This paper focuses on the importance of the examination of all the evidence, showing to the Court only one possible mechanism of injury: a penetrating sharp force wound.

Japanese Sword, Homicide, Evidence

G40 Sharp Force Injury Fatalities in New York City

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The goal of this research project is to present participants with an overview of sharp force injury deaths in one year in New York City.

Several studies in the United Kingdom and Sweden have examined large numbers of sharp force injury deaths. Most of these studies involved long time periods for data collection that ranged from 9-45 years in order to examine from 28 to 279 sharp force injury deaths. There have been a few large cohort studies of sharp force injury fatalities in the United States. We reviewed the case records of 120 people who died from sharp force injuries in New York City in a single year, 1999. The epidemiological profile, circumstances, toxicology findings, location, and injuries were examined.

There were 120 deaths: 101 homicides, 17 suicides, and 2 accidents. The causes of death included: 112 due to stab(s) with or without incised wounds and 8 pure incised wound fatalities of which 5 were suicides. No sharp force injury fatality had an undetermined manner of death. In sharp force fatalities, the patterns of injuries and the circumstances often demonstrate the intent of suicide or the hand of another in a homicide, thus allowing the investigator to discern the manner of death.

The locations of injuries may help determine the manner of death. It is extremely rare for a person committing suicide to cut his/her face. Hesitation and defense injuries also are useful in determining manner, as may the clustering of wounds which were seen in twice as many suicides (41%) as homicides (17%). Tight groups of wounds may assist in the investigation and reconstruction of homicides and suicides. In a homicide, grouping of sharp force injuries usually indicates that the decedent was repeatedly stabbed following incapacitation. In a suicide, injuries may be concentrated over accessible vital region(s) and typically are superficial (i.e., hesitation marks). In addition, suicidal incised wounds tend to be parallel or colinear. In a homicide, with continued infliction of injury after incapacitation of the victim, the grouped wounds, typically deep, may not be in an accessible area to the decedent (e.g., the posterior thorax) and are typically deep.

"Defense wounds" were reported in 49% of the homicides and "hesitation" wounds were found in 65% of the suicides. There were no self-inflicted sharp force injuries of the face and no sharp force injury suicides by Hispanics, Asians, or anyone under the age of 18 years. Over half of the suicides at home occurred in the bathroom and 78% of these occurred in the bathtub. A study of suicide by stabbing in the United Kingdom of suicide by stabbing found that the majority of decedents were discovered in the bedroom or kitchen. Suicide notes were found in 24% of the cases, and an additional 24% verbally expressed a plan to commit suicide.

Deaths due to a single stab wound occurred in 34% (34/101) of the homicides and 24% (4/17) of the suicides. Of these 38 deaths, 58% were of the anterior thorax (chest) and 71% injured the heart and/or great vessels. The remaining deaths with single stab wounds involved the femoral artery, abdominal organs, or head. A common question with fatalities from a single stab wound to the anterior trunk is, "Was the decedent intentionally stabbed or did he/she run into the knife?" When considering this issue, it is helpful to consider the overall directions of the stab wound track. It is extremely unlikely for a person to be stabbed by "running into" a knife that is positioned other than perpendicular to the decedent's body.

The age range was 5 to 84 years for homicides (mean of 34) and 18 to 76 for suicides (mean of 49). There were more men than women for both homicides (3.2 to 1) and suicides (2.4 to 1). Hispanic (40%) and Black (44%) decedents made up 84% of the homicides. Among the suicides, 65% were White and 35% were Black. Alcohol and/or illicit drugs were found in both homicides and suicides as in other studies on sharp force injury fatalities. Detection of ethanol and/or illicit drugs constituted 61% in the homicide and 12% in the suicide groups. Among male and female homicide victims, ethanol and/or illicit drugs were detected in 72% and 38%, respectively. More homicides occurred in the warmer months from April to September. The percent of sharp force-related homicides that occurred indoors was similar in the colder (51%) to the warmer months (49%). The percent of homicides that occurred outdoors (typically on the street) was greater in the warmer months (78%) than the colder months (22%).

Forensic Pathology, Sharp, Forensic Science

G41 No Homicide on Christmas Eve !? — Case Report of an Unusual Stab Wound of the Brain

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The goals of this research project are to learn about the clinical and autopsy findings of stab wounds of the brain with particular emphasis on an unusual case, which was initially misdiagnosed as cerebral contusion and led to false conclusions concerning the manner of death.

A Russian immigrant was celebrating Christmas in his apartment with his wife and a friend. One or two bottles of vodka were also present. After a while the men began to argue and the tenant wanted his mate to leave. The argument turned into a fight on the stairs. Eventually the mate was laying unconscious on the stairs, a knife in his hand and bleeding from several chest and skull wounds. The wife of the tenant who had only some minor cuts called the emergency doctor. The victim was admitted to nearby Wuerzburg University Hospital by helicopter and immediately underwent diagnostic CT and surgery. At this point he was first seen by the 24-hour forensic service provided by the Wuerzburg Institute of Legal Medicine. According to the clinical findings, diagnoses were stab wounds of the chest and abdomen, with penetration of several ribs, and cerebral contusion, with beginning cerebral swelling.

The victim was said to be eccentric and alcohol-dependent in contrast to the presumed assailant who was a well-integrated employee with intact family and personally known by one of the police investigators. Obviously, nobody wanted to have a "case" on Christmas Eve. This may explain why the police initially believed that the victim's injuries were self-inflicted. During examination of the knife found in the victim's hand by the forensic pathologist, however, it became clear that the blade was not thick and pointed enough to penetrate bone or cartilage which meant that the weapon involved was unknown.

After the emergency treatment of the victim, his condition deteriorated due to further elevation of intracranial pressure and his death came

within the next days. Since the brain injury had to be considered as future cause of death, the police insisted on the possibility that a fall on the sharp-edged stair could have caused the brain injury. The case then would have been qualified as bodily harm or as accident and not as homicide, and there would have been no need to intensify the search for a murder weapon during Christmas. The forensic pathologist in charge agreed eventually to this interpretation although the wound margins seemed to be rather sharp and regular. But, due to the therapeutic intervention no closer examination of the wound could be performed. The assailant remained under arrest, the intensive care unit personnel worked at their best and everybody had a nice Christmas.

As expected the victim died two days after Christmas. The autopsy revealed that the brain injury was clearly caused by a stab wound of the left temporal region. In the following days, the police presented every knife they found in and around the apartment of the assailant, where his wife and children still lived. Due to the lapse of time since the day of the fight there would have been enough occasions for the tenant before his arrest, or for his wife, who must have witnessed the fight but who refused any statement, to walk off with the knife. However, about ten days later one knife found in the apartment met all the requirements to be considered as the murder weapon. Moreover, despite several dishwasher cleanings, DNA from the deceased could be found on the blade by STR analysis. The retrospective examination of the CT scans revealed findings consistent with an intracranial stab wound and not typical for contusions due to blunt injury or fall.

This case is presented for several reasons:

1. Cranial stab wounds are rare events and present problems in clinical and forensic differential diagnosis as long as the patient is alive. They allow for exact requirements for the presumed weapon involved. This will be illustrated by our case and by a short literature review.

2. Forensic investigation under the influence of external factors like holidays or personal relationships may exert subtle pressure on the forensic pathologist which may be difficult to resist. Although this case could be worked up completely despite the delay in considering the case as homicide, the forensic scientist never should rely on clinical information and should never agree to any statement he is not totally convinced of. All clinically available information including CT scans should be personally reviewed by a forensic specialist who is familiar with radiography of brain injuries or by a radiologist who has forensic casework experience.

Stab Wounds of the Brain, Homicide, Clinical Diagnosis

G42 Accidental Hanging Death of a 10-Year-Old Boy From a Lanyard Key Chain

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The goal of this research project is to recognize the dangers of lanyard key chains around the neck and the importance of a thorough death scene investigation, especially when hanging deaths of children are at issue.

Any item around the neck can be dangerous, especially if the item hangs loosely and can become entangled in moving machinery or caught on a fixed object. The popularity of lanyard key chains has exploded in recent years. They are used to hold keys or identification badges at home, school, and work. The lanyards are made of strong woven cloth or nylon material, made to hang around the neck to the mid-chest with a plastic or metal clasp at one end to hold keys or badges securely. The lanyard chains are also commonly imprinted with advertising or promotional slogans or logos. The danger is that these lanyard chains are extremely strong and do not break or separate if they become entangled.

Case Report: A 10-year-old Black male child was found in his mother's bedroom hanging and suspended by a lanyard key chain around his neck from an elevated metal bedpost of a four-poster bed. He was

found by his mother when she returned home from work early in the evening. He had been home alone during the day while she worked, and was not at school due to a one-day suspension for a note-writing incident. His mother lowered him from the bed post, laid him on the bed, and called police. Resuscitation was unsuccessful and his body was brought to the Medical Examiner's Office as a presumed self-inflicted event.

Examination showed a well-developed and well-nourished 10-year-old child with a sharply backwards- and upwards-slanting abraded ligature impression mark consistent with the lanyard found around his neck and accompanying the body. His neck additionally showed marked hypermobility, and internally showed dislocation of the first and second cervical vertebral bodies with posterior neck muscle hemorrhage, consistent with an abrupt drop-type hanging.

Scene investigation, reconstruction and interviews were conducted to determine the nature and circumstances of the hanging. The boy commonly wore the lanyard chain outside his clothing to hold his house key so that he could let himself into the home after school. His mother stated that he was often reprimanded for jumping up and down on her bed and swinging from the crossbars that connected the four raised bedposts. This swinging had caused the crossbars to bend downward, which was noted by investigators. The metal bedposts were of sufficient strength and configuration to support his weight and to catch the lanyard while he was jumping up and down. The lanyard itself, which had no safety release clasp, could easily support his weight without breaking. It was concluded that there was no evidence of an intentional hanging. With the autopsy and scene investigation findings, the death was ruled an accidental hanging. Medline review reveals no similar incidents involving lanyard key chains.

Methods are available to prevent accidental hangings by lanyards. A simple do-it-yourself method involves cutting the lanyard chain in the back to form two ends, and affixing commercially available adhesive Velcro to refasten the ends. This prevents the lanyard from supporting body weight or withstanding enough force to cause injury, but still allows it to hold keys and badges securely. Another method requires that the manufacturer use a "break-away" fastener where the two lanyard cloth ends meet at the clip in the front. The use of lanyard key chains has markedly increased, and as with any item around the neck, there is a danger in its use. Fortunately, means are available to prevent this type of injury from recurring while still preserving the lanyard's useful function, especially for children.

Lanyard Key Chain, Hanging, Children

G43 Sudden Death in Baseball: A Case Report and Review of Literature

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The goals of this research project are: (1) to document a cause of sudden death on the baseball arena; and (2) to review the currently available literature about the causes, patterns, and consequences of baseball fatalities.

Sports, as they say, is big business. Death in such a setting, in and around the sporting arena, attracts much public attention and media coverage. We have, after all, come a long way from the era of the gladiators and the days of blood, gore and death as spectacular spectator sports. Thus, it is not surprising that deaths occurring due to stampedes secondary to stadium collapses or mayhem perpetuated by soccer hooligans make banner headlines around the world. Deaths of participants in sporting events also generate widespread media coverage, public outcry, and political pontification. Such deaths are no surprise when they occur as a consequence of illicit or prescription drug abuse. Moreover, we are psychologically prone to think of sudden deaths due to fatal impact injuries as more likely to occur in contact sports like boxing, football or

hockey than in non-contact sports like baseball. Most catastrophes leading to sudden and unexpected death of young athletes in non-contact sports are often the consequence of unsuspected congenital or acquired cardiovascular disease. A less well-recognized cause of sports related sudden death on the baseball, cricket, hockey or lacrosse fields is "Commotio Cordis." We present here a case report of a sudden death due to fatal impact occurring on a baseball field.

The case report is that of an 18-year-old male who was playing baseball. He was chasing a ball hit to the outfield, when he collided with a fellow player. As no video or photographic records of the fatal event was available, it could not be verified whether the shoulder, arm, elbow or the knee of the fellow player made contact with the neck of the victim. The victim was observed to collapse and become cyanotic soon afterwards. The emergency medical services responding to the scene were unable to intubate him and so transported him to the nearest available hospital. An emergency tracheotomy was performed which revealed significant hemorrhage within the trachea. An emergency thoracotomy was subsequently performed. Despite the several therapeutic maneuvers, the victim succumbed to his injuries. At autopsy, fractures of the cricoid and thyroid cartilages were present. Aspirated blood was present within all major bronchi and extending into the bronchioles.

It is estimated that more than 19 million children are involved in youth baseball in the United States. A Consumer Product Safety Commission Report stated that in the 5 to 14 year-old age group, more fatalities and injuries necessitating emergency room visits occurred in baseball and softball compared to any other sport. There were 88 deaths related to baseball in the 5-14 year age group between 1973 and 1995, of these deaths, 68 were caused by impacts with the ball, 13 were caused by impacts with the bat, and 7 were from another cause or were of unknown cause. These data translate into one death in youth baseball for every 4.75 million participants. The case report that we present is thus a documentation of a very unusual and really freakish accident. In our search of the literature, we failed to find a similar case of sudden death during a baseball game.

Blunt Neck Trauma, Sudden Death, Baseball

G44 Post Collision Vehicular Fires—Determination of Probability of Occupant Survival Post Impact

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The goals of this research project are to present the forensic community with an explanation of the analysis necessary to determine the survivability of a post collision vehicular fire. This analysis can also be used in the determination of death in other cases in which fire may mask the injuries and death.

This paper will discuss the problems of determining the survival of an occupant involved in an automotive crash that subsequently involves a post collision fire. This will provide some insight into the primary questions involved in this type of incident. Did the occupant survive the collision? Did the occupant sustain injuries that, even though the fire and/or its consequences may have played a role in the death, prove he/she would have died from the collision injuries regardless?

To make this determination, one of the first steps in the analysis is to consider the collision dynamics of the incident. The first parameter, and probably the most important, is the Delta V or crash severity of the incident. As important as the Delta V are the direction of the impact to the vehicle, and a rollover, if one has occurred, how many rolls and at what speed the rollover began. The next parameter is the pulse or duration of the crash and also whether or not there are airbags in the vehicle and if these devices deployed during the incident.

After the investigator has an understanding of the collision dynamics, he must analyze the next piece of the puzzle, the injury pattern. This includes determination of all the injuries sustained in both the collision and due to the post collision fire. Within this portion of the analysis, consideration has to be given to the method of removal of the bodies from the vehicle as well as the mode of transport to the forensic science laboratory. During this examination a determination of true traumatic injuries versus fire related injuries should be separated out. Of additional importance, an attempt to determine whether or not restraints were in use may be possible based on types of injuries present, absence of injuries, and information from vehicle inspection.

A toxicological analysis should be performed to determine the carboxyhemoglobin levels of the victims. Due care has to be taken in the use of the values in the overall determination of the cause of death. This requires further investigation into what types of materials were contained within the fire environment, what type of air exposure, and whether the decedent(s) were smokers.

To complete the piecing together of this complex puzzle, consideration of witness accounts to the incident have to be evaluated. These persons can provide testimony as to the intensity of the fire, movements of any of the bodies within the fire, sounds and other noises heard from the fire during its progression.

The determination of post collision survival and whether death has occurred as the consequence of a vehicle fire is a complex issue. In some cases post mortem examination and autopsy may stand alone in answering this question. In many cases, however, even with a post mortem and autopsy, the additional information accumulated in the investigation is extremely important and necessary in making such a determination.

There may be cases in which without an autopsy there is enough accumulated information from other sources to determine that there is a reasonable probability that the person survived the crash, and that fire, within a reasonable degree of forensic, medical and scientific probability caused the death of the individual.

Fire can mask many types of death including homicides, suicides and natural deaths. It is only the work of a skilled and trained investigator that the answers from the dead in such a case can be heard.

Fire Death, Carboxyhemoglobin, Vehicle Fire

G45 Decapitation by Motorized Shoulder Harness: A Case Report

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The goal of this research project is to present an unusual traffic fatality associated with a motorized shoulder harness, and to inform the audience how a shoulder harness without a lap belt can cause serious and fatal injury.

Deaths associated with motorized shoulder harnesses have been the subject of recent litigation. Automobiles with motorized shoulder harnesses automatically draw the harness against the occupant when the ignition is turned on. This "passive" restraint may give the occupant of the vehicle a sense of security, allowing him or her to think he or she would be safe in a frontal collision. In truth, the occupant is at serious risk for injury unless the lap belt is fastened. Failure to use a lap belt results in injuries from "submarining" — the harness restrains the movement of the lower body forward during a frontal collision while the upper body. Serious and fatal thoracic and neck injuries can occur from submarining. Also, the shoulder harness without the lap belt does not prevent occupant ejection. The following case illustrates an unusual and fatal injury pattern resulting from the use of a motorized shoulder harness alone: decapitation.

While driving a two-door sedan and traveling at about 80 miles per hour on an interstate highway, a 58-year-old female collided with two

slower cars prior to leaving the road at a high rate of speed. As her vehicle rotated counter clockwise, it became airborne after leaving the shoulder of the road. The left rear of the car forcefully struck the ground, and the driver was ejected to the left and rearward through the opened driver side door. Her headless body and decapitated head were found 100 feet from each other.

Autopsy disclosed the level of decapitation to be at the base of her neck, level with her shoulders. About 2 inches of cervical spine and attached hemorrhagic soft tissue protruded from the margin of decapitation. Brush abrasions lay in the skin of the upper chest and over the right clavicle, and contusions involved the tissues inferior to the right clavicle and in the right upper anterior chest. The cervical spine disclosed a ragged fracture-transection between cervical vertebrae three and four. Additional injuries included a frontal deep scalp contusion, light subarachnoid hemorrhage throughout the cerebrum and cerebellum, and fractures of the anterolateral aspects of right ribs one, three, four, five, six and seven. Other head, trunk or extremity injuries were slight to absent. Toxicologic evaluation of blood from femoral vessels and urine disclosed no evidence of ethanol or drugs.

Examination of the vehicle disclosed damage mostly to the front and left rear portions of the vehicle. The driver side door was deformed in an open position. In spite of the frontal damage, there was minimal to no intrusion into the front occupant compartment. There was no evidence of damage to the steering wheel or dash and no evidence of body impact against the front windshield. The shoulder harness was in the fully engaged position, and the receptacle was bent to the left toward the opened driver-side door. Blood and tissue stained the shoulder harness from 4 to 9 inches from the receptacle. There was no evidence of lap belt use at the scene of the accident.

During her ejection through the driver-side door at a high rate of speed, the fabric of the shoulder harness decapitated the victim. Failure to use a lap belt with the shoulder harness allowed her neck to be severed by the harness as her body ejected from the vehicle.

Traffic Fatality, Motorized Shoulder Harness, Decapitation

G46 The Memorials at the Lockerbie and Ermenonville Forest Air Disaster Sites

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The goals of this research project are to 1) earn that mass disasters involving aircraft evoke swells of both communal anger and grief. These evolve into the need to keep alive the memory of both the event and the victims by erecting memorials; and 2) recognize that the forensic scientist may benefit personally and professionally by seeking out and viewing these memorials.

Visiting and viewing memorials brings forcibly and poignantly to the forensic scientist both the reality and the finality of the disasters which they commemorate. This may be true in particular when the scientist has previously read extensively about the disasters and has seen images of them in the media.

A memorial, for instance, a monument or a holiday, serves to keep alive the memory of a person or an event. It serves as an historical record, and may recognize and give permanence to valiant lives or deeds. A memorial may also keep alive the memory of a tragedy, serving as a site for gathering, mourning, and remembering.

Thus, memorials have been erected to commemorate sites of forensic interest, primarily mass disasters, both natural and man-made. Of these, and particularly in the second half of the 20th century, a number commemorate aircraft crashes in which there was great loss of life; i.e., aircraft disasters.

A recent visit to Europe enabled the author to visit two such memorials: the first, that to the destruction by sabotage, and the subsequent crash of Pan Am Flight 103 in Lockerbie, Scotland on December 21, 1988; the

second was that to the crash of Turkish Airlines Flight 981, in the Ermenonville Forest northeast of Paris, France on March 3, 1974, following the loss of a rear cargo door which irretrievably damaged the plane's controls.

Motives for the visits included adding to knowledge of these disasters gained through reading and the media, coming to terms with emotions brought about by this research, and recording images to be used in teaching.

Lockerbie: The small town of Lockerbie is in southwest Scotland, just north of the border of the English county of Cumbria. Portions of the aircraft and the passengers fell both into the town and onto surrounding countryside.

The Garden of Remembrance is located at the edge of the town. Rolling fields and hills are all about. High-flying airliners, some flying transatlantic routes similar to that set out on by Pan Am 103, are seen and heard directly overhead. A large, central memorial of tablets bearing the names of all of the victims is flanked by individual tablets to passengers and crew. There are attractive flowers and plantings. Several miles in the opposite direction, in hills and fields above the town, is the small Tundergarth parish church. Nearby, the cockpit and anterior cabin of the 747 "Maid of the Seas" fell into a field; images of this wreckage have been published throughout the world. In the churchyard was erected a small cabin, the Tundergarth Memorial Room, which contains a large book in which there are text and images of the passengers and crew, and floral arrangements.

Ermelonville Forest: This dense virgin forest contains a number of structures of historic interest, and is a popular recreational site for both Parisians and other visitors. The crash occurred deep in the forest, and the memorial is accessible only by graveled footpaths through the forest. This is a soaring memorial of dark grey Cornish stone, adjacent to which is a tablet bearing a commemorative poem. Most unexpected, and most riveting, is the finding of numerous small, usually charred fragments of the crashed DC-10 previously retrieved from the surrounding forest and laid upon the edges of the monument. Other such artifacts still lie in surrounding vegetation. Opposite the memorial are low stone tablets bearing the names of passengers and crew. Aircraft taking off from Paris Charles de Gaulle Airport are seen and heard just south of the Forest.

Conclusions: Visiting and viewing public memorials to aircraft disasters give visible evidence of the strong communal feelings of both grief and the celebration of individuals' lives engendered in the survivors following such disasters. It also makes much more immediate and memorable to the forensic scientist, who has previously heard and read of a disaster, the locale and immediate surroundings of the same, the magnitude of loss of life, and the conflicting emotions which were, and always will be, so strong within the survivors. Even more poignant are the continual commercial air traffic above and near the memorial sites and the finding of artifacts at one.

Aircraft Accident, Forensic Sciences, Memorial

G47 Experiences Following the Crash of Singapore Airlines SQ006 Boeing 747-400 in Taipei

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The goals of this presentation are to address the events following the aviation disaster of Singapore Airlines SQ-006 and to detail the standard operation procedures used during this experience.

On October 31, 2000, at approximately 23:17 Taiwan time (15:17 UTC), Singapore Airline Flight SQ-006, with Singapore registration 9V-SPK, Boeing 747-400 aircraft, entered the runway under construction

at Chiang-Kai-Shek (CKS) Airport, Taiwan. Heavy thunderstorm and strong wind from typhoon "Xiang Sane" arrived at the time of this aviation accident. Before taking off, the airplane cracked when it collided with the runway construction equipment and the impact produced a fire. There were a total of 179 people on board: 159 passengers, 3 flight crew members, and 17 cabin attendants. Official reports show that 83 people died (including 4 cabin crewmembers) and 44 people were injured. The accident of Singapore Airline SQ-006 at CKS International Airport resulted in the instant deaths of 79 persons from 19 different countries. 77 bodies were rescued from the scene immediately after the fire was extinguished; two of 79 bodies were found under the cracked aircraft about 43 hours after incident.

Although many of the bodies were identifiable, the prosecutor's office of Tau-Yuan District Court (40 km to the south of metropolitan Taipei) decided to request the DNA typing method to confirm identity of each body; in addition, odontological and anthropological identification that included one X-ray mobile van was also requested. Immediately after this accident, the Criminal Investigation Bureau, Ministry of Interior and medical examiners of IFM were asked 1) to collect the samples, mostly consisting of muscle tissue from deceaseds' bodies; 2) to label carefully the evidence; and 3) to follow independently the chain-of-the-custody. STR profiling system was applied and MJIB and IFM were assigned to collect the family members' blood samples. STR profiling types were processed for further paternity matching. In order to increase the efficiency of DNA typing, the forensic scientists of molecular biology were organized into a blood collector group, a DNA extraction group, a STR typing group, and STR matching work stations as a DNA typing and identifying mass production chain. The CODIS 13 STRs were applied to fulfill the DNA data interchange. The first group of families arrived on the next day at 8:30 a.m., about 9 hours after the crash; their blood samples were drawn for DNA typing to establish genetic relationship to the decedents. 20 hours after the crash, the first group of 12 bodies was identified including anthropological and odontological examination and DNA confirmation.

After five days of mass production operation in the DNA laboratory, 80 bodies matching their relatives from 19 different countries were identified including one rescued survivor who died about 24 hours after incident. Another two decedents died in the hospital; these two were identified by next-of-kin. One of the 80 decedents was identified by STR direct matching (STR typing result and blood sample sent from Singapore) from a previous blood sample left in the blood bank of Singapore. An exceptional case involved one decedent who was identified after the CODIS 13 data of decedent's family member sent from India. 15 of 65 decedents were identified by sibship profiles with collateral consanguinity and paternity test with linear consanguinity, respectively.

Forensic DNA matching correlated with odontological and anthropological examination is a very accurate and efficient tool used to identify badly injured bodies. Established professional guidelines as standard operation procedures of DNA typing and body identification played a crucial role in coping effectively with mass disaster of Singapore Airlines SQ-006 Air crashed Accident.

Forensic Science, CODIS 13, Air Crash

G48 Mortality Estimate for the 1994 Northridge Earthquake

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The goals of this research project are to present sources of error in the Medical Examiner's report of mortality from a widespread disaster.

On January 17, 1994, a large earthquake occurred in a suburb of Los Angeles, causing widespread damage. The Los Angeles County Department of Coroner received a large number of requests from the

media for the number of earthquake-related deaths. There were also several requests for identity of the victims, both from the media and for purposes of compensating the families.

The official death toll of 57 was based on the following case definition: "A death is considered earthquake-related if it occurred on the day of the earthquake, and it was a direct result of trauma (such as structural collapse) or if it resulted from a stress-related illness." The official death toll underestimates the actual death toll because it does not include the following:

1. Deaths from atherosclerotic disease that were not reported to the Coroner. Deaths from atherosclerotic cardiovascular disease increased on the day of the earthquake, but then decreased for several days afterwards.
2. Deaths occurring in other counties.
3. Delayed deaths, including deaths from aftershocks and suicide.
4. Deaths from an earthquake-related epidemic of Coccidioidomycosis.

Based on analysis of excess mortality on the date of the earthquake, the actual death toll was approximately twice the official death toll.

Mortality statistics from a widespread disaster have sources of variation not present in a confined disaster. These include the region surveyed, the time interval examined, and the causes of death considered. In this situation, it may be impossible to give an accurate death toll, or to determine the identity of many of the victims.

Earthquake, Mortality Statistics, Northridge

G49 Death in the Desert: Multiple Fatalities as a Consequence of Environmental Exposure

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The goal of this research project is to further illustrate the multidisciplinary nature of death investigation, especially as this pertains to multiple deaths and resource management within a medical examiner's office.

In May of 2001, the Office of the Medical Examiner, Pima County, Arizona, was requested by the Yuma County Medical Examiner to provide assistance in the investigation of the deaths of fourteen people who had been found in a remote area of the Sonoran Desert near Yuma, Arizona. Explicit in this request was the need for the determination of cause of death for each of the fourteen individuals—all of whom were presumed to be Mexican Nationals—as multiple charges of homicide were to be filed against the person or persons responsible for leaving these unfortunate people in such a desolate landscape. Both the Yuma County Sheriff's Department and the Pima County Sheriff's Department, as well as the FBI, assumed a role in the investigation because at the time of the postmortem examinations it was uncertain whether these cases would be prosecuted by state or federal officials. Serving as a much-needed liaison between the medical examiner's office and relatives of the victims was the Mexican Consulate in Tucson. This assistance was invaluable because the majority of the decedents were not identified when they were received into our office. The receiving of fourteen individuals en masse—in addition to the regular daily caseload—into a medical examiner's office can create problems, as well as additional stress, but these problems and stresses can be managed by mobilizing the appropriate resources.

The immediate resources tapped were the employees of the office of the medical examiner. To the credit of these dedicated personnel, workdays were lengthened, days off were postponed, and vacations were delayed without complaint. Teams were organized so that the examinations of the usual daily caseload could be conducted while the examination of the fourteen related deaths could be performed with continuity. The

office was a beehive of activity for a few days, with all of the medical examiner employees working along side representatives of the sheriff's office, the FBI, and the Mexican Consulate. Because this multiple-death event offered the unique opportunity to gain experience in managing a future mass-disaster, our office implemented another resource: mobile refrigerated storage space. To this end, a local beverage distributor donated—and delivered to our door—a refrigerated trailer. Although it was not necessary to utilize this storage space in this instance, logistical experience was gained that will be beneficial if the need ever arises.

After the post mortem examinations were completed, it was revealed that each of the fourteen individuals died as a result of exposure to an arid, desert environment. To date, thirteen have been identified by a variety of techniques and repatriated (with the assistance of the Mexican Consulate) to Mexico. Efforts to identify the final individual continue. Through the utilization of the various resources available to the medical examiner, successful resolution of a multiple death event was accomplished.

Multiple Deaths, Multidisciplinary Investigation, Resource Management

G50 The Role of the Forensic Anthropologist in Determining the Manner of Death in Suicidal Shotgun Wound to the Back of the Head

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The goals of this research project are: (1) to present a case of suicidal shotgun wound to the back of the head, (2) to outline the methods employed in the reconstruction of the fragmented skull to understand the bullet trajectory, and (3) to discuss how this reconstruction was crucial in supporting the alleged manner of death.

The value of the forensic anthropologist in assessing trauma to and identification of skeletonized remains is clearly understood and is widely accepted in both the forensic anthropology and forensic pathology communities. Assessing such trauma in completely fleshed remains, however, is not as clearly defined or as well recognized. What is clear is that there are cases of significant skeletal trauma in fleshed remains where cause and/or manner of death are in question. In these cases the services of forensic anthropologists can also be invaluable because of their ability to reconstruct fragmented bones, to recognize injury patterns, and to determine possible weapons used to inflict the trauma. This paper discusses a case of complex cranial trauma in a fully fleshed body and illustrates how forensic anthropology can assist in determining the cause and manner of death.

The case involved a 33-year-old male who reportedly shot himself with a 12-gauge shotgun loaded with deer slug ammunition in a successful suicide attempt. The decedent had a history of depression and multiple ongoing social stressors including an impending divorce, the recent loss of a job, and impending foreclosure on his house. He had been arguing off and on with his live-in girlfriend on the day of his death. During their final altercation he verbally threatened to commit suicide and retrieved a gun from another room in the house. His girlfriend reported that he placed it near his right ear at an upward angle and pulled the trigger. The gun did not fire and she turned to leave the room. As she walked away, she heard the gunfire and turned to find him on the floor, surrounded by blood. Paramedics were called and pronounced him dead at the scene. Police

responded and “determined” that it was a suicidal gunshot of the head but could not determine the entrance site. The county medical examiner did not order an autopsy and the body was released to the funeral home. During the embalming process, the funeral director noticed that the entrance wound was at the rear of the skull and questioned the likelihood of the presumed scenario (i.e., a self-inflicted shotgun wound to the rear of the head). Upon receiving this information, the medical examiner ordered an autopsy on the embalmed body. Autopsy revealed a massively distorted head with shattering of the cranial vault and virtually complete evacuation of the endocranial space. An entrance site was identified on the right side of the occipital squamous, approximately two inches posterior to the right ear and soot was identified on the inner and outer tables of the adjacent bone. Because numerous skull fragments were missing or dislodged, it was impossible to identify the exit site(s) or to determine the trajectory of the projectile. The question posed at autopsy was this: could this really be a suicidal shotgun wound to the back of the head or is this a homicide being disguised as a suicide? There was evidence to support the hypothesis that it is physically possible to commit suicide in this fashion if the slug took a tangential course through the skull. Therefore, the determination of the path of the bullet was considered critical.

The complexity of the cranial injuries and the gravity of the questions raised warranted the involvement of the forensic anthropologists from Michigan State University. At the time of the autopsy, it was the anthropologists’ opinion that a proper determination of the exit wound and therefore the bullet trajectory required the removal of the head and ultimately the examination of the relevant skeletal material devoid of flesh. The head was defleshed and reconstructed at the Michigan State University Forensic Anthropology Laboratory. This process resulted in the identification of a minimum of three exit sites (i.e., the slug had fragmented) in the right parietal area, posterior to and to the right of bregma, and allowed for the reconstruction of the most likely trajectory. From the reconstructed cranium, it was apparent that the bullet entered the skull from the right side of the occiput, fragmented and that the fragments took a steeply vertical path along the right side of the head. The determination of the wound path made it possible to conclude that the death was consistent with a self-inflicted gunshot wound to the back of the head and these findings were consistent with the girlfriend’s account.

Examination of Fleshed Human Remains, Suicide, Anthropology

G51 Sudden Death Due to Myocardial Infarct Associated With Systemic Lupus Erythematosus: Two Case Reports and a Review of the Literature

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The goal of this research project is to understand the etiology of myocardial infarcts associated with systemic lupus erythematosus.

The authors present two cases of sudden death due to myocardial infarcts (MIs) associated with systemic lupus erythematosus (SLE) and discuss the etiologies for MIs associated with SLE.

The two patients, one a 29-year-old white female and the other a 25-years-old white female, had known diagnoses of SLE. Both collapsed at home, one with no acute complaints and the other, who was 22-weeks pregnant, had complained of bilateral arm pain for two days prior to her death. At autopsy of the 29-year-old woman we found multiple aneurysms of the right coronary artery caused by arteritis. One of the coronary artery aneurysms was thrombosed and the inferior wall of the left ventricle had an AMI. The second case showed occlusion of the left anterior descending coronary artery by atherosclerosis and thrombus with an associated anterior and lateral wall AMI.

AMI is a recognized fatal complication of SLE. Reported mechanisms include atherosclerosis, arteritis, coronary artery aneurysms, intracoronary thrombi without significant coronary artery disease, coronary embolus from verrucous endocarditis, and coronary ectasia. In general, older age at diagnosis, longer time since diagnosis, longer duration of corticosteroid use, hypercholesterolemia, and postmenopausal status are more common in women with lupus who suffer cardiovascular events.

Patients with SLE often have accelerated atherosclerosis. An autopsy study of 21 women between the ages of 16 and 37 with SLE showed >75% narrowing by atherosclerosis of one or more coronary arteries in 10 of the women.

The accelerated atherosclerosis seen in lupus may be due to hypertension, chronic corticosteroid use, and hyperlipidemia.

Although uncommon, coronary arteritis associated with SLE and resulting in MI, is well documented. In addition to the case presented here, several other cases of coronary artery aneurysms and MI in patients with SLE have been reported. The uncommon vasculitis of major coronary arteries and the vasculitis of small coronary artery branches are not usually seen in drug-induced lupus-like syndromes.

Patients as young as 8-years old are reported to have suffered MIs due to intracoronary thrombi without significant coronary artery disease in SLE. The presence of antiphospholipid antibodies (such as the lupus anti-coagulant) has been associated with such thrombotic events in SLE. In one reported case, thromboses of small intramural arteries of the heart were associated with a thrombus in a coronary artery.

Conclusion: AMI is a well-described complication of SLE. Accelerated atherosclerosis is the most common risk factor for an AMI in patients with SLE, but a number of other mechanisms may result in the vascular stenosis responsible for the infarct.

Systemic Lupus Erythematosus, Myocardial Infarct, Sudden Death

G52 Unexpected Multicystic Encephalopathy After Accidental Intoxication by a Corrosive Agent: Case Report

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The goal of this research project is to illustrate an unusual neuropathological autopsy finding and to discuss the probable etiology, using text and photographs.

Multicystic encephalomalacia is an extremely dramatic disease usually presenting in the immature fetus. The lesions typically occur in the white matter, because of this region’s putative higher metabolic activity and, therefore, high vulnerability to anoxia related to active myelinization. The cysts may vary greatly in size and be distributed throughout the cerebral cortex bilaterally. A few, rare studies have reported cerebral encephalomalacia in adult life in patients following toxic intoxication or after gastrointestinal surgery. We report an unusual case of multicystic encephalomalacia observed in a 55-year-old man with a history of alcohol intake, who had undergone partial gastrectomy after caustic ingestion. In March 1998, the patient accidentally ingested caustic liquid (Sumazon – containing sodium hydroxide, sodium hypochlorite and phosphates) used for dish washing. On his arrival in hospital, a stomach pump was administered and appropriate pharmacological treatment was started. Esophago-gastro-duodenoscopy (EGDS) performed two days later showed acute esophagitis and gastritis due to caustic ingestion, with multiple irregular ulcers especially in the antro-pyloric region. On discharge, the control EGDS demonstrated diffuse gastric scarring. In April, the patient was hospitalized for persistent post-prandial vomiting

associated with epigastric pain, and EGDS showed tight stenosis of the scarring in the pylorus. Partial gastroduodenal resection was performed according to Billroth II. In May, due to persistence of the vomiting and progressive deterioration of the patient's nutritional status, he was examined once more and the presence of a mechanical obstacle to the passage of food was excluded. Irritation of the residual gastric mucosa induced by bile and pancreatic secretion was postulated to be the cause, and a new operation was proposed (biliary and pancreatic derivation). On 24 May 1998, the patient was admitted to a surgical ward and refractory vomiting, malnutrition, anemia, electrolytic alterations (Na^+ , K^+ ; H^+) and calcemia were recorded, together with a state of mental confusion, visual disturbances, vertigo and paresis of the right arm. The patient was administered parenteral nutrition and a crano-encephalic CT scan was performed, which showed asymmetry of the lateral ventricles ($\text{sin} > \text{dx}$) and cerebral atrophy; no areas of pathological density were revealed in the parenchyma. On 4 June the patient died of irreversible cardiac arrest. As there was some suspicion of malpractice, the judge ordered an autopsy. External examination of the cadaver evinced greenish areas of putrefaction over the inferior abdominal quadrants, various tattoos of varying sizes, no teeth in the superior maxillary arch, and the scars due to the partial gastrectomy. On sectioning the body, acute polyvisceral congestion was observed (right lung gr. 650, left lung gr. 680; heart gr. 300; liver gr. 1400; spleen gr. 130; right kidney gr. 220, left kidney gr. 240); scars were due to partial gastrectomy, absence of pleural, pericardiac and peritoneal leakage. The brain, weighing 1,250 grams, was asymmetrical in the two hemispheres, and flattened grooves and wide circumvolutions were apparent. The circle of Willis showed scattered atheromatous plaques along the walls of the vessels. Examination and section of the encephalon were performed after fixation of the organ (30 days in 20% formalin); before cutting into the parenchyma, post-mortem brain magnetic resonance imaging (MRI) coronal proton density and T2 scans showed multiple cyst-like lesions involving the subcortical white matter and basal ganglia. The genu of the corpus callosum presented an area of gliosis on the left side. All these aspects were absent on the CT scan performed only a few day before exitus. Section of the encephalon confirmed the presence of cystic lesions in the white matter, containing cerebrospinal fluid and ranging in diameter from 3 mm to 1.3 cm, symmetrically distributed along the cerebral hemispheres, in the brain stem, the ganglia of the base and the cerebellum, especially the periventricular areas. The left ventricle was dilated and there was no tissue herniation. Sections 4-5 microns in size, stained with hematoxylin-eosin, Pas, Luxol Fast Blue, Azan-Mallory, Grocott and Zihel-Nielsen, were observed under the optical microscope and it was seen that the cystic cavities mainly involved the white matter and rarely the grey matter, and that they had no epithelial sheath and were delimited by zones of astrocytosis. Demyelinized foci were present, and there were areas of gliosis in the corpus callosum. Tests for bacteria (mycobacterium tuberculosis and atypical mycobacteria), fungi (candida and cryptococcus), viruses (cytomegalovirus, herpes) and protozoa (toxoplasmosis) were negative. Histology of the other organs confirmed the overall state of congestion but provided no other noteworthy findings apart from areas of fibro-adipose tissue in the ventricular myocardium (left and right) and hepatic steatosis. Death was thus attributed to the synergic effect of the cerebral lesions provoked by the metabolic acidosis together with the persistent electrolytic imbalance. The case we describe confirms the reports in literature indicating ungovernable vomiting as a rare, severe complication of gastroresection and suggests that a metabolic imbalance may be etiopathogenic for cerebral cyst formation in the adult. To ensure correct diagnosis at autopsy, therefore, examination and MRI of the brain, previously fixed in formalin, is advisable to investigate the features of tissue damage in cases of death induced by metabolic imbalance.

Corrosive Agent Intoxication, Electrolytic Imbalance, Multicystic Encephalopathy

G53 Notochord Regression Failure Initially Suspected as an Abusive Fracture in an Infant

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The goal of this research project is to have participant become familiar with an atypical case of notochord regression failure initially suspected as an abusive fracture in an infant

Background: The evaluation of any infant death must include a full skeletal survey in order to detect any possible trauma. The finding of suspicious trauma would eliminate the diagnosis of sudden infant death syndrome as a cause of death and may suggest abusive treatment by the caregivers.

Case History: The decedent was a four-month-old male infant. According to reports, the decedent was found by his father in a crib under a blanket unresponsive in the early morning hours. He was brought to the emergency room with a poor respiratory effort. He was intubated but continued to decline and never regained consciousness. He was pronounced dead approximately four days after admission to the hospital. Evaluation in the hospital included an antemortem skeletal survey and ophthalmologic examination. These were both unremarkable except for a defect of the 3rd lumbar vertebra which was interpreted as a possible fracture. However, follow-up radiological studies of the lumbar vertebrae failed to reveal a definite fracture. There was no history of trauma or abuse.

Pathological/Anthropological Assessment: Initial examination of the antemortem radiographs taken of the infant revealed a clear defect of the vertebral body of L3, with a slight defect in L5. Autopsy examination failed to reveal any fractures or hemorrhages in the lumbar area. In order to accurately determine if the defects were due to developmental abnormalities or trauma, the lower lumbar vertebrae were removed, dissected and macerated for evaluation. The defects were also noted in the postmortem radiological examination.

Visual examination of the vertebrae revealed a complete coronal cleft of the centrum of L3, while the centrum of L5 possessed only slight indentations of the lateral aspects. No residual defects were noted on L4. Linearly transecting the two portions of the centrum of L3 were residual cartilaginous tissue and the remnants of the notochord. The coronal cleft and the cartilaginous tissues are consistent with the failure of the notochord to regress appropriately during the development of the vertebral body (Barnes, 1994). This would interfere with the normal unification of the anterior and posterior portions of the centrum, and give the false appearance of being fractured. Microscopic examination confirmed the diagnosis of notochord regression failure. This type of vertebral body cleft defect is more commonly seen in the lumbar region.

Conclusions: The pathologic correlation to the radiological findings of this defect in the spine was failure of the notochord to regress, a developmental defect and not the result of trauma. No other developmental or congenital anomalies were identified. No other significant trauma or anatomic cause of death was identified and the cause of death was classified as sudden infant death syndrome. Although a rare occurrence, failure of the notochord to regress is an important entity, primarily because it may be confused with an abusive traumatic fracture.

Notochord Regression Failure, Fracture, Child Abuse

G54 The Clinical and Pathological Features of Fatal Concussion

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The goals of this research project are to present the clinical and pathologic features of fatal concussion, with emphasis on potential contributing factors.

Diffuse brain injuries (DBIs) are the most common type of head injury and form a continuum of progressively severe brain dysfunction. The majority of cases fall under the clinical heading of Cerebral Concussion, in which minimal or no sequelae follow a brief period of unconsciousness, and rarely come to the attention of the forensic pathologist. More frequently encountered are the severe DBIs associated with motor vehicle or pedestrian accidents, assaults, or falls from a height. The hallmark of DBI is damage to the axon resulting from the shearing forces of rotational acceleration. The severity of the injury and length of survival determine the degree to which axonal injury can be appreciated microscopically. The characteristic finding of axonal bodies becomes apparent 18 to 24 hours after injury. With the use of immunohistochemical stains for beta-amyloid precursor protein (?APP), the window between injury and detection is reduced to three hours. Small hemorrhages in the parasagittal subcortical white matter, corpus callosum, and dorsal brainstem, as well as mild subarachnoid (SAH) and/or intraventricular hemorrhage can be macroscopic markers of axonal injury due to the susceptibility of small blood vessels to the same shearing forces.

Rare are the cases in a sudden death following blunt head trauma where autopsy fails to demonstrate any injury to the brain, either macroscopically or microscopically. This entity has been referred to as *commotio cerebri*, fatal concussion, and reflex death. While this subject is well known anecdotally, it is obscure in the literature. A couple of articles have been published in recent years that discuss possible pathophysiologic mechanisms for death in these instances. The general consensus is that a "concussion" of the reticular formation in the brainstem is paramount to the lethal outcome. Whether this event triggers death via a cardiac dysrhythmia or apnea remains a topic of debate. Ethanol intoxication has long been recognized as a cofactor in the mechanism of death in certain individuals; however, this finding is not absolute.

The purpose of this study is to determine the incidence of fatal concussion in New York City and to further delineate its clinical and pathological features, as well as possible contributing factors, in order to gain a better understanding of possible mechanisms for sudden death in these instances.

The electronic database for the Office of Chief Medical Examiner in the city of New York was retrospectively searched from January 1997 through July 2001 for potential cases that met criteria for fatal concussion, that is immediate death following blunt impact to the head; no skull fractures, epidural or subdural hemorrhages, or focal brain injuries; and no other explanation for death. Identified cases were reviewed to determine the circumstances surrounding death, resuscitative efforts, acute intoxications, and underlying natural disease. A complete autopsy including toxicologic studies and neuropathology consultation had been performed in each instance. Microscopic evaluation of the brain was not included due to the short survival period. Findings were recorded in a new database for analysis.

Seven cases were identified during this 4 ½ year period. All victims were male and the ages ranged from 14 to 56 years (mean 34.4 years). Two of the decedents fell from standing and struck their head on the ground, two fell down a flight of stairs, and two were struck by an object. The seventh individual was an unrestrained passenger in a motor vehicle accident. Toxicology was negative in one instance. Of the remaining six decedents, five were acutely intoxicated with ethanol (0.12-0.36 g%). In

one of these five, cocaine was additionally detected in the blood and ethylbenzoylecgonine in the urine. Furthermore, chronic alcoholism was a recognized factor in four of these five decedents. Cannabinoids were detected in the blood of the seventh individual. Six of the decedents had cardiac hypertrophy defined as a heart weight exceeding 0.5% of body weight in kilograms or a left ventricle wall thickness \geq 1.5 cm. The heart in the seventh individual fell well below the expected weight. Traumatic injuries were limited to scalp lacerations in two victims. Additional findings of thin SAH were present in three decedents. One instance involved a blow to the posterior neck with hemorrhage in the muscles overlying the second to the fourth cervical vertebrae, but no detectable injury to the spinal cord or vertebral artery. The remaining individual had no external manifestations of trauma to the brain, but a few small hemorrhages in the frontal white matter and pontine tectum were detected upon sectioning.

Fatal concussion is an infrequently encountered entity that has received little attention in the literature. It is generally accepted that the sudden nature of death in these instances results from a "concussion" to the vital centers in the brainstem. But what is a concussion? Recent studies have shown that patients who suffer a cerebral concussion and survive but die shortly afterwards from another cause have evidence of axonal damage demonstrable using immunohistochemical stains for ?APP. With this information, one can consider axonal injury the structural defect common to all DBIs and it is the distribution and extent of damaged axons that determine the severity of brain dysfunction. It is the belief of these authors that fatal concussion falls within the continuum of DBIs and the reason autopsy often fails to demonstrate any injuries is because of the extremely brief survival period between impact and death. The presence of subtle hemorrhagic markers supports the theory that axonal damage plays a mechanistic role in the death of these individuals. The reticular formation in the brainstem controls the autonomic functions of the body, most importantly breathing and heart rhythm. Therefore, axonal damage within this vital center could theoretically trigger episodes of apnea and/or cardiac dysrhythmias. Of the two, cardiac arrhythmia is by far a more common cause of sudden death.

The second question we must ask is why do some people die from a concussion while others survive with minimal residual effects? This study identifies two cofactors that can help explain why some people may be predisposed to sudden death following what otherwise appears to be minor head trauma: ethanol intoxication and cardiomyopathy. Conduction disturbances and arrhythmias are frequently seen in those with cardiomyopathy whether it is due to hypertension, ethanol or stimulant abuse, or of an idiopathic nature. Acute ethanol intoxication alters sympathetic activity resulting in tachycardia or bradycardia depending on the level of intoxication. Ethylbenzoylecgonine, a byproduct of the concomitant use of cocaine and ethanol, is another recognized cardiac toxin, which can induce ventricular arrhythmias. Even cannabinoids have been associated with electrical disturbances in the heart. Five of the six decedents in this study with an underlying cardiomyopathy were also under the influence of an arrhythmogenic substance. Each of the individuals had at least one cofactor present. It seems reasonable to conclude then that a blunt impact to the head or upper cervical spinal cord producing a concussion in the brainstem can easily trigger a fatal arrhythmia in an individual with an underlying predisposition to sudden cardiac death.

Fatal Concussion, Cardiomyopathy, Ethanol Intoxication

G55 "Doctors as Detectives" (1987 - 2001): Fifteen Years of Introducing Forensic Medical Science to High School Students in Northwest Ohio and Southeast Michigan

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The goals of this research project are to describe a low cost and minimal effort approach for sharing forensic medical science with local high school students and their teachers.

In the May/June 2001 issue of *Academy News*, President Mary Fran Ernst indicates that "middle and high school teachers are now clamoring for information and pleading for resources and assistance to help them incorporate forensic sciences into their science and math curriculums." She also states "the Academy is now providing you an opportunity to help our children and the forensic sciences" and asks "Are you going to step up to the plate?" (President's Message). In actual fact, Toledo Ohio, members of the AAFS associated with the Lucas County Coroner's Office and the Medical College of Ohio "stepped up to the plate" in October 1987 and have since shared forensic science with at least 4,400 students and their teachers from at least 40 high schools in Northwest Ohio and Southeast Michigan.

In 1989, we presented a poster on this subject at the AAFS Annual Meeting. At that time we wrote in our abstract:

"A desire to replicate the AAFS' Student Academy locally led forensic scientists from the Medical College of Ohio and the Lucas County Coroner's Office to organize a day long series of lectures, posters and demonstrations for area high school students. Although lead time was short, the response to our announcement was overwhelming and we were forced to limit participation to about 200 students and teachers from 33 schools (requests indicated that at least twice as many wished to attend). Presentations by forensic pathologists (Patrick, Desley and Scala-Barnett) introduced the general field, followed by specialists from anthropology (Saul and Saul), odontology (Burns and Strickland) and toxicology (Forney and Darling). Questionnaires filled out by participants (analyzed by DeBruin) indicated that these potentially disconcerting presentations were well received and it was unanimously requested that the event be repeated annually."

We have now (as of 3 October, 2001) successfully conducted fifteen of these annual programs for about 300 students and teachers per year since we began the series on 20 October, 1987. The format remains essentially the same with morning presentations on the basic forensic medical sciences by members of the Lucas County Coroner's Office (forensic pathology, anthropology, odontology and toxicology). Separating each topic are 15 minute breaks during which time students can view exhibits and demonstrations and speak one-on-one with forensic scientists. A one-hour break for lunch (supplied on campus) is followed by a one-hour afternoon session on some special aspect of forensic science, usually given by guest faculty. These afternoon sessions vary from year to year.

The afternoon programs provided an opportunity to focus on DNA as early as 1990 ("Molecular Biology in the Courtroom") and have also included airplane crashes and other mass fatality incidents, forensic entomology, crime scene analysis, facial reconstruction, blood spatter analysis, burial customs (and grave robbing), the role of dogs in death investigation, etc. Guest speakers have come from a variety of agencies including the Armed Forces Institute of Pathology, the FBI Evidence Response Teams and other law enforcement agencies.

Teachers have often indicated that these programs provide an applied and meaningful context for some of their basic science teaching. Several schools have developed courses that relate to our program. In addition, a number of students have obtained access to internships at the Coroner's Office through this program.

Program expenses are minimal and include administrative costs (donated), lunch and room rental. The buffet lunch at the Hilton Hotel on the Medical College campus has risen from \$5 in 1987 to about \$13 and auditorium rental at the Dana Center, also on campus, has risen from \$125 in 1987 to about \$600. Occasional donations from the Ohio Embalmers Association (for providing them with a similar program) and a few other outside donations have helped us hold down the registration fee which has risen from \$5 in 1987 to \$15. Some schools pay the fee but most registrants pay their own way. Financial aid has always been offered but never accepted.

Forensic Medical Sciences, High School, Teachers and Students

G56 Exsanguination From a Dialysis Catheter: Trace Evidence Examination in Determining Manner of Death

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The goal of this research project is to recognize an unusual cause of death in patients undergoing chronic renal dialysis, and the usefulness of trace evidence examination in resolving the issue of manner.

A blind, 70-year old man receiving thrice-weekly renal dialysis for chronic renal failure was found dead in his wheelchair in blood-covered clothing. He had exsanguinated and sustained venous air embolism from an exposed, indwelling central venous dialysis catheter coiled on his upper chest, inspection of which showed a number of transverse slits, most of them superficial, but at least one of which penetrated to the catheter lumen. Deliberate cutting of an indwelling venous catheter is occasionally encountered as a means of suicide, and the multiplicity of the defects, somewhat resembling hesitation marks, suggested that possibility. The alternate possibility of structural failure of the plastic catheter was also entertained.

The catheter was submitted to the trace evidence section of the Hamilton County Crime Laboratory for examination, specifically to determine if the defects in the tubing were cuts or breaks and, if cuts, what implement might have been used to cause them.

Microscopic examination of the catheter revealed a series of 18 slits within the space of approximately one inch. Two of the slits reached the lumen. They were sequentially shallower with increasing distance from the deepest slit. Though uniformly transverse, the slits were not perfectly parallel. Many, indeed, were not straight and could not have been made by a sharp-edged tool.

In cross sectional view, the inside edges of the slits appeared fractured and displayed no markings or striations indicative of being made by a tool. A known cut was made with a scalpel blade in the tubing away from the area of interest. Comparison photographs were made of the questioned splits and the known cut, revealing obvious differences between the known and questioned defects. Additionally, near the questioned defects, a series of fine cracks in the plastic was observed, analogous to fractured glass.

Several tools collected at the scene of death and submitted to the laboratory were also examined and eliminated; however, on the basis of examination of the tubing, it was concluded that the decedent's exsanguinating hemorrhage was due to structural failure of the plastic tubing rather than to its deliberate incision.

Exsanguination, Dialysis Catherer, Trace Evidence Examination

G57 Sudden Death Due to Idiopathic Giant Cell Myocarditis: Case Report and Literature Review

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The goal of this research project is to increase forensic awareness of idiopathic giant cell myocarditis as a cause of sudden cardiac death and discuss the pathogenesis, histologic findings and differential diagnosis.

We present a case of a 15-year-old female with a one-week history of chest pain who had been diagnosed with costochondritis and treated with prednisone and hydrocodone + acetaminophen. She was found unresponsive in the bathroom. An EKG in the Emergency Department showed an elevated ST segment with a slightly widened QTc interval of 449 ms. Because of her continued instability she was transferred to a tertiary medical center. During transport, she had narrow complex tachycardia and was given two doses of adenosine without result. She had persistent pulselessness and CPR was discontinued and she was pronounced dead 3½ hours after being found unresponsive.

Major findings at autopsy included diffuse tan-gray areas of poorly delineated necrosis and infiltrates with focal areas of serpiginous hemorrhage mainly involving the left cardiac ventricle. These extended from the apex to the base, mainly involving the inferior left ventricle but also involving the posterior septum and free wall. About 40% of the ventricular myocardium appeared replaced by the tan-gray hyperemic infiltrate. The right ventricle was less involved. Microscopically, the myocardium exhibited extensive myocytic necrosis with a polymorphous, non-granulomatous mixed inflammatory infiltrate containing multinucleated giant cells. Special stains for acid-fast bacilli and fungi were negative. Other findings included epicardial fibrinous adhesions, a pericardial effusion, bilateral pleural effusions, pulmonary edema, cardiomegaly (420 gm) and Hashimoto thyroiditis.

Idiopathic giant cell myocarditis is a rare form of myocarditis of unknown cause characterized by the presence of multinucleated giant cells. It often causes rapid congestive heart failure and dysrhythmias in young- to middle-aged adults. At autopsy, the distinctive features often include cardiac enlargement, ventricular thrombi, grossly visible serpiginous areas of ventricular myocardial necrosis and microscopic evidence of multinucleated giant cells within an extensive inflammatory infiltrate. The cause of myocardial giant cell myocarditis remains obscure although it has occurred in association with autoimmune disorders.

The differential diagnosis of idiopathic giant cell myocarditis includes cardiac involvement by sarcoidosis, tuberculosis, syphilis, rheumatic fever, fungal infections, rheumatoid arteritis, inflammatory pseudotumor, metastatic osteosarcoma and lymphoma.

Idiopathic Giant Cell Myocarditis, Sudden Death, Cardiac Death

G58 Immunopathological Study of Methamphetamine (MAP)-Induced Fatalities

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The goal of this research project is to understand the mechanism of MAP-induced neuro-toxicities and the correlation of the MAP-induced behavioral sensitization and its dopaminergic system of MAP abusers.

The abuse of illicit drug is a worldwide phenomenon that causes serious social problems. Hence, such abuse prompts much attention regarding the issue of illicit drug abuse and additionally related public hazard and criminal activities. It is essential to understand the pathogenesis of MAP-induced lesion in order to propose a prospective anti-drug program and to inform the public on the government's strategy. Long-term MAP abusers may become addicts and may generate psychotic, self-destructive behavior and emotional disturbances. A close relationship exists between MAP-induced fatalities and high homicide rate (25-30% in the manner of death) in comparison to opiate-related fatalities and low homicide rate (0-5%). MAP induces long-lasting deficits in the innervations involving the striatum from DA (dopamine) neurons of *substantia nigra*. This study is primarily based on MAP-induced fatalities collected from the IFM. We used Hematoxylin & Eosin stain (HE) and immunohistochemical treatments, including tyrosine hydroxylase (TH), vesicular monoamine transporter (VMAT), neuronal membrane DA transporter (DAT) and glial fibrillary acidic protein (GFAP), to understand the morphological characteristics. We evaluated alterations of catecholamine metabolites within *substantia nigra pars compacta* and *reticula* of the ventral midbrain of MAP-induced fatalities with the history of long-term MAP abuse. Furthermore, this study aims to identify the relationship of the nigrostriatal dopamine system with its deficits and the alterations of dopamine neuron in the *substantia nigra*. In this study, the assessed cases of MAP abuse were divided into control group and MAP group (four male and four female fatalities in each group). The sections of *substantia nigra* in midbrain were isolated, stained with HE stain, and then with Immunohistochemical stains (TH, VMAT, DAT and GFAP). It has been demonstrated that the morphology of dopamine neurons of MAP-related fatalities under HE stain exhibit a metaphase-like nucleus and nucleoli in the *substantia nigra* correlative with a metamorphosis of cytoplasma characterized by a granular aggregation that segregated into lucid and granular zones. It develops into four "circularities" in the marginal region of DA neuron under HE stain in MAP-induced fatalities. Decreasing numbers of the enzyme-positive neurons after immunological treatment of TH, VMAT, DAT were noted. However, increasing numbers of spines with enlarged round-shape vesicles of terminal synapses become aggregated after the treatment of GFAP, showing neo-growth of glial cells with innervations. This implied that MAP-related DA neuronal lesions were associated with regeneration of glial processes. Under the observation of Laser Scanning by using a confocal microscope after the fluorescent treatments of TH, VMAT and DAT, the fluorescent activity of the MAP group appeared attenuated compared with control. These data demonstrate that long-term dopaminergic deficits with retardation of dopaminergic-metabolite enzyme could reduce the neuronal fluorescent activity. Chronic abuse of MAP may cause morphologic alterations in *substantia nigra* and a decrease in the number of enzyme-positive neurons after immunological treatments of TH, VMAT, and DAT. On the other hand, increasing numbers of GFAP-positive glial cells aggregate after treatment with GFAP implying the healing process with gliosis. These studies demonstrate that long-term dopaminergic deficits may decrease neuronal activity by destruction of the DA neuronal terminal and cause degeneration as well as neo-growth of glial cells as part of the healing process. This study demonstrates well the relationship of dopaminergic deficits and the behavioral model of MAP abusers. In conclusion, these results will assist in the recognition of the mechanism of MAP-induced neurotoxicities, in explanations of MAP-induced behavioral sensitization, and will also provide strategic schema for the government's anti-drug program.

Forensic Science, Dopamine, Methamphetamine

G59 Experiences of Human Bodies Identified by DNA Typing in Singapore Airlines SQ006 Crash in Taipei

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The goal of this research project is to establish the standard operation procedure to manage the mass disaster during the experience of Singapore Airline SQ-006 Air crashed Accident by using CODIS 13 STRs profilers to identify badly wounded bodies.

On October 31, 2000, approximately 2317 Taiwan time (1517 UTC), a Singapore Airlines Flight SQ-006, with Singapore registration 9V-SPK, Boeing 747-400 airplane entered the incorrect runway at Chiang-Kai-Shek (CKS) Airport, Taiwan. Heavy rain and strong wind from typhoon "Xiang Sane" prevailed at the time of the accident. The airplane was destroyed by its collision with the runway construction equipment and by post impact fire. There were a total of 179 people on board with 159 passengers, 3 flight crewmembers and 17 cabin attendants. Official report, 83 people died (including 4 cabin crews), and 44 people injured. After the airplane SQ-006 of Singapore Airline got an accident at CKS international airport before taking off, 79 persons from 19 different countries died instantly. Although some of the bodies were identifiable, the prosecutor's office of Tau-Yuan district court (40 km away located southern Taipei metropolitan) decide to request the DNA typing method to confirm each body identity in addition to odontological and anthropologic identification.

Immediately after this accident, the Criminal Investigation Bureau, Ministry of Interior and medical examiners' of IFM were asked to type the sample from deceased's bodies and STR typing were applied, and MJIB and IFM were assigned to collect the family members' STR for further paternity matching. For the purpose to increase the efficiency of DNA typing, the forensic scientists of molecular biologist were organized into blood collector group, DNA extraction group, STR typing group and STR matching work stations as a DNA typing and identifying mass production chain. The CODIS 13 STRs were applied to fulfill the DNA data interchanging.

The first group of families arrived on the next day 8:30am about 9 hours after the crash accident and their blood samples were drawn for DNA typing to establish genetic relationship to the deceased, with the access of the 24 hour running-basis working team, 20 hours after the crash, the first group of 12 bodies were identified. After five days' mass production operation in the DNA laboratory, 80 bodies matching their relatives from 19 different countries were identified including one once rescued decedent died about 24 hours after incidence. Another two decedents died in the hospital without identification problem. Due to lack of lineal or collateral consanguinity information of one decedent to claim the body until the odontological and anthropological characteristics were confirmed. One of the 80 decedents was identified by STR direct matching (STR typing sent from Singapore) with previous blood sample left in the blood bank of Singapore. An unique case of a decedent was identified after the CODIS 13 data of decedent's family member who were unable to be Taiwan in time. 15 of the decedents were identified by sibship profiles due to collateral consanguinity. 65 of the decedents were recognized by paternity test with linear consanguinity. Forensic DNA matching is an accurate and efficient tool for badly crashed bodies identifying in addition to the odontological and anthropological method. To establish the professional guideline as the standard operation procedure of DNA typing and body identification is a crucial role to cope the mass disaster effectively during the urgent operation period. The Singapore

Airlines SQ-006 Air crashed accident by using STR CODIS 13 profilers to identify badly wounded bodies during five days' experience is worth for strategic schema.

Forensic Science, CODIS 13, Air Crash

G60 A Case Report of Sudden Death in a Patient With Kartagener Syndrome

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The goals of this research project are to (1) Review the pathophysiology of Kartagener Syndrome with emphasis on the cardiac manifestations, and (2) to demonstrate how cor pulmonale can complicate Kartagener Syndrom as a result of chronic lung disease (bronchiectasis) and obesity resulting from the side effects of the medication used to treat lung disease.

A 23-year-old obese white female was diagnosed to have immotile cilia syndrome and hypertension since eight years of age. She had been trying to lose weight and was a cigarette smoker. The night before her death she and her friends were dancing at a dance hall during which she drank six wine coolers. She went to bed without any complaints and awoke the next day to help a friend clean house. She sat down on a couch laughing and drank a soft drink (Mountain Dew). Suddenly, without complaint she fell forward and stopped breathing.

Upon their arrival, EMS found the decedent supine on the floor, apneic, cyanotic, and pulseless. Quick look monitors revealed pulseless ventricular tachycardia. Despite ACLS protocol, the cardiac rhythm deteriorated to an agonal rhythm. She was pronounced dead upon arrival to the hospital. Follow-up coroner interview with the decedent's mother revealed that the decedent and a sister had immotile cilia syndrome. Throughout childhood she underwent surgical procedures for duodenal obstruction and complications from situs inversus. Her sister, still living with immotile cilia syndrome, had a "hole in the heart" that healed without surgery. She and her sister were prescribed steroids to control both nasal congestion and chronic bronchiectasis of immotile syndrome. The decedent and her sister battled obesity throughout their lives and had tried many diets. The decedent was not on any diet medications at the time of death. The only other sudden death in the family was that of a grandmother at the age of 36.

On external examination, she was an atraumatic, extremely obese female with a body mass index of 44 kg/m². Internal examination revealed situs inversus with polysplenia and bilateral "left sidedness" (bilobed right lung). Bronchiectasis was prominent in both lungs with increased fibrovascular tissue around the affected airways on microscopic examination. The heart weighed 580 grams and exhibited biventricular hypertrophy. Other findings in the heart included a ventricular septal aneurysm with an associated tethered septal leaflet of the tricuspid valve. There was evidence of aortic insufficiency. No isomerism was seen between the atrial appendages. Other findings included a foreshortened thoracic cavity and early nephrosclerosis of the kidneys.

In view of the sudden collapse and anatomic findings on autopsy, the cause of death was ascribed to cardiac dysrhythmia due to biventricular hypertrophy resulting from Kartagener Syndrome. Cor pulmonale was characterized by right ventricular hypertrophy. Other conditions contributing to the development of pulmonary hypertension included obesity with a foreshortened thoracic cavity, sleep apnea, and chronic pulmonary disease. Kartagener Syndrome or Immotile Cilia Syndrome consists of the triad of sinusitis, bronchiectasis and situs inversus. Ciliary motility of cells of the body is abnormal due to defects of structures in the microtubular doublets within the cilia. The most common defect is absence or abnormal dynein arms. Impaired ciliary motility predisposes the body to infection resulting from poor bacterial clearance from the

sinuses and bronchi. Males affected with the condition are infertile due to the immobility of the sperm tails. Cell motility during embryogenesis is affected and results in situs inversus in about half of the patients. The mode of inheritance is autosomal recessive and the phenotype is variable. This is a case of sudden death in a patient with Kartagener Syndrome manifesting cor pulmonale as a complication.

Kartagener's Syndrome, Cor Pulmonale, Situs Inversus

G61 Micro-Computed Tomography: An Advantageous Tool for the Analysis of Patterned Tool Marks in Bones

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Micro-Computed Tomography (Micro-CT) may offer a worthwhile opportunity to analyze patterned injuries in bone. In the field of forensic science, it has not been possible until now to non-destructively document such damages to bone. However, based upon high resolution imaging of these patterned injuries, it is now possible to draw conclusions on the injury-causing instrument. In fact, those conclusions may lead to the identification of the perpetrator.

Materials and methods:

Based on a real murder case, porcine pelvic bones were experimentally stabbed with multiple knives. Afterwards these bone samples were examined with a micro-CT system developed at the IMP Erlangen. This cone beam scanner can achieve an isotropic resolution from 10 to 100 μm for sample diameters from 1 to 40 mm. We used a scan protocol of 720 projections for a 360° rotation with a 512 detector matrix. The 512³ data volume is reconstructed using a modified Feldkamp algorithm. Resolution in the specific bone samples is 30 to 75 μm depending on the sample size. Until the present, analysis has been performed by visual inspection of double oblique slices of the reconstructed volume to optimally display the plane cut by the knife using Impact View (VAMP GmbH, Erlangen, Germany). Additionally, stabbing wounds were quantitatively evaluated by measuring distances and angles. We also tried out different stabbing techniques in and out with and without additional rotation of the knife.

Results:

The micro-CT datasets of the injured bone samples were used to obtain those 2D slices that optimally showed the stabbing wounds inside. Based on the measured distances and angles, it was easily possible to uniquely identify the size and shape of the injury-causing knife in straight stabs. Additional rotating and twisting cause broader wounds, thus an expert visually selects the injuring instrument from a choice of known knives by fitting the shape to the stab in the micro-CT image. In this way, not only the knife can be identified, but also information about the action of injury is received.

Conclusions:

In the field of forensic pathology, Micro-CT provides a new and advantageous tool for the non-destructive examination and analysis of patterned tool marks in bones. By using the micro-CT technology, new horizons are open for matching a possible injury-causing instrument against the patterned lesion in the bone.

Forensic Radiology, Micro Computed Tomography, Patterned Injuries

G62 Immunohistochemical Study for Determining the Time of Injury to Rats Following Stab Wounds and Blunt Trauma to the Brain

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The aim of this research project is to investigate the possibility of utilizing changes in the proliferating astrocytes expressing glial fibrillary acidic protein (GFAP) and proliferating cell nuclear antigen (PCNA) in determining the time of brain stem injury following stab wounds and mechanically induced injury.

Astrogliosis is a predictable response of astrocytes to various types of injury caused by physical, chemical, mechanical, and pathological trauma. It is characterized by hyperplasia, hypertrophy, and an increase in glial fibrillary acidic protein (GFAP), which is an intermediate filament protein. GFAP is the principal marker for brain astrocytes; whereas, proliferating cell nuclear antigen (PCNA) is an intrinsic marker of DNA replication. In forensic pathology, there are few reports concerning the differentiation of early antemortem brainstem injuries from postmortem injuries following stab wounds and blunt trauma. In the present study, investigation was carried out to determine the possibility of utilizing changes in the astrocytes expressing glial fibrillary acidic protein (GFAP) and proliferating cell nuclear antigen (PCNA) following stab wounds and mechanically induced injury in determining the time of brainstem injury. Forty-eight rats (150-200 g) were divided into two groups (24 rats in each group) and received stab wounds and blunt trauma respectively. After the rats were anaesthetized, sagittal median incisions of the scalp were made right above the foramen magnum. For antemortem injury, a 3-mm deep stab wound was made with a sterilized stainless steel needle through the upper median point of the foramen magnum. For brain stem contusions, a 10g impact rod was allowed to drop from a height of 5 cm at the same site. The rats were killed 1, 5, 24, and 48 hours after trauma. For post-mortem injuries, the brainstem was either stabbed or mechanically traumatized 15 minutes after the rats were killed, and the brain was removed one hour after injury. For the normal control, no wounds were made and the brain was removed 15 minutes after death. The brain was then placed in 10% formalin solution, embedded in paraffin, and serial 5 μm sections were prepared. In each of the studied group, one section was stained with hematoxylin-eosin according to routine procedures and two sections were stained by immunohistochemical method for GFAP and PCNA. In the antemortem group, GFAP-positive astrocytes showed a gradual increase in number after injury and their immunoreactivity became intense especially at the vicinity of the wound. On the other hand, there was no significant difference between the postmortem injury group and the normal control group. Proliferating cells were identified by immunostaining for PCNA, which showed a high labeling index around the wound at 48 hours. The results indicate that early brainstem injury could be diagnosed by GFAP immunohistochemistry. Also, the chronological changes in the number of GFAP-positive cells could be utilized in determining the time of brainstem injury. PCNA could be used as a marker for survival after fatal head injuries.

Brain-Stem, Glial Fibrillary Acidic Protein, Proliferating Cell Nuclear Antigen

G63 Postmortem Interval Decomposition Chemistry of Human Remains: A New Methodology for Determining the Postmortem Interval

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The goal of this research project is to present to the forensic community a novel and accurate methodology for determining the postmortem interval.

This study was conducted to characterize the chemistry associated with the decomposition of human remains with the objective of identifying time-dependent biomarkers of decomposition. The purpose of this work was to develop an accurate and precise method for measuring the postmortem interval (PMI) of human remains. Eighteen subjects were placed within a decay research facility throughout the year and allowed to decompose naturally. Field autopsies were performed and tissue samples were regularly collected until the tissues decomposed to the point where they were no longer recognizable (encompassing a cumulative degree hour (CDH) range of approximately 1,000 (3 weeks). Analysis of the biomarkers (amino acids, neurotransmitters and decompositional by-products) in various organs (liver, kidney, heart, brain, muscle) revealed distinct patterns useful for determining the PMI when based on CDHs. The initial results of this study demonstrated that one particular compound, oxalic acid, is an important determinant which affects PMI decisions. This compound was not initially targeted as important in PMI determinations, but was discovered incidentally. Oxalic acid derivatizes easily and is readily detectable in even the earliest tissue samples with a characteristic molecular ion of $m/z=261$. This compound, given time, then goes through a reduction reaction, apparently converting a $C=O$ group to a methylene group producing an oxalic acid derivative with a molecular ion at $m/z=247$ and is subsequently identified as hydroxyacetic acid (glycolic acid). This reduction reaction occurs at different times (CDHs) depending on the tissue type and is an informative PMI indicator by itself.

Other important compounds, which have been found to be reproducible between corpses, include a variety of amino acids and gamma amino butyric acid (GABA). In order for a compound to be relevant for PMI determinations in this study, its ratio compared to other biomarkers must be reproducible over time. Initial tissue surveys indicated that the common, odoriferous amine indicators of decomposition, cadaverine and putrescine, would be useful biomarkers. Unfortunately, this was not the case in this study. While the concentrations of these compounds were quite abundant ($>3,000$ ng/mg tissue) in some instances, the values (between corpses) were quite inconsistent as were the precursors of these compounds (lysine and ornithine). GHB was also a disappointment as a useful biomarker.

Since every death involves its own unique set of circumstances, the model was designed to take into account the many ways in which individuals perish. To accomplish this, the model was developed to encompass more than one indicator organ. For instance, if the individual's heart was damaged by trauma, there are four other organs from which to obtain useful data. The more organs used, the narrower the PMI becomes. Crossmatching PMIs from several organs can result in intervals as narrow as five CDHs, a time frame below the ability of the investigator to obtain reliable temperature data. This model also has the distinct advantage that additional information about the victim, such as weight, is not required since the model was developed based on ratios between the biomarkers and not absolute values. One of the interesting results to emerge from this study was the observation that every organ studied produced such a varied assortment of complex biomarker information. Intuitively all the organs should possess a relatively similar

composition. While the water content and assortment of cellular enzymes varies from organ to organ, the basic building blocks should be quite similar. During putrefaction, the abdominal organs (kidney, liver) are exposed to different bacterial populations than the thoracic organs (heart, lungs) and while this may produce varying results initially, it appears as if the tissue still exerts its "personality" long after decomposition has progressed to the point where the organs are no longer recognizable.

It has been demonstrated that proper use of these methods allows for PMIs so accurate that the estimate is limited by the ability to obtain correct temperature data at a crime scene rather than sample variability.

Postmortem Interval, Time-Since-Death Determination, Tissue Composition

G64 Effect of Ant Activity on Decompositional Rates and Estimation of Postmortem Interval: A Case Study

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The goal of this research project is to demonstrate the problems encountered when estimating the postmortem interval in cases involving blowfly and ant invasion of human remains. This presentation will provide insight into foraging behavior of ants on blowfly larvae which can significantly retard the decompositional process and lead to false assumptions of a short postmortem interval.

The use of forensically significant insects to estimate the postmortem interval is well established. Analysis of insects for the estimation of the postmortem interval is primarily based on the development of the fly. The fly families commonly utilized in these analyses are the Calliphoridae (Bottle Flies), Sarcophagidae (Flesh Flies), and Muscidae (House Flies). Postmortem estimates provided by these insects are most accurate within the first thirty days, and involve the determination of the larval developmental age under reported environmental conditions. Adult flies are attracted to a body within minutes to hours after death. Each female is capable of ovipositing hundreds of eggs on the deceased which hatch within approximately twelve to twenty-four hours. The newly emerged larvae migrate about the body feeding with a ravenous appetite.

Not only are flies attracted to a decomposing body, but a large array of insects, including beetles, wasp, and ants are, too. The successional pattern of these carrion frequenting insects is quite unique as some come to feed on the decomposing tissues, while others prey upon other insect species attracted to the body. Ants, for example, are commonly associated with a decomposing body, and are typically observed shortly after death or during the early postmortem phase. Many small punctate or scratch type lesions may be observed on a body which are the result of postmortem ant attack. Soft tissue injury resulting from postmortem ant attack is many times misinterpreted by inexperienced examiners as the result of antemortem trauma.

Ants are not only attracted to a decomposing body corpse as a food source, but also as an opportunistic event by which the adult ants feed on fly eggs and larvae. Entomological studies have demonstrated that scavenging ant colonies are capable of removing fly eggs and larvae which have been deposited on a corpse in such numbers as to actually slow the rate of decomposition. Early removal of fly eggs and larvae many times leads to the misconception of a short postmortem interval. In cases involving postmortem interval estimates based on entomological evidence, the presence or absence of ants should be taken into account.

One such case in which postmortem ant activity was initially overlooked involved the shooting death of a young male in Washington State. In early May 2000, the body of a twenty-two year old Caucasoid male

was discovered in a partially wooded area of the US Army post, Ft. Lewis, Washington. During the examination of the death scene, investigators noted the presence of a large number of red and black ants crawling over the corpse. The only other carrion frequenting insects noted in context with the remains were a few fly eggs which were located in the hair of the scalp.

Examination of the body found the decompositional state to be moderate, with exposed epidermal tissues exhibiting a leathery consistency with an orange-brown discoloration. A white-colored mold was also noted growing on exposed body surfaces. Rigor was pronounced, but easily broken with pressure, and livor was fixed. The internal organs were in a relatively good state of preservation. Cause of death was attributed to multiple gunshot wounds to the head, one to the right parietal area which exited the left parietal area, and a second which was located along the occiput, which exited at the nose.

Based on the minimal state of decomposition and the absence of blowfly larvae and unhatched fly eggs, the postmortem interval was thought to be relatively short, approximately twenty-four to forty-two hours. A secondary review of the decompositional findings and reported environmental conditions suggested a longer postmortem interval, approximately four to six days. The wooded terrain and loose soil conditions along with the considerably cool temperatures and precipitation were found to be conducive to retarding the decompositional changes. Cool temperatures and intermediate precipitation also acted to slow degradation of the body by limiting carrion insect activity, specifically that by blowflies. The limited number of blowfly eggs and absence of larvae were attributed not only to the inclement weather conditions, but in large part to the foraging activity of ants inhabiting the corpse in large numbers. As a result of the ant activity and environmental conditions, the degradation of the corpse was significantly retarded.

Investigation into the death revealed that the deceased had been murdered by another soldier approximately five and a half days prior to the discovery of the corpse. A suspect later confessed to authorities that the shooting was accidental; however, evidence revealed the shooting to be intentional and robbery to be the motive. The accused was found guilty and sentenced to life in prison. When faced with estimating the postmortem interval, investigators should take into account not only environmental conditions which are conducive for delaying decomposition, but the presence of foraging ants which can delay the degradation of the corpse by eradication of blowfly larvae.

Decomposition, Entomology, Postmortem Interval

G65 Forensic Entomology: Decomposition in Cars

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The goals of this research project are to determine the entomological succession on a decomposing pig inside a vehicle following its sacrifice by CO poisoning (suicide pig), to calculate the time of decomposition of a suicide pig and determine temperature fluctuations inside vehicles.

Decomposing animal tissues provide an opportunity for flies to utilize the fauna and flora of microorganisms. Cadavers undergo a series of predictable changes during decomposition, and are “visited” by a succession of flies and other insects. This ordered process has handed us an invaluable tool for estimating the age of cadavers (post mortem interval), and the biology of this process has resulted in the science of Forensic Entomology. One current program at UWA is determining the post mortem intervals of pigs decomposing in vehicles (simulated suicides).

The significance of this research is: the requirement by police, coronial and justice systems for accurate information on cadavers, particularly in regard to homicide and suicide, and the accuracy of the

Post Mortem Interval (PMI) which depends on the available knowledge base, and which in most cases is dependent on a number of facts and assumptions concerning insect biology, behavior and ecology. It is the assumptions that require investigation especially in cases of suicide and suicide/homicide. The police service and the justice systems are constantly expressing concern about the accuracy of the PMI.

Most suicides conducted in vehicles happen in isolated areas where the vehicle is parked in wooded areas for the purposes of concealment. Generally, this is a shaded area or an area with minimal exposure to the sun. The methodology includes sacrificing 45kg pigs using CO gas. Following death, the pigs are quickly dressed and placed inside a vehicle. CO gas is pumped into the vehicle for another 5 hours. Decomposition is recorded using infrared video cameras as well as daily observations of insect activity. Decomposition rates are compared with two other pigs (one pig sacrificed by CO poisoning and the other by head bolt) decomposing under normal conditions. Each pig has a datalogger placed inside its throat, abdomen and colon. The temperature inside the car is also measured and compared with the recorded ambient temperature.

One particular aspect of this work is the modeling of temperatures inside vehicles. To determine how a body decomposes inside a vehicle, it is important to understand the temperature changes inside a vehicle. The temperatures inside the trunks and passenger compartments of 30 vehicles (sedans) have now been measured under a variety of conditions. These include full sun and shade and partial shade. Vehicles are placed in a north/south and east/west position and the temperature in each vehicle is monitored every 30 minutes over a three week period. This work has now been extended into community service especially in cases where young children or animals are confined to cars on hot days. This study demonstrates how vehicle temperatures increase in a parked situation in direct sunlight with windows completely closed and with windows slightly open.

Forensic Entomology, Postmortem Decomposition Inside Vehicles, Entomological Succession

G66 Deceased, Dismembered, and Disarranged: Central Nervous System Consequences of an Unusual Body Disposal Strategy

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The goal of this research project is to present an unusual thermal artifact of intracranial contents in a dismemberment case, and suggest mechanisms by which it develops.

Postmortem criminal dismemberment of the human body may be performed in the context of one or more of several possible motives, including but not necessarily limited to, ease of disposal of a body to prevent discovery of the death; to confound body identification; aggressive body mutilation in homicides reflecting intense emotion on the part of the assailant; as a symbol intended to intimidate or otherwise convey some message to others; during the course of ritualistic behaviors associated with either a natural death or with a homicide; or in the context of behavior related to necrophilia or other forms of psychopathology. Based on information available at the time of this report, the victim presented herein was dismembered for the purpose of covert disposal.

The dismembered body of a 73-year-old male was found in refrigerator and freezer compartments of his private residence. He was last seen alive three weeks prior to discovery of the remains. Recovered body parts included torso, head, neck, hands, feet and several smaller tissue fragments but did not include the remainder of the extremities.

Body parts were found in a variety of containers and wrappings, and the methodology suggested an above-average level of dissection skill and anatomic knowledge. For example, the neck was disarticulated between C7 and T1, and the torso between L2 and L3 with minimal damage to adjacent bone.

Tool mark analysis was consistent with use of at least two instrument classes: a saw and a sharp instrument such as a knife. The partially dissected head and neck was found in the refrigerator, incompletely submerged in brownish liquid in a large metal pot with lid. The color, texture and histologic appearance of the head and neck tissues were consistent with having been subjected to prolonged boiling. No other body parts demonstrated evidence of thermal injury; most were frozen.

The general autopsy findings included generalized atherosclerosis, (with an estimated 75% obstruction of the right coronary artery and 50% obstruction of the left anterior descending coronary artery), myocardial interstitial fibrosis, pulmonary emphysema, and post mortem autolysis/putrefaction. The scalp had been removed. Gross, microscopic, and radiologic examination of body parts revealed no definite evidence of antemortem trauma. Since the evidence that dismemberment was postmortem and a negative toxicology examination did not exclude foul play leading to death (particularly given other information discovered during the investigation) the cause and manner of death was listed as undetermined.

The primary focus of this presentation is on the appearance of the intracranial contents. There was no skull fracture. Removal of the cranial vault revealed numerous curd-like tissue fragments varying in color from gray to tan to dark brown, filling a very enlarged epidural space. Removal of this material from the epidural space exposed a dark brown structure with the shape of a miniaturized brain, firmly adherent to the base of the skull. The dura demonstrated two localized defects bridged by meningeal and cerebral vessels. Subsequent study revealed the epidural space to be filled with brain tissue admixed with a small amount of blood. A widely distributed, very thin layer of subdural blood was also present. Internal brain architecture was largely obliterated, having been replaced by intradural fragmented brain tissue and blood similar to that present in the epidural space but much more tightly packed.

This very unusual type of disarrangement of intracerebral contents has rarely been reported in the forensic literature, and, to our knowledge, has been described only in burned bodies. This case shares some features resulting from prolonged exposure of tissues to high temperature with the reported burn cases, but is devoid of burn artifacts such as skin splitting, scalp charring or heat-induced skull fractures which are typically seen in the latter. The open cervical canal in our case excludes global increased intracranial pressure as a contributing factor. Our observations, combined with information derived from a confession by the suspect, are more consistent with this unusual artifact being the consequence of a combination of factors that must be (but apparently rarely are) simultaneously present. These factors may include: a sufficient amount of moist heat (e.g., by immersion or by continued presence of cerebrospinal fluid) delivered over a sufficiently long period; disproportionate shrinking of dura mater relative to brain parenchyma; increased friability of dura mater and brain tissue secondary to thermal effects; relatively weak adhesion (focally or diffusely) between dura mater and inner table of skull; development of a dural defect which allows escape of brain tissue into the newly created epidural space resulting from tissue shrinkage; and variable appearance of the resultant epidural brain tissue depending not only on the degree of brain tissue thermal damage but also the nature of the dural defect (e.g., size, and whether or not it is bridged by vessels and/or meningeal tissue creating a sieve-like orifice through which the brain tissue must pass before entering the epidural space). This hypothesis, if correct, may explain both the low incidence and atypical appearance of this type of heat-induced postmortem artifact.

Dismemberment, CNS, Thermal Artifact

G67 Detection of Chemical Signals by the Parasitic Wasp *Microplitis Croceipes*

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The goals of this research project are to teach participants on the ability of insects to learn various chemicals of legal importance will be presented. We determined that the parasitoid wasp, *Microplitis Croceipes*, is an excellent candidate for the development of a biosensor for the detection of ultra-low levels of forensically important compounds.

Proposition: The wasp, *Microplitis croceipes*, can detect and learn various compounds of forensic importance at thresholds lower than that detectable by modern automated equipment.

Over the course of the past two years protocols for training the parasitoid wasp *M. croceipes* to learn and detect trace amounts of non-native chemicals have been developed. Behaviors associated with the detection of these odors, such as head bobbing, antennating, and complete rotation of their bodies over the source of the odor, have been identified.

Appetite can be used to teach wasps to learn and identify specific odors. Female wasps starved for 48 hours were provided 33% sugar-water solution on an approximately 2 mm² piece of filter paper immediately surrounded by 7-9 holes (each approximately 1 mm diameter) placed in an aluminum foil cover of a 3 cm plastic tube connected to a volatile collection chamber (containing the compound), a flow meter (18 ml per min flow rate), and a motor generating positive air flow. The wasps were allowed to feed on the sugar water for 10 seconds during three sessions, during which time they were also exposed to the chemical odor. Following these training sessions, it was determined that the wasps associate these odors with food and will enter a series of predictable behaviors attempting to locate a food resource when exposed to these compounds.

In order to determine level of learning and sensitivity, individual wasps were placed near a hole (1 mm diameter) in the center of a Teflon cap on a small glass cylinder. The compound was delivered to individuals using the system previously described, but at a much lower rate of 6-8 ml per minute. Percent response was recorded for various concentrations of each chemical examined. For a check, the trained wasps were exposed to air passed through a volatile collection chamber not containing the chemical. A positive response was defined as the wasp entering the hole or bobbing its head into the hole.

Results recorded for wasps trained to chemicals commonly used to train canines to locate human remains (i.e., putrescine and cadaverine) were investigated. To date, results recorded indicate that *M. croceipes* can detect concentrations of certain chemicals < 4 ppb, which are much lower than thresholds determined for a mechanical nose.

Current research is focusing on the development of a mass-training system for these wasps, as well as a system for housing the trained wasps, processing samples, and that signals investigators of a positive detection of a particular compound of interest. Additionally, the ability of *M. croceipes* to detect compounds released by explosives (i.e., 2,4 DNT, a major by-product released from landmines and other explosives), as well as narcotic metabolites, is being investigated.

Information gathered from this research may be used to develop biosensors utilizing the parasitic wasp *M. croceipes* to detect ultra-low concentrations of volatiles released from narcotics and explosives in airports or other locations deemed important. Additionally, such biosensors may be useful in locating human remains that have been buried for an extended period of time.

Associative Learning, Parasitoid, Biosensor

G68 Suicidal Air Rifle Wound of the Head

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The purpose of this paper is to report an unusual means of suicide and to increase awareness of the lethality of air-powered weapons.

Firearm deaths are extremely common in a busy medical examiner office. In 1999, the Dallas County Medical Examiner's Office (DCME) investigated 533 firearm deaths including 233 (44%) homicides, 283 (53%) suicides, 6 (1%) accidents and 9 (2%) undetermined causes of death. The majority of the firearms were handguns (75%), followed by shotguns (15%) and rifles (10%). Firearm injuries accounted for 283 (67%) of the 431 suicides investigated by the DCME in 1999. Though technically not firearms since they are powered by compressed air rather than gases produced by burning propellants, air guns and air rifles are capable of producing serious and, rarely, lethal gunshot wounds. A review of the computerized database of all cases investigated by the DCME from 1992 to the present revealed no previous deaths due to air weapons. The following is a case of a suicidal air rifle wound of the head.

A 33-year-old white male was discovered deceased by his mother on the living room floor of his locked apartment. Beside the body was a .177 caliber air rifle with an empty chamber. A mostly full, 250 count box of .177 caliber pellets was found in the same room. The mother had last spoken to her son by telephone the previous evening. The son had a medical history of hypertension and depression including two prior suicide attempts by drug overdose. He had recently been convicted of driving while intoxicated. Propranolol and Prilosec medications with recent prescription dates were found in the apartment. No suicide note was found.

Autopsy revealed a tiny round entrance wound in the left temple measuring approximately 1/16 inch in diameter surrounded by a thin rim of marginal abrasion. No muzzle abrasion was identified. No exit wound was present. Radiographs of the head revealed a single radiodense object in the right superolateral cranial cavity. Internal examination revealed perforation of the left temporalis muscle, the left squamous temporal bone, the left inferolateral parietal lobe, the body of the corpus callosum and penetration of the right parietal lobe. A tiny flattened lead pellet was recovered from the cerebral cortex of the right superior parietal lobe of the brain. The remainder of the autopsy examination was negative. Toxicology testing revealed 0.17% ethanol in postmortem femoral blood and 0.23% ethanol in vitreous fluid. The drug screen was negative.

The weapon was identified as a Benjamin and Sheridan Model 397PA Bolt Action Pump Air Rifle, a multi-stroke swinging-arm type of pneumatic airgun, manufactured by Crosman in August 2000. The ammunition was identified as Copperhead Model P177 (7.9 grain) Pointed Pellets. The advertised muzzle velocity for this air rifle is up to 800 fps (244 mps) which is comparable to the muzzle velocity of a .38 special handgun. Muzzle velocities of 150 fps and 200 fps are reportedly required to perforate skin and bone, respectively.

Review of the English literature since 1966 reveals several reports of air rifle and air gun injuries and fatalities. In fact, air weapons reportedly cause 30,000 injuries per year in the United States and are the main cause of ocular trauma and subsequent enucleation in children and young adults in Canada. Moreover, dozens of fatalities have been reported to the United States Consumer Product Safety Commission. Most of the reported injuries and deaths involve children with accidental penetrating wounds of the chest and head. Intracranial injuries are relatively rare and typically enter via the orbit, neck, the thin frontal bone of children or the squamous temporal bone of children and adults. Only two homicides and four suicides by air weapons have been previously reported. Three of the suicides and both homicides were the result of

intracranial injuries. This case report of a suicidal air rifle wound of the head again illustrates the commonly unrecognized lethal potential of air weapons.

Air Rifle, Suicide, Atypical Gunshot Wound

G69 Pediatric Injuries: Can CPR Related Injuries Mimic Inflicted Injuries?

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The goals of this presentation are to help attendees understand what types of injuries CPR can cause and be able to differentiate them from inflicted injuries.

Medical experts are often asked whether CPR rendered either by the caretaker or medical personnel could have caused the injuries present in a case of child abuse. This prompted us to undertake a retrospective review of the autopsy findings of all pediatric deaths involving children 2 1/2 years of age and under done in our forensic unit over a 13-year period (1989 to June, 2001). Both clinical and autopsy reports were utilized in order to examine patient demographics, clinical findings, duration of CPR, person/persons administering CPR, cause and manner of death. 234 children were included in this study out of which 173 of them received CPR. The average duration of CPR was 40 minutes with the range being 6 minutes to 259 minutes. 15 out of 173 children sustained minor injuries attributed solely to CPR. Despite the lengthy resuscitative attempts by those with varying skills and levels of performance, there was not a single rib fracture.

No significant injuries were found in our series apart from minor chest contusions. There was one case of retinal hemorrhage and another case of small hemorrhage in the orbital fat without any other evidence of injury that were attributed to CPR.

Our study emphasized that child abuse should be considered in the presence of multiple and major injuries even after a history of prolonged CPR.

CPR, Inflicted Injuries, Pediatric

G70 When "Non-Terminal" Is Fatal—Medical Examiner Cases of Fibromyalgia Fatalities

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The goal of this research project is to present medical examiner cases in which the decedents were young, female and had non-terminal illness as a primary diagnosis. The speaker will discuss the incidence and aspects of forensic pathology, investigation, psychology to assist in the future handling of similar cases nationwide.

The authors reviewed medical examiner cases with a history of Fibromyalgia (FM) for the 42 month period January 1998 through July 1, 2001. 17 cases were identified as containing enough historical and death scene detail for study. The mean age was 48, and all were female, though one decedent was undergoing gender change to male. Forty-seven percent were determined to be accidental deaths, nearly exclusively secondary to overdose with prescription medications dispensed to treat the symptoms of FM. Thirty-five per cent were classified as suicide. We found these cases to be complex, and required the utmost diligence in investigation by the medical examiner staff, toxicologists, and forensic pathologists. The high incidence of accidental and suicidal deaths, particularly by overdose of prescription medications, indicates that further study and education designed for the forensic community about chronic pain patients is necessary in obtaining the most

accurate cause and manner of death in future cases. Treating physicians may also benefit from additional education on the risks of polypharmacy and benefits of multidisciplinary pain management in this patient population.

Accidental Death, Fibromyalgia, Death Investigation

G71 Rapid Death From Phlegmonous Gastritis Associated With Lymphoma

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The goal of this research project is to make attendees aware of this rare pyogenic infection of the stomach and predisposing factors causing rapid death.

Acute phlegmonous gastritis is a serious illness, which fortunately is rare, with an estimated world incidence of 2.5 cases per year. It is a pyogenic infection of the stomach beginning as localized cellulitis which may either become a circumscribed abscess or a diffuse phlegmon. In 70% of cases hemolytic streptococci have been isolated. Other organisms including Ecoli, staphylococcus, anthrax bacillus have been cultured in some cases. Alcoholism, chronic gastritis, debility, peptic ulcer, previous gastric surgery and hypoacidity of gastric secretions are considered as predisposing factors to the disease. Prompt diagnosis is essential in view of high mortality without therapy. The case is hereby reported to renew awareness of the condition as a cause of death and its possible occurrence in compromised hosts with malignancy or steroid therapy.

Case Report: A 61-year-old female reported to the emergency room of a local hospital one December evening with complaints of continuous vomiting since that morning accompanied by a fever of 105. Denied hematemesis or diarrhea. Had a history of rheumatoid arthritis and prednisone therapy. In the emergency room she had a temperature of 102.6, pulse 100 R 32 BP 120/70 mmHg. Abdomen examination was benign. Chest examination revealed tubular type breath sounds in the bases. Arthritic deformities were seen in hands. Otherwise, physical examination was unremarkable. Chest x-ray showed right base infiltrate. White blood count was 11,600 with 76% polymorphs and 20% bands. Initial impression was gastritis and basilar pneumonia and she was discharged on Tylenol, ampicillin and Compazine. No cultures were done. At home, she apparently spent a restless night and was found unresponsive the following morning. She could not be resuscitated and was pronounced dead by the paramedics.

Medical Examiner autopsy findings revealed (1) rheumatoid arthritic deformities, hands, (2) enlarged mesenteric lymph nodes with firm white cut surface confirmed microscopically to be lymphoma, (3) fatty changes in the liver, (4) diverticulosis, sigmoid colon, (5) cholelithiasis, (6) edematous stomach wall with gray-brown purulent material extruding from pyloric cut surface from between the muscularis and mucosa. Microscopically neutrophilic infiltration of muscle and mucosa was present with microabscess formation. Since the body was embalmed, no culture could be done but gram stain revealed gram positive cocci in chains consistent with streptococci.

Conclusion: One should have a high index of suspicion for this condition especially in a patient with high fever, epigastric pain, vomiting, normal amylase in the absence of radiologic findings of perforated viscus and presence of nondistendible stomach on Barium studies with low incidence of mucosal abnormality. Therapy would be vigorous broad spectrum antibiotic therapy to include a penicillin type drug and prompt laparotomy.

If only antrum is involved, resection can be done; otherwise, a total gastrectomy may be necessary. Mortality rate is high with medical therapy alone.

Phlegmon, Gastritis, Immunocompromised State

G72 Victim-Offender Relationship in Florida Medical Examiner District 8

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The goals of this research project are to establish the correlation between victim-offender relationship and motive, weapon choice, and number of injuries inflicted for 57 homicide cases from Florida Medical Examiner District 8, 1992-1996. Relationship categories are clearly differentiated and new motive categories are introduced. All variables are established independently.

The study of victim-offender relationship is a young field and has received limited assessment. Nevertheless, research in this area has been integral in broadening our understanding of the interplay between victim and perpetrator during the crime event. Previous research of homicide victim-offender relationship has focused mainly on demographic variables of the victim and the offender. In addition, studies of victim-offender relationship with regard to homicide motive have sought mostly to differentiate homicides occurring in conjunction with other felonies, usually between strangers, from all other homicides. Thus, default associations have been created between relationship and motive. Motives have traditionally been denoted as either expressive in nature (as an expression of emotion) or instrumental in nature (occurring for gain, usually financial gain). However, such severely delineated motive categories fail to acknowledge impetuses for homicide that contain both emotional and instrumental aspects such as revenge. This paper seeks to expand upon and clarify previous research in the area of homicide victim-offender relationship by clearly differentiating relationship categories, introducing new motive categories that alleviate deficiencies introduced by motives that are both expressive and instrumental, and defining relationship and motive independently from each other. In addition, this paper will address areas that have received little attention, i.e., the association between victim-offender relationship, weapon choice, and number of injuries inflicted.

Methods: Relationships are divided into primary and secondary categories. Primary relationships include intimates, relatives, and friends. Secondary relationships include acquaintances and strangers. Primary and secondary relationship categories are differentiated based on the level of emotional attachment and positive interaction established between victim and offender. Motives are denoted as dispute/conflict, revenge, and felony type (representing all homicides committed in conjunction with other felonies). Disputes/conflicts are further differentiated between those of a romantic nature and those not of a romantic nature. Weapons are differentiated between firearms and all other weapons, or a combination of the two. Number of injuries inflicted is either singular or multiple.

The sample of 57 homicide victims stems from 177 total homicide cases processed in Florida Medical Examiner District 8 between 1992 and 1996. All state-mandated executions, victims of motor vehicular homicides, child victims of homicide, victims killed during law enforcement activity, homicides ruled accidental in nature, homicides involving suspected mental illness on the part of the offender, and homicides for which some or all information is unknown are excluded from the study. Offender data were collected from the files of the Office of the State Attorney, Florida Judicial Circuit 8.

Results: Significant correlation exists between victim-offender relationship and homicide motive ($p<.0001$). Sixty-three percent of disputes and conflicts occurred between people in primary relationships, and felony type homicides occurred with ten times more frequency between individuals in secondary relationships than in primary relationships. Revenge killings occurred in much higher frequency in secondary relationships. Despite a default association between romantic disputes and primary relationships, no bias is introduced. When subsuming all romantic disputes into a general dispute/conflict category, correlations remain significant ($p=.0012$). In addition, when all romantic disputes are removed ($n=47$), correlation occurs at the $p=.0375$ level. No correlation

is found between victim-offender relationship and either weapon choice or number of injuries inflicted ($p>.05$).

The new motive categories provide a clearer assessment of the variety of causes behind homicide while not introducing bias. In addition, all variables are determined independently, thus allowing for evaluation of the correlation between each of the variables without default associations. Further analysis of additional factors influencing weapon choice and number of injuries inflicted is needed to fully understand the interaction of these characteristics with victim-offender relationship.

Victim-Offender Relationship, Homicide, Victimology

G73 Medical Malpractice: A Case History Study by the Forensic Medicine Section From Bari

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The goal of this research project is to study the real entity of the medical malpractice phenomenon, the medical actions at risk and their incidence on the mortal event.

Legal actions arising from deaths derived from presumed malpractice and the autopsies arranged by the Judicial Authority, in cases of alleged of medical professional responsibility, are progressively increasing. This phenomenon reflects above all the distrust by the public for the medical community and towards public and private health care institutions. This feeling is amplified by the mass media which, seeking a larger audience, points out and emphatically chronicles single cases of real or presumed iatrogenic injury. In any event, the media are not disposed to reporting the ascertained cause of the danger. Moreover, the possibility of obtaining enormous compensation, increased above all by insurance, either by the single doctor or by the health offices, has decreased more and more the number of judicial proceedings often started on the basis of simple suspicion. On this basis, an important instrument to clarify the situation is surely represented by the autopsy. For this reason, highly qualified and experienced professionals who are able to point out the cause of death and to identify the possible wrong conduct and its exact consequences must carry out the autopsy. Only in this way is it possible to eliminate definitively any doubt about the doctor's action.

For the reasons reported above, it is easy to understand the utility of a study that verifies, with scientific precision, the real dimensions, characteristics and typology of the putative malpractice. To achieve this aim, we examined all data based on the single cases of autopsy occurring in the last decade in the Forensic Medicine Section of the Internal and Public Medicine Department of the University of Bari. We selected the malpractice cases and, among them, we identified the ones in which a death was attributed to a medical error. We differentiated them from the cases in which a death was not related to the medical conduct.

This work also permitted us to document the incidence of the malpractice and to identify the medical and surgical branches more frequently involved. We took into consideration the decade 1991–2000. In this period 2,123 autopsies were performed in our section and 364 of them involved cases in which the medical responsibility was implicated and for which a judicial proceeding was started. In this group we distinguished three different situations: 1) a medical error caused the death of the patient; 2) a medical error, by all accounts, was not directly attributed to the patient's decease or death; and 3) the medical conduct was correct.

In the sample concerning the 364 cases of presumed malpractice, females represented 48% and males, 52%.

A correlation between malpractice and patient death was demonstrated in 30% of the cases; conversely, the medical conduct was correct in 55% of the cases; the medical error could not be directly attributed to

the death of the patient in 15% of the cases. The cases of verified professional responsibility involved 84% of the public institutions, and for the remaining 16% private health care institutions. The highly specialized institutions involved were 31%. The remaining 69% were cases involving lesser-specialized institutions. The service occurred in a public hospital in 87% of the cases. Only 10% of the cases occurred during emergency situations and the 3% in public clinics. The surgical disciplines were involved in 52% of the cases; the medical ones in 41%; and, the anaesthesiology in the remaining 7%. Among these disciplines, obstetrics and gynaecology were involved in 16% of the cases; general surgery, in 14%; internal medicine, in 9%; orthopaedics, in 8%; first aid, 8%; anaesthesiology, in 7%; neurosurgery, in 5%; cardiology, in 4%; pediatrics, in 3%; ear, nose and throat medicine, in 2%; and, 24% in all other disciplines.

Another interesting aspect pointed out by our work is that the malpractice claim is not always linked to substandard conduct of a single doctor; in some cases, it was possible to notice and to distinguish other fundamental causes. These could be summarized as follows: 1) responsibility of the leading doctor in regard to the internal organization of the hospital stay department; 2) responsibility of the general director or of the medical director because one or both did not address in a timely and adequate manner the inefficiency, the insufficiency, the deficiency, of the defects of the institutions and/or the medical equipment; 3) responsibility of the local politicians and administrators connected to the institutions at the medical site and/or of medical equipment suitable and adequate for the population and the site.

The case history research must be considered to be partial, and, at the moment, in progress. In fact, we are aiming at a further, more intense investigation. It is a preliminary methodological approach to understand the malpractice phenomenon in Apulia where the current study has been limited to the autopsy case study of our Forensic Medicine Section.

Malpractice, Medical Error, Autopsies

G74 Nuclear and Mitochondrial DNA Analyses Following X- and Gamma-irradiation

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The goals of this research project are to determine if gamma- and/or x-irradiation adversely affect nuclear and/or mitochondrial DNA for identification purposes.

Identification of human remains is often accomplished by analysis of nuclear or mitochondrial DNA. Nuclear DNA (nDNA) allows a statistically more significant result while mitochondrial DNA (mtDNA) allows results in cases of advanced decomposition where nDNA identification is not possible. Because both methods, nDNA and mtDNA, are often used in cases of advanced decomposition, including skeletonization, the materials under study typically have been or require radiographic analysis for documentation, foreign body recognition/localization, skeletal assessment, and possible identification. Limited data are available regarding the effects of such ionizing radiation exposure on nDNA and mtDNA analysis.

In order to assess the effects of investigator applied ionizing radiation on DNA for identification purposes, 0.5 to 2.0 gram portions of vertebral body (from five co-mingled skeletal remains at 375 day post mortem interval), scalp hair (single living donor), and blood (single living donor),

were exposed to iridium 192 at 3 inches distance for 1 hour (7552r total) and 200 Kv at 4.5 ma x-irradiation at 7.5 inches distance for 2 minutes (7000r total). The exposed samples and matching non-exposed controls were subsequently analyzed by polymerase chain reaction (PCR) – short tandem repeat (STR) at 8 STR loci and amelogenin for nDNA and sex typing.

The fresh blood and hair samples gave consistent results at all eight loci by PCR-STR. The bone samples yielded positive results at up to two loci and positive amelogenin results. One vertebral body was analyzed for mtDNA at hypervariable regions I and II. Nine polymorphisms consistent between samples were identified in the control and x-irradiated specimens. The gamma-irradiated sample yielded no mtDNA results due to insufficient or excessively degraded mtDNA.

These results show that neither x- nor gamma-irradiation, in amounts typically employed in processing of skeletal remains, adversely affects nuclear or mitochondrial DNA for identification purposes.

Identification, DNA, Irradiation

G75 Recovery and Processing of Co-Mingled Remains Following Extended Submersion Period Facilitated by Computer Animation

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The goals of this research project are to utilize multi-disciplinary approach to successfully process co-mingled remains of multiple individuals while utilizing computer animation techniques and accident reconstructionists to allow for better lay understanding of the event.

The extrication of five sets of partially skeletonized human remains from the confines of the rear seat of a passenger vehicle is described. The case was highly emotionally charged and involved extensive press coverage and charges of racial bias.

Six young adults disappeared after last being seen at a nightclub in a rural area. Their whereabouts remained a mystery for five months until the vehicle was located in a local river. Due to the intense public interest and circumstances of the case, the unprocessed vehicle was placed on a flatbed truck and transported several hours away for examination.

On inspection, it was obvious that multiple sets of human remains were co-mingled in the back seat of the vehicle. These were accessed by removing the roof and block lifting proximate materials for evaluation.

The multi-disciplinary approach to this case included motor vehicle accident reconstructionists whose evaluation showed the car entered the water at a low rate of speed (<15 mph). In order to facilitate understanding of the dynamics of this crash, a computer animation of the event was created. The latter allowed interested laity to easily grasp the complexities of the crash and injuries related thereto.

The team approach allowed a rapid resolution to the case without incident, despite one lingering question – only five sets of remains were recovered.

Motor Vehicle Crash, Submersion, Recovery

G76 Comparison of Drug Concentration in Blowflies (Diptera: Calliphoridae) and Human Tissues

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The goal of this research project is to help participants understand the uses of forensic entomotoxicology.

The renewed interest in forensic entomology, as reflected by the great number of recent publications and increasing incorporation of entomological evidence into the routine forensic investigation, has caused us to reconsider one of the more interesting applications: entomotoxicology.

Insects feeding on a decomposing body will introduce various xenobiotics present in that body in their own tissues. For this reason, Diptera and Coleoptera can be proven to be a valuable source of toxicological information for a body in an advanced stage of decomposition, when fluids and tissues normally used for analyses are not longer present.

The significance of this approach was recently underlined by a case in which the insect larvae showed positive for secobarbital while muscle tissues tested negative. Although the use of insects as alternate specimens for toxicological analyses has been well documented, there are still areas for further research, in particular, in the relationship between concentrations of xenobiotics in insects and the human tissues and fluids.

The results presented here deal with three cases from the Institute of Legal Medicine, University of Milan, where there was an insect infestation of the body with suspected drug involvement and 16 rearings of insects from cadaver tissues where there was a known drug intoxication. After a preliminary toxicological screening of blood and urine with EMIT® and GC/MS, samples of all available organs and biological fluids were collected. Samples of liver were removed from each case and exposed to insect activity. Colonizing species were *Lucilia sericata* (Fabricius) (Diptera: Calliphoridae) and *Sarcophaga haemorrhoalis* (Fallen) (Diptera: Sarcophagidae). Collections were made of 3rd instar and post-feeding 3rd instar larvae, and, in one instance, puparia was rearing of Diptera was also conducted on tissues from traumatic or natural death as controls.

Entomological samples from both cases having postmortem insect infestations and rearings from tissues control and known drug-related death were washed with deionized water and stored at -20°C. Additional samples were fixed in boiling water and preserved in 70% ETOH for species determinations.

Prior to toxicological analyses, larvae were again washed, dried, and homogenized with deionized water. Samples of humans organs were also homogenized. Drugs detections and quantifications were accomplished using GC/MS and ONLINE techniques (Roche©). In addition to opiates, cocaine, and/or benzoilecgonine and barbiturates, we were able to detect clomipramine, amitryptiline, nortryptiline, levopromazine, tioridazine and methadone from both human tissues and the insects analyzed. All xenobiotics were detected in both feeding and postfeeding 3rd instar larvae. In two of the questioned cases, analyses of Diptera puparia and Coleoptera larvae were positive. Controls were all negative for all drugs involved. From the quantitative point of view, differences were noted between real cases and experimental rearings. All xenobiotics were more concentrated in the entomological specimens from experimental rearings than in those from the real cases.

In most instances, the concentrations of the drugs were lower in the postfeeding 3rd instar larvae than for the feeding 3rd instar larvae. Exceptions for this pattern were encountered in clomipramine and levopromazine. Both these drugs were more concentrated in the postfeeding 3rd instar larvae. Additionally, while in most instances, drug concentrations were higher in liver tissues than in larvae, in four cases we encountered cocaine concentrations higher in the larvae than in liver tissues.

Our results confirm the reliability of entomotoxicological materials for the qualitative analyses of xenobiotics. Although additional case studies are indicated to further clarify quantitative aspects of entomotoxicology, it must be kept in mind that entomological materials are easy collectible, can be analyzed by unmodified routine techniques, and are free from contaminants due to putrefaction encountered in advanced stages of decomposition.

Forensic Entomology, Entomotoxicology, Blowflies

G77 Removing External Contamination of Maggots With a Bleach Solution Without Inhibiting Genetic Analysis of Maggot Crop Contents

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The goals of this research project are to understand (1) the procedure for dissecting a maggot and removing its crop for DNA analysis; (2) the effect washing maggots has on reducing the risk of external contamination; and (3) the effect washing maggots has on recovering vertebrate DNA from the maggot crop.

The type of corpse a maggot has been feeding on can be identified through mitochondrial DNA (mtDNA) analysis of the maggot crop contents. The crop is a diverticulum of the anterior end of the alimentary canal. Recently, Wells *et al.* identified several situations when this type of analysis would be useful in a forensic investigation (*J Forensic Sci* 46(3):685-687). DNA analysis could help investigators identify a missing victim if maggots are discovered at a suspected crime scene in the absence of a corpse. Maggot crop analysis could also provide a forensic entomologist with another way to associate a maggot with a victim when making a postmortem interval (PMI) estimation. If insect evidence is to be used for PMI estimation, it is assumed that the insect specimen's entire development took place on the victim. Maggot crop analysis could reveal that the maggot had moved onto the victim from a different nearby food source.

When amplifying mtDNA from a new source such as a maggot's crop, the forensic analyst must consider the risk of contamination. For maggot crop analysis, the analyst must be certain the recovered DNA is from the crop and not contaminant DNA from the maggot's exterior. In the case of identifying a missing victim, exterior contamination of human origin could lead to incorrect assumptions about the identity of the missing person. Exterior contamination would also interfere with making correct inferences about whether a maggot had been feeding on multiple food sources.

Removing external contamination could be accomplished through a simple washing of the maggot's exterior. The chosen wash method should reduce the amount of contaminant DNA located on the maggot's exterior, but should not interfere with the recovery of vertebrate DNA from the maggot's crop. In this study, we investigated the suitability of using a bleach solution to sterilize the external surface of a maggot prior to crop content analysis.

Soaking them in beef blood of a different genotype intentionally contaminated maggots raised on beef liver. A portion of these maggots was soaked overnight in a bleach solution. Before crop dissection, all maggots were briefly rinsed in water in order to recover a portion of any remaining outside contaminant. All maggots were dissected to remove the crop, which was then extracted. The water used to rinse each maggot was also extracted in order to detect whether the bleach wash had removed the external contaminant. A portion of cytochrome b was amplified from all extractions using newly developed primers designed to amplify most vertebrate DNA without amplifying insect DNA. Successful amplifications were sequenced using a PE-Biosystems (Foster City, CA) 310 genetic analyzer and BigDye Terminator® sequencing kit.

In all maggots, careful dissection of the crop led to the recovery of the food source DNA without any recovery of the external contaminant. Even maggots that were soaked in contaminant blood and not washed did not show any trace of the external DNA in the analyzed sequences from the crop. However, the maggots used in this study were well preserved and had large crops (6-8 mm in length). Further research is needed to assess the risk of contamination in maggots with near empty crops that have not been well preserved.

Soaking a maggot overnight in a bleach solution does not prevent the successful recovery of vertebrate DNA from the maggot crop. As previously mentioned, DNA from the food source was recovered from all of the analyzed maggot crops. The bleach wash appeared to have no effect on DNA recovery as all crop amplifications resulted in approximately the same quantity of amplified product.

Soaking a maggot overnight in a bleach solution does reduce the quantity of external contaminant. We were unable to recover contaminant DNA from the exterior of intentionally contaminated maggots that had been soaked in a bleach solution. This contaminant DNA was easily recovered from the exterior of intentionally contaminated maggots that had not been washed or washed only in water.

Our results demonstrate that a careful dissection process prevents contamination in maggot crop analysis even when dissecting heavily contaminated maggots. Also, soaking a maggot overnight in a bleach solution greatly reduces the quantity of external contaminant without compromising the ability to recover DNA from the maggot crop.

Forensic Entomology, Maggot Crop, Mitochondrial DNA

G78 The Child Abuse Works of Ambroise Tardieu...Had We Only Taken French

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The goals of this research project are to help participants realize the value of two enduring quotes: 1) "In fine, nothing is said now that has not been said before." (Terence, ancient Rome); and 2) "Those who ignore history are condemned to repeat it." (anon.). All of this will pertain to our so-called recent advances in the diagnosis of child abuse.

In the middle of an eleven-year review of child deaths investigated by the University of Tennessee, Memphis, Division of Forensic Pathology, an advanced literature search regarding the recorded history of forensic involvement in child abuse uncovered the humbling works of Ambroise Tardieu. This general practice physician was born 1818 in France, and rose in stature to become the Dean of the prestigious Faculté de Médecine de Paris. His name is familiar to forensic pathologists world wide by his anatomical tombstone "Tardieu spots." With the recent heightened interest in the phenomenon of child abuse evidenced by Caffey(1946) and Kempe (1962), and more recently, by the Shaken Baby Syndrome, it was a humbling discovery to review Tardieu's seminal work entitled "A Forensic Study on Abuses and Maltreatment Exercised on Children" published in the Annales d' Hygiène Publique et de Médecine Légale (1860, 13: 361-398). Often referenced by only one or two sentences in forensic texts, radiologists like Silverman and now Brogdon come closest to appreciating what most English-speaking pathologists will come to regret: that Tardieu's works have not become required reading during their fellowships.

This treatise reflected his involvement with 32 cases of child maltreatment over a 14 year time-span, 18 fatal (with 16 autopsies) and 14 non-fatal. Tardieu differentiated between abuse by neglect and abuse by violence; emphasized the importance of establishing patterns and chronology of abuse; recognized torture and identified causality between the shaking of a baby and nerve damage with or without cranial hemorrhage; alerted the medical community to the discrepancy between parental explanation of trauma and clinical tableau; recognized sexual abuse; understood the judicial ramifications of his role as medical examiner; stressed the sociological, cultural and demographic context of abuse; and optimized autopsy techniques in fatal abuse cases. Yet, not confined by his practice only to the dead, he readily addressed the emotional crippling of abuse victims. Tardieu's extraordinary vision at a time when clinical diagnosis was not technologically dependent (the x-ray had yet to be

discovered) is truly humbling. No doubt Tardieu was a man of great intellect imbued with the concept of forensics in service to the community, capable of aiding the living as well as advocating for the dead. His great success was due in no small part to the French legal system that was already deeply committed to the welfare of its children with a sophisticated acknowledgement and understanding of child abuse. Of no less importance was the social and cultural readiness to accept his actions and intent, serving as a catalyst to his medical abilities and inherent humanitarianism. Meanwhile in New York City (1874), eight year-old Mary Ellen Wilson remained tied to a bed, malnourished and beaten, until the cruelty to animal laws were applied to her situation.

One hundred years have passed and we have re-invented the wheel. Since Dr. Kempe coined the term "battered-child syndrome" in 1962, abuse has been defined as physical, emotional and sexual abuse and abuse by neglect. The definitions are now clear; the challenge is to be as involved within the home to the same extent as Dr. Tardieu.

Translations of his observations will be presented through photos from our recent cases. A more daunting challenge may be his other 1200+ page work on toxicology.

Child Abuse, Forensics, Legal Medicine

G79 Coming of Age in Memphis... How Our Children Die

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This paper reviews the fatalities between birth and 18 years of age investigated by the Shelby County, Tennessee Medical Examiner from 1991 to 2001. The goals of this project are: 1) to identify trends in natural, accidental, homicidal, and suicidal deaths, 2) to examine the circumstances surrounding each to understand the surrounding cultural and social environment, 3) to evaluate the validity of forensic investigators linking age with the behavior defined parameters of childhood.

This study reviews 1,363 cases. Manner of death indicated 43% were natural; 33%, accidental; 19%, homicidal; and 5%, suicidal.

Half of the 586 natural deaths were diagnosed as Sudden Infant Death Syndrome (SIDS). Black babies (79 %) were more likely to be affected than white (20%), male (60%) more than female (40%). Non-SIDS natural deaths represented a diverse pathology.

Of the 448 accidental deaths 70% were traffic, and 30% non-traffic. Vehicular accidents were 70% automobile, 2% motorcycle, 2% train and 1% bicycle. Seventy-three pedestrians (23%) were struck by automobiles, and 6 by train. Only males were casualties of train, motorcycle and bicycle accidents, with a higher median age of 15 years for 10 whites and 12 years for 5 blacks. A difference also existed among pedestrians. Black children made up 70 % of all pedestrian deaths with a median age of 5, white 29% with a median age of 10. The 219 automobile accidents affected males (61%) more than females (39%). There was a significant contrast in gender following repartition within age intervals. From birth to 14 years, the difference between genders is nil, but skews significantly in the 15-18 year interval with 66% male and 34% female. This contrast reflects a change among individuals still legally defined as children, but who no longer behave as such. Of 148 casualties between 15 and 18 years, 38% were drivers and 61% passengers. Males predominate with 74% driving, 60% riding, and a balanced distribution in relation to ancestry (54% white, 46% black driving, evenly divided for passengers). Alcohol or drug use was not found in any case through the age of 15. But results in 18% of all vehicular deaths in the 16 to 18 year age group, (24% of white male, 24% of black male, and 4% of white female but no black female) were positive.

Of the 136 non-traffic accidental deaths, 25% resulted from drowning, 21% asphyxia, 15% fire-related, 11% poisoning, 10% gunshot

wound, 9% blunt trauma, 3% hanging and 2% hyperthermia. Drowning under the age of 2 takes place within the home with gender and ancestry ratios nearly equal. Drowning of older children occurred outside the home, mostly while unsupervised (70% male, 30% female: 83% black, 17% white). Asphyxia in 28 cases was linked to various mechanisms. Aspiration of gastric content, 13 cases, was the leading cause, followed by 10 instances of positional asphyxia, 4 of overlying and 1 post-surgical. The highest incidence of gastric aspiration peaked around 2 years of age and primarily affects black boys, 12 cases (92%). Positional asphyxia (median age 6 months) and overlying (median age 4 months) affected even younger demographic groups. Racial distribution reveals a similar prevalence among blacks (71%). House fires resulting in burns or carbon monoxide inhalation victimized more blacks (81%) than whites (19%). Significant socio-economic unevenness between the various demographic segments may be reflected in these ratios. Poisoning (15 cases) was sorted out according to type. Chemical agents such as cleaning products were responsible for 3 deaths under the age of 2 years, 1 sniffing and 5 medication deaths between 2 and 15 years. Illicit drugs (MDMA, cocaine) overdose and sniffing affected 6 whites, (4 males and 2 females) between 16 and 18 years of age. Accidental gunshot wounds killed 12 males and 2 females, 10 blacks and 4 whites with a median age of 14 years. Accidental blunt trauma lead to the death of 12 children, 9 males and 3 females, 9 blacks and 3 whites; the median age was 2 years.

Death by suicide involved 75 children, gunshot wounds (83%) were the primary cause of death, followed by hanging (6%) and drug overdose (4%). Gender and ancestry showed 56 males (28 white, 25 black, 2 asian, 1 hispanic) and 19 females (14 white, 3 black and 2 hispanic). Although 2 were 12 years old, the greatest incidence of suicide was found at a median age of 17 years for gunshots, 16 for hanging and 18 for drug overdose. Circumstances surrounding suicides involved failing relationships, parental divorce, and/or family turmoil. Variation in incidence between genders, and among females suggests differential coping skills based upon gender, cultural and behavioral differences.

258 juvenile deaths were ruled homicide. Causes of death include 182 cases (70%) of gunshot wounds, 36 (14%) blunt trauma, 16 (6%) sharp force, 6 Shaken Baby Syndrome, 3 drowning, and 3 cases of maternal demise. It is imperative for any analysis of violent death to go beyond global statistical calculations. Overall, it appears that children are most often murdered by gunfire. However, taking into account age distribution, guns were used in 9 deaths (5%) in children under 10 years, all of them bystanders. By contrast, 173 (95%) homicides between 11 and 18 succumbed to gunshot wounds, with few bystanders. All gunshot wound victims under 10 years were black, with an even distribution between males and females. Older victims were predominantly black (94%) and male (95%). In many respects, circumstances leading to sharp force injuries were analogous to firearm deaths. Although the instrument of death varied, the demography did not. In contrast, while blunt trauma is responsible for only 14% of all juvenile homicides (36 cases); 86% (31 cases) of these occur under the age of 3. Whereas street violence and use of weapons kill the older, it is domestic violence using hands or instruments of convenience that kill the younger. These are children, acting like children, powerless as children, with a median age of 18 months, and a peak incidence at 2 years. From birth to 18 months, incidence among males (59%) was higher than among females (41%). The ratio, however, reversed in the interval between 18 month and 3 years (43% male and 57% female); blacks (81%) still remained more likely to be victimized than whites (19%). This latter distribution was found among the 6 cases of Shaken Baby Syndrome as well. Blunt trauma and Shaken Baby Syndrome can be taken as part of the same modality both in regard to circumstances and mechanisms of death. This conclusion is reflected in the frequent finding of both forms of injury in the same victim.

Although legally defined as children, analysis of how they die identifies behavioral differences within the first 18 years of life with a clear schism between youngsters who behave like children and those who assume adult conduct. Patterns of accidental, suicidal, and homicidal death

clearly reflect these behavioral differences. Realizing this difference is the first step to breaking down the concept of a homogeneous category of victims known as children. Focusing on specific age groups and their unique behaviors may provide the opportunity to design solutions to specific problem areas rather than emphasizing one solution for all.

Child Abuse, Homicide, Death

G80 Bruises in Infancy: How Many Are Too Many?

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The goal of this research project is to emphasize the rarity of accidental contusions in infants less than nine months of age.

Bruises may be noted on young infants as incidental findings during well-child exams or at autopsy. The presenter will review several recent studies indicating that accidental bruises of any sort are rare in the first eight months of life. Bruises of the face, trunk, and upper extremity are even less common.

In 1999 Sugar et al (1) reported the results of 973 children under 36 months who were examined during well-child visits. The presence, site, and number of bruises were recorded. Developmental stage, particularly the ability to walk along furniture ("cruising") or independently, was noted. Children with known medical conditions causing easy bruising and children in whom abuse was suspected for any reason were excluded from the study. Only 2 of 366 children under 6 months of age (0.6%) and 8 of 473 children under 9 months of age (1.7%) had any bruises. Bruises were noted in only 2.2% of children who were not yet cruising, but in 17.8% of cruisers and 51.9% of walkers. Bruises of abdomen, buttocks, hands and feet were rare in all age groups. Bruises of trunk, upper arm and face were extremely rare in non-cruisers.

In 2001 Labbe and Caouette (2) reported the results of 2,040 examinations of 1,467 children aged 0 to 17 years who were seen at well-child visit or in a hospital emergency department. Children seen in emergency departments were excluded if they had presented because of trauma. Children were also excluded from the study if they had a neurologic disorder which affected mobility, medical conditions causing easy bruising, were deemed "unstable" or were suspected of having been abused. The majority of children older than 9 months (76.6%) had at least 1 recent skin injury; predominantly bruises. In contrast, only 11.4% of infants 0 – 8 months had any skin lesions; these were predominantly scratches. Only 3 of 246 infants under 9 months of age (1.2%) had any bruises.

Two recent cases in our office illustrate the importance of investigating bruises.

Case 1: A 5-week-old infant was brought to his pediatrician's office with a complaint that he "fell off the couch." He had a hematoma on the pinna of his left ear and a subconjunctival hemorrhage of the right eye. No report was made to child protective services. Two months later, the child was brought to a local hospital in full cardiorespiratory arrest. History provided was that the child was being fed and burped and then became lifeless. He was briefly resuscitated, but died of multiple organ system failure. Postmortem examination revealed multiple subgaleal hemorrhages, thin film subdural and epidural hemorrhages, a torn corpus callosum, severe cerebral edema with tonsillar herniation, bilateral diffuse retinal hemorrhages with retinoschisis and diffuse subdural hemorrhage of the spinal cord. Bruising was seen externally over the right face and pinna, extending onto the right scalp. A similar distribution of bruising was seen on infrared examination on the other side of the face.

Case 2: A 3-month-old child was noted to have multiple bruises while being bathed by her grandmother. She appeared otherwise well. She was brought to the hospital for evaluation. Pattern bruises were found to the abdomen, upper arm, neck and face. Skeletal survey revealed 3 ages

of rib fractures, and a compression fracture of L2. None of these skeletal injuries was suspected on physical examination.

In conclusion, the presence of any bruises in a child who is not yet walking along furniture is concerning. Bruises in unusual sites, such as the abdomen, face or upper arm, should lead to a child protection referral to investigate the possibility of inflicted trauma.

Contusions, Child Abuse, Skin Pathology

G81 Child Abuse Autopsy Technique... What Works for Us

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The goals of this research project are to: 1) become familiar with the application of new autopsy techniques designed to enhance their ability to observe, record and present these findings, and 2) actual case studies will demonstrate how to perform these procedures.

Autopsies on victims of child abuse are more involved than most assault cases. The question of neglect, past physical abuses, torture, sexual abuse, instrumentality, timing or sequence of injury and dating of wounds is further complicated by the fact that children are not small adults. Growth and developmental processes from the epiphyseal plates in long bones, unfused sutures in cranial bones, degree of central nervous system myelination, susceptibility to certain forms of injury and basic considerations of size and weight are all differences requiring special or modified autopsy procedures. Over the years of autopsy service provided by the University of Tennessee, Memphis and the Regional Forensic Center, certain techniques have been employed to maximize the discovery, documentation, and demonstration of injuries. Some of these methods will be discussed using case based examples and include:

Epiluminescence is a dermatologist's aid utilizing the optical properties of oil applied to the skin surface to enhance the observation of injuries at or just below the epidermis.

Casting of the skin surface using elastomeric materials to preserve toolmark/bitemark impressions.

Angiography for the assessment of vascular patency and distribution. Post-mortem carotid catheterization and instillation of radio-opaque dye can be performed simply in the autopsy suite followed by standard x-ray views to record the vascular changes. Coronary angiographies may be performed *in situ* or *ex vivo* and x-rayed in any position.

Ocular Special procedures demonstrate retinal and optic nerve hemorrhages, *in situ* and by histology. Borrowing from eye donor protocols, circumferential incision of the limbus under suture traction allows gentle removal of the cornea followed by separate excision of the iris and lens. The vitreous is used to maintain the retina in place and utilize its optical properties to obtain clear photographs of the retina in place while maintaining the orientation of its landmarks. Hemorrhages and folds are readily demonstrated. Following this, the globe remnant is excised and retina and optic nerve removed for histological evaluation.

Skeletal assessment by physical examination techniques, radiographic protocols, anthropologic evaluation, histology and preservation as evidence. The rib cage is x-rayed using oblique views to enhance pre autopsy diagnostic accuracy. After thoracic evisceration, inspection and palpation are performed passively and under stress loading to identify well approximated and nearly bloodless fracture sites. The external surfaces are surgically freed to aid this. Injured ribs and those immediately adjacent are excised since occult fractures and green fractures are likely to escape any other method of detection. Fractures indicating any likelihood of age beyond immediately prior to death may be sectioned in part for histological dating with correlation by anthropological methods. All excised bone is processed for evidentiary retention by mild digestive techniques.

Wound dating or sequencing techniques correlate histological appearances with chronology or clinical history. The process of inflammation and repair is a phenomenon that proceeds along a well defined pathway, but progresses at a rate affected by its circulation, any interference with that blood supply, episodes of pre-existent shock, magnitude of the injury and area of injury examined and effects of decomposition.

Bronchoscopy evaluation of the airway in fire, asthma and pneumonia deaths. Persons receiving an endotracheal tube as a result of medical intervention prior to death are very amenable to bronchoscopic examination utilizing the lumen of the tube. Greater skill is required to examine the patient in rigor without a tube. Asthma patients show typical mucus plug formation; gastric aspiration is accompanied by a rapid onset mucosal erythema and pneumonia patients frequently exhibit purulent material. Smoke inhalation is easily diagnosed by the presence of soot deposits, while those dead before the fire have none.

Organ and tissue donor programs take precedence over medical examiner jurisdiction in Tennessee. As a result of good cooperation and mutual support of activities, no forensic autopsy has been compromised and tissue recovery has soared. The actual practice involves both parties, acting together in concert or sequentially to identify injuries prior to harvest and preservation of those areas of forensic interest. An exchange of pathology reports between donor agencies and the medical examiner completes the pathologic examination by our office while the donor agency determines suitability for transplant based in part upon our reports.

With these tools, the ability to record, describe and present injuries effectively is enhanced before families, attorneys and juries alike. Additionally, opposing experts get to review higher quality material that is less ambiguous.

Child Abuse, Autopsy, Organ Donor