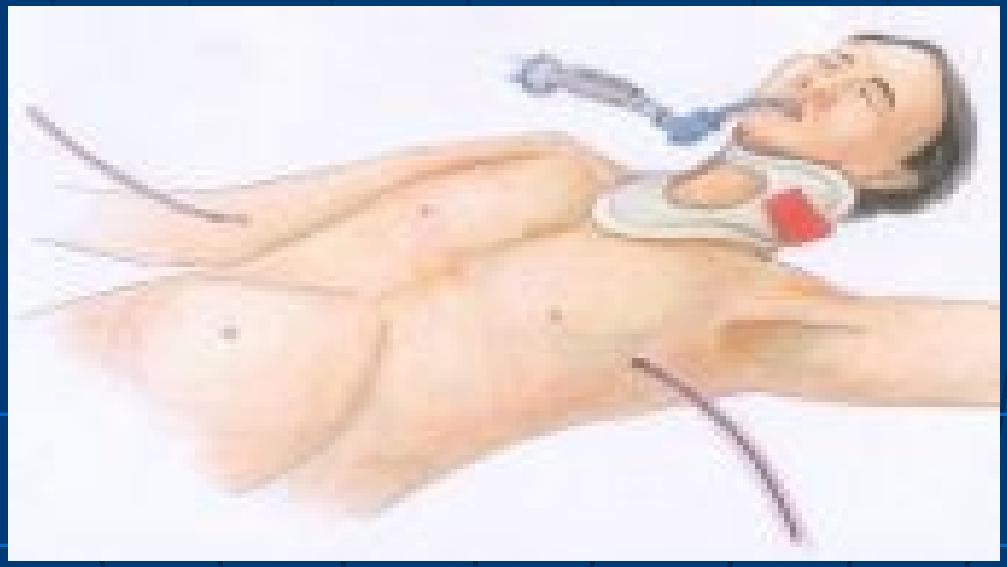
ADVANCED TRAUMA LIFE SUPPORT (ATLS)

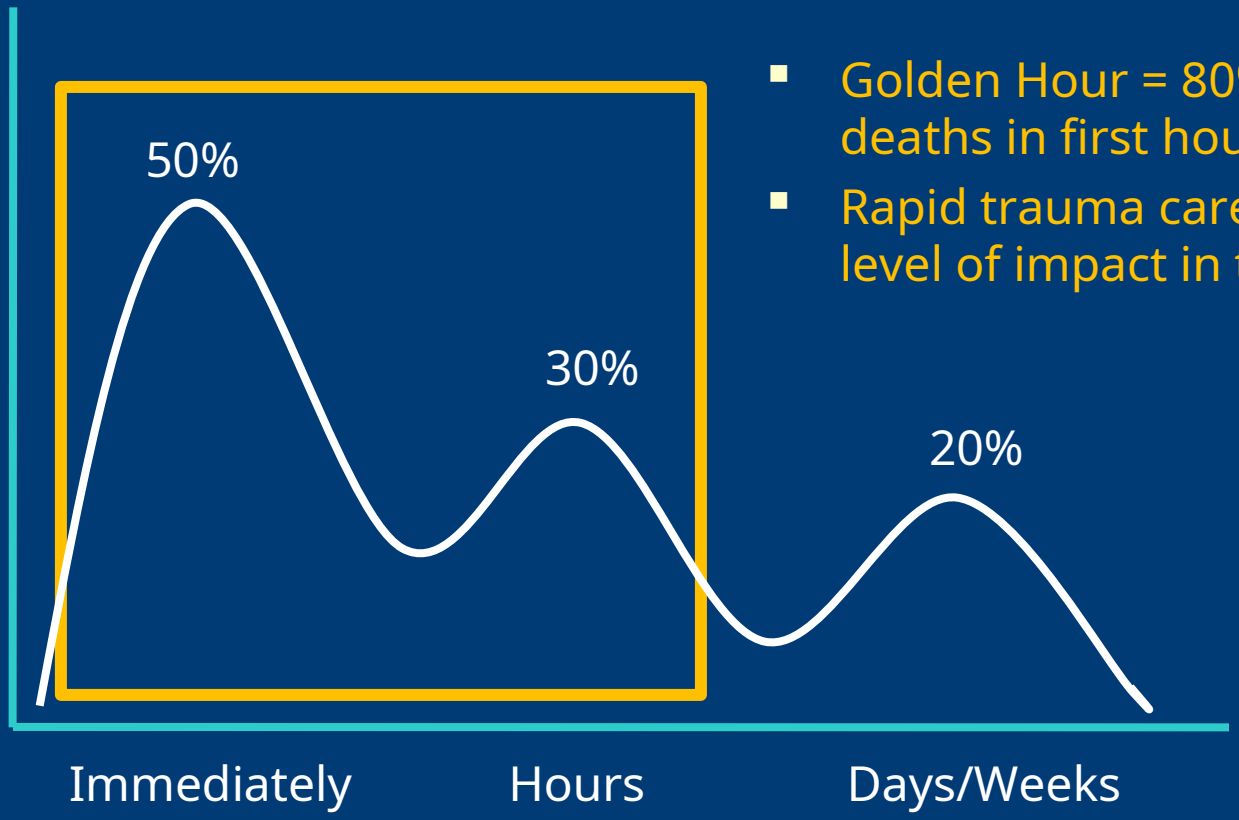
Onwong’a Isaac Nyabuto

Initial Assessment and Management of the Trauma Patient- ATLS



Epidemiology

Trimodal Distribution of Trauma Deaths



- Golden Hour = 80% of trauma deaths in first hour after injury
- Rapid trauma care has greatest level of impact in these patients

History of Trauma System Development

- Standardized Trauma Assessment
  - Nebraska Cornfield, 1976
  - Orthopedic Surgeon
  - Lead to development of ATLS
- Trauma Systems Development
  - First developed my military in wartime
    - i.e. MASH Units
  - Expanded to Level 1, 2, 3 Trauma Centers
    - Urban Systems
    - Statewide networks of systems/Refferal systems
    - **Level 1** – Highest level of care, Leaders in research, clinical care and education
    - **Level 2** – Provides definitive care in wide range of complex traumatic patients
    - **Level 3** – Provides initial stabilization and treatment. May care for uncomplicated trauma patients
    - **Level 4** – Provides initial stabilization and transfers all trauma patients for definitive care
    - WHERE ARE WE IN KENYA?????

Mechanisms of Injury

- Blunt Trauma
  - Compression Forces
    - Cells in tissues are compressed and crushed
    - E.g. Spleen
  - Shear Forces
    - Acceleration/Deceleration Injury
    - E.g. Aorta
      - Shearing force = Spectrum from Full thickness tear (Exsanguination) to Partial tear (Pseudoaneurysm)
  - Overpressure
    - Body cavity compressed at a rate faster than the tissue around it, resulting in rupture of the closed space
    - E.g. Plastic bag
    - E.g. in trauma = diaphragmatic rupture, bladder injury

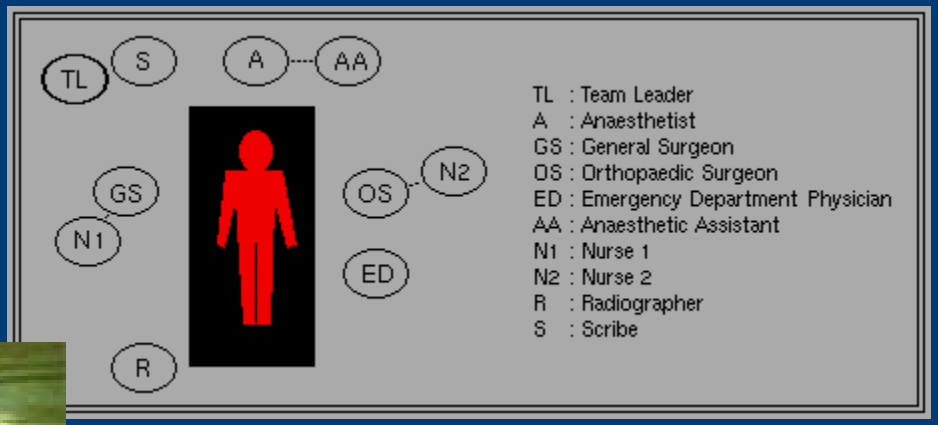
Mechanisms of Injury

- Frontal Impact Collisions
- Lateral Impact Collisions (T bone)
- Rear Impact Collisions
- Rollover Mechanism
- Open Vehicle or Motorcycle/Moped
- Pedestrian Vs. Car
- Penetrating Injury (Guns vs. Knives)

Basics of Trauma Assessment

- Preparation
  - Team Assembly
  - Equipment Check
- Triage
  - Sort patients by level of acuity (SATS)
- Primary Survey
  - Designed to identify injuries that are immediately life threatening and to treat them as they are identified
- Resuscitation
  - Rapid procedures and treatment to treat injuries found in primary survey before completing the secondary survey
- Secondary Survey
  - Full History and Physical Exam to evaluate for other traumatic injuries
- Monitoring and Evaluation, Secondary adjuncts
- Transfer to Definitive Care
  - ICU, Ward, Operating Theatre, Another facility

Preparation . . .



Organize Trauma Response Team

Primary Survey

- **A**irway and Protection of Spinal Cord
- **B**reathing and Ventilation
- **C**irculation
- **D**isability
- **E**xposure and Control of the Environment

Primary Survey

- Key Principles
  - When you find a problem during the primary survey, **FIX IT**.
  - If the patient gets worse, restart from the beginning of the primary survey
  - Some critical patients in the Emergency Department may not progress beyond the primary survey

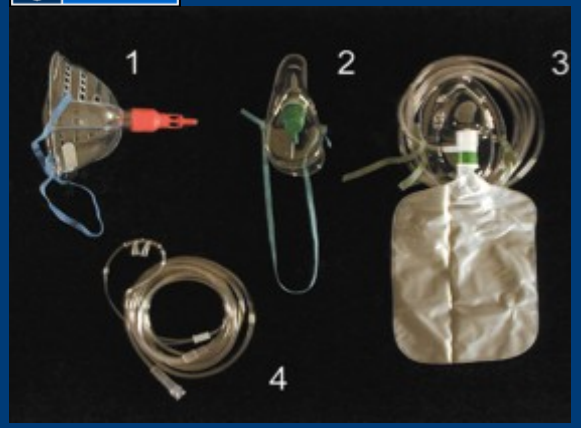
Airway and Protection of Spinal Cord

- Why first in the algorithm?
  - Loss of airway can result in death in < 3 minutes
  - Prolonged hypoxia = Inadequate perfusion, End-organ damage
- Airway Assessment
  - Vital Signs = RR, O2 sat
  - Mental Status = Agitation, Somnolent, Coma
  - Airway Patency = Secretions, Stridor, Obstruction
  - Traumatic Injury above the clavicles
  - Ventilation Status = Accessory muscle use, Retractions, Wheezing
- Clinical Pearls
  - Patients who are speaking normally generally do not have a need for immediate airway management
  - Hoarse or weak voice may indicate a subtle tracheal or laryngeal injury
  - Noisy Respirations frequently indicates an obstructed respiratory pattern

Airway Interventions

- Maintenance of Airway Patency
  - Suction of Secretions
  - Chin Lift/Jaw thrust
  - Nasopharyngeal Airway
  - Definitive Airway
- Airway Support
  - Oxygen
  - NRBM (100%)
  - Bag Valve Mask
  - Definitive Airway
- Definitive Airway
  - Endotracheal Intubation
    - In-line cervical stabilization
  - Surgical Crichothyroidotomy

PD-INEL Source undetermined



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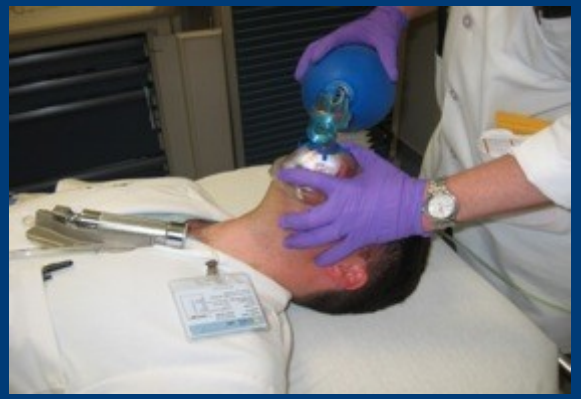
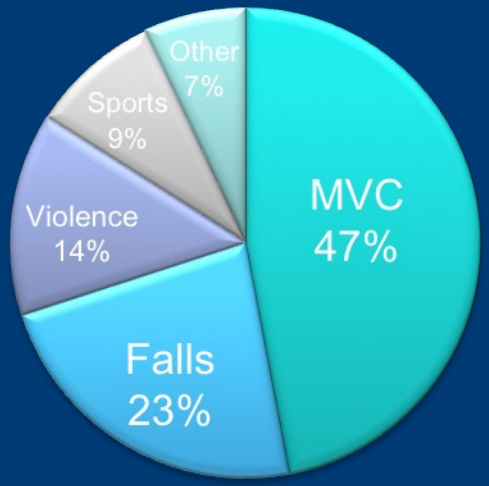


Protection of Spinal Cord

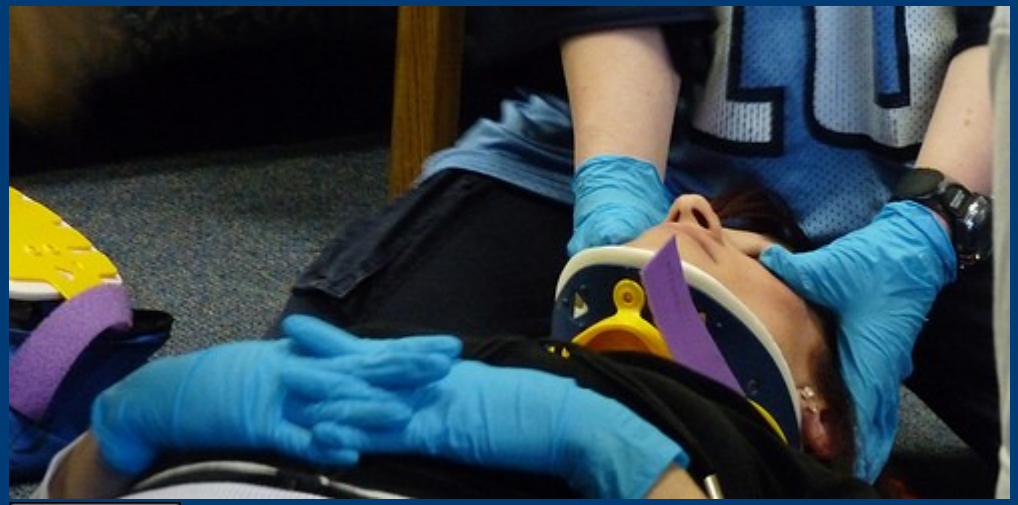
- **General Principle:** Protect the entire spinal cord until injury has been excluded by radiography or clinical physical exam in patients with potential spinal cord injury.
- Spinal Protection
  - Rigid Cervical Spinal Collar = Cervical Spine
  - Long rigid spinal board or immobilization on flat surface such as stretcher = T/L Spine
- Etiology of Spinal Cord Injury
  - Road Traffic Accidents (47%)
  - High energy falls (23%)
- Clinical Pearls
  - Treatment (Immobilization) before diagnosis
  - Return head to neutral position
  - Do not apply traction
  - Diagnosis of spinal cord injury should not precede resuscitation
  - Motor vehicle crashes and falls are most commonly associated with spinal cord injuries
  - Main focus = Prevention of further injury



Cervical spine Immobilization

- Return head to neutral position
- Maintain in-line stabilization
- Correct size collar application
- Blocks/tape
- Sandbags

Source: www.ossur.com/bracesandsupports/neckandspine/prehospit...oncollars/phillyblockhead Accessed 9/20/09 Yahoo Images

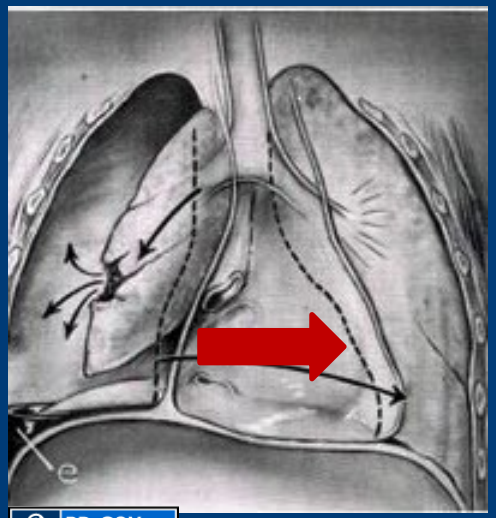


Paladinsf (flickr)

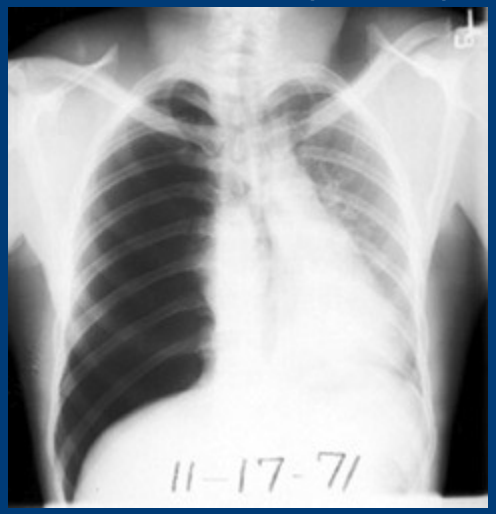
Breathing and Ventilation

- General Principle: Adequate gas exchange is required to maximize patient oxygenation and carbon dioxide elimination
- Breathing/Ventilation Assessment:
  - Exposure of chest
  - General Inspection
    - Tracheal Deviation
    - Accessory Muscle Use
    - Retractions
    - Absence of spontaneous breathing
    - Paradoxical chest wall movement
  - Auscultation to assess for gas exchange
    - Equal Bilaterally
    - Diminished or Absent breath sounds
  - Palpation
    - Deviated Trachea
    - Broken ribs
    - Injuries to chest wall

Breathing and Ventilation



PD-GOV **Delldot** (wikimedia)



PD-INEL

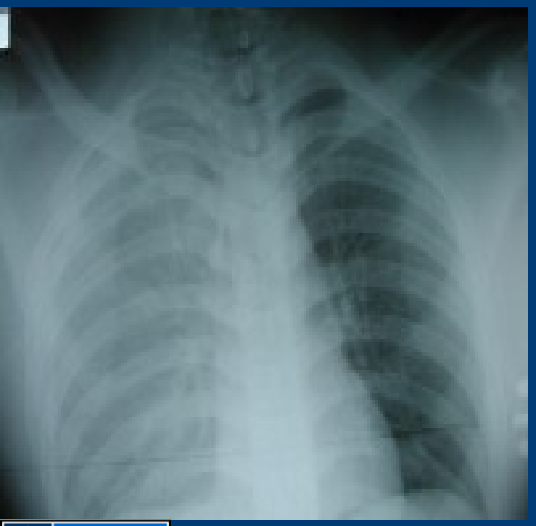
Source: www.meddean.luc.edu lumenMedEd/medicine/pulmonar/cxr/pneumo1.htm
Accessed 9/20/09 – Yahoo Images

Identify Life Threatening Injuries

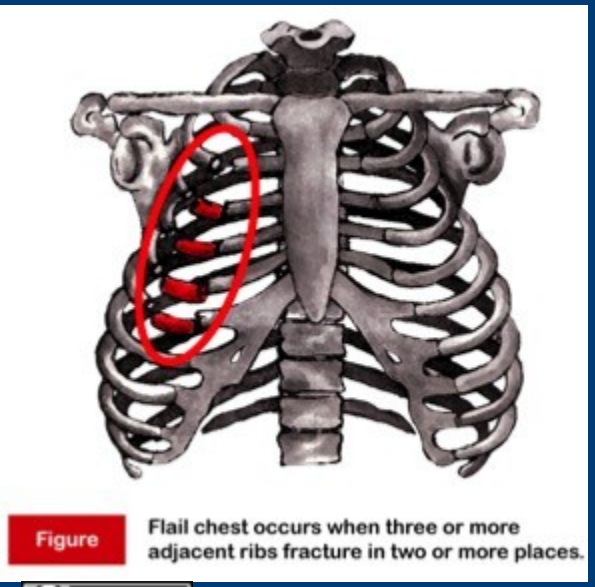
- Tension Pneumothorax
  - Air trapping in the pleural space between the lung and chest wall
  - Sufficient pressure builds up and pressure to compress the lungs and shift the mediastinum
  - Physical exam
    - Absent breath sounds
    - Air hunger
    - Distended neck veins
    - Tracheal shift
  - Treatment
    - Needle Decompression
      - 2nd Intercostal space, Midclavicular line
    - Tube Thoracostomy
      - 5th Intercostal space, Anterior axillary line

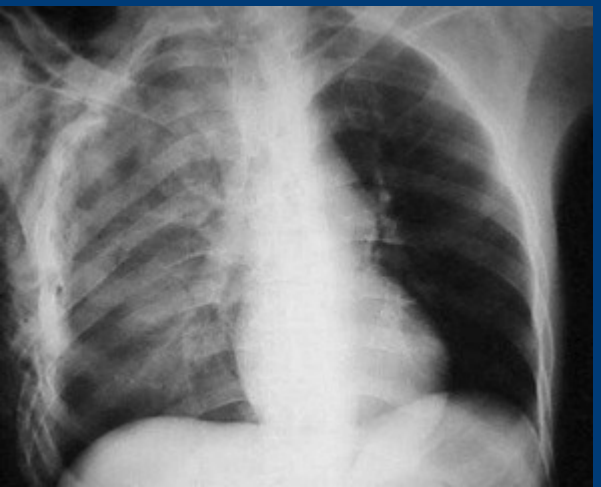
Breathing and Ventilation

- Hemothorax
  - Blood collecting in the pleural space and is common after penetrating and blunt chest trauma
  - Source of bleeding = Lung, Chest wall (intercostal arteries), heart, great vessels (Aorta), Diaphragm
  - Physical Exam
    - Absent or diminished breath sounds
    - Dullness to percussion over chest
    - Hemodynamic instability
  - Treatment = Large Caliber Tube Thoracostomy
    - 10-20% of cases will require Thoracotomy for control of bleeding



Breathing and Ventilation





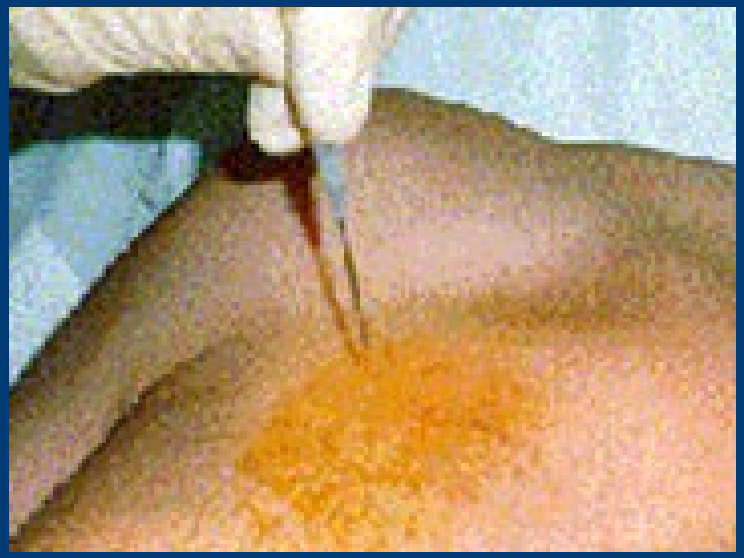
- Flail Chest
  - Direct injury to the chest resulting in an unstable segment of the chest wall that moves separately from remainder of thoracic cage
  - Typically results from two or more fractures on 2 or more ribs
  - Typically Accompanied by a pulmonary contusion
  - Physical Exam = Paradoxical movement of chest segment
  - Treatment = Improve Abnormalities in gas exchange
    - Early Intubation for patients with respiratory distress
    - Avoidance of overaggressive fluid resuscitation

Breathing and Ventilation

PD-GOV

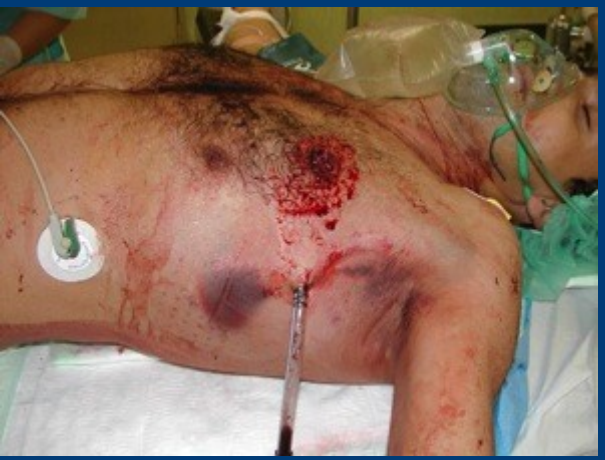
- Open Pneumothorax
  - Sucking Chest Wound
  - Large defect of chest wall
    - Leads to rapid equilibration of atmospheric and intrathoracic pressure
    - Impairs oxygenation and ventilation
  - Initial Treatment
    - Three Sided occlusive dressing
    - Provides a flutter valve effect
    - Chest tube placement remote to site of wound
    - Avoid complete dressing, will create a tension pneumothorax

Needle Thoracostomy



- Needle Thoracostomy
  - Midclavicular line
  - 14 guage angiocath
  - Over the 2nd rib
  - Rush of air is heard

Tube Thoracostomy



- Insertion site
  - 5th intercostal space,
  - Anterior axillary line
- Sterile prep, anesthesia with lidocaine
- 2-3 cm incision along rib margin with #10 blade
- Dissect through subcutaneous tissues to rib margin
- Puncture the pleura over the rib
- Advance chest tube with clamp and direct posteriorly and apically
- Observe for fogging of chest tube, blood output
- Suture the tube in place
- Complications of Chest Tube Placement
  - Injury to intercostal nerve, artery, vein
  - Injury to lung
  - Injury to mediastinum
  - Infection
  - Allergic reaction to lidocaine
  - Inappropriate Placement of chest tube

Circulation

- Shock
  - Impaired tissue perfusion
  - Tissue oxygenation is inadequate to meet metabolic demand
  - Prolonged shock state leads to multiorgan system failure and cell death
- Clinical Signs of Shock
  - Altered mental status
  - Tachycardia (HR > 100) = Most common sign
  - Arterial Hypotension (SBP < 120)
    - Femoral Pulse – SBP > 80
    - Radial Pulse – SBP > 90
    - Carotid Pulse – SBP > 60
  - Inadequate Tissue Perfusion
    - Pale skin color
    - Cool clammy skin
    - Delayed cap refill (> 3 seconds)
    - Altered LOC
    - Decreased Urine Output (UOP < 0.5 mL/kg/hr)

Circulation

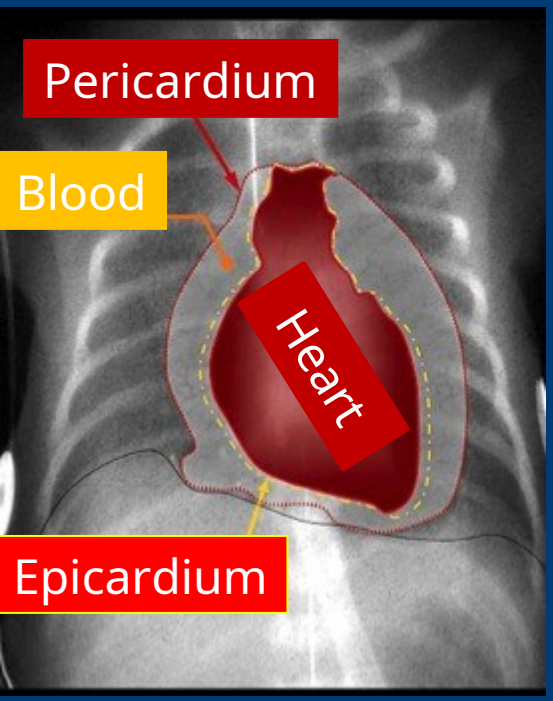
- Types of Shock in Trauma
  - Hemorrhagic
    - Assume hemorrhagic shock in all trauma patients until proven otherwise
    - Results from Internal or External Bleeding
  - Obstructive
    - Cardiac Tamponade
    - Tension Pneumothorax
  - Neurogenic
    - Spinal Cord injury
- Sources of Bleeding
  - Chest
  - Abdomen
  - Pelvis
  - Bilateral Femur Fractures

Circulation

- Emergency Nursing Treatment
  - Two Large IV Lines
  - Cardiac Monitor
  - Blood Pressure Monitoring
- General Treatment Principles
  - Stop the bleeding
    - Apply direct pressure
    - Temporarily close scalp lacerations
  - Close open-book pelvic fractures
    - Abdominal pelvic binder/bedsheet
  - Restore circulating volume
    - Crystalloid Resuscitation (2L)
    - Administer Blood Products
  - Immobilize fractures
- Responders vs. Nonresponders
  - Transient Response to volume resuscitation = sign of ongoing blood loss
  - Nonresponders = Consider other source for shock state or operating room for control of massive hemorrhage

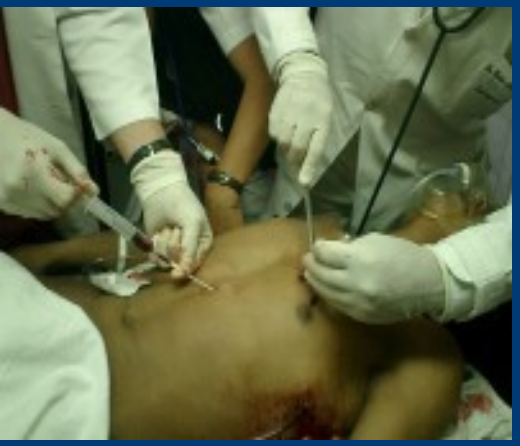
Circulation

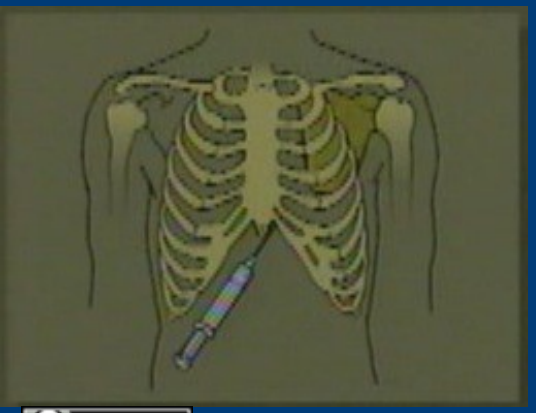
- Pericardial Tamponade
  - Pericardium or sac around heart fills with blood due to penetrating or blunt injury to chest
  - Beck's Triad
    - Distended jugular veins
    - Hypotension
    - Muffled Heart Sounds
  - Treatment
    - Rapid evacuation of pericardial space
    - Performed through a Pericardiocentesis (temporizing measure)
    - Open Thoracotomy



Aceofhearts1968 (Wikimedia)

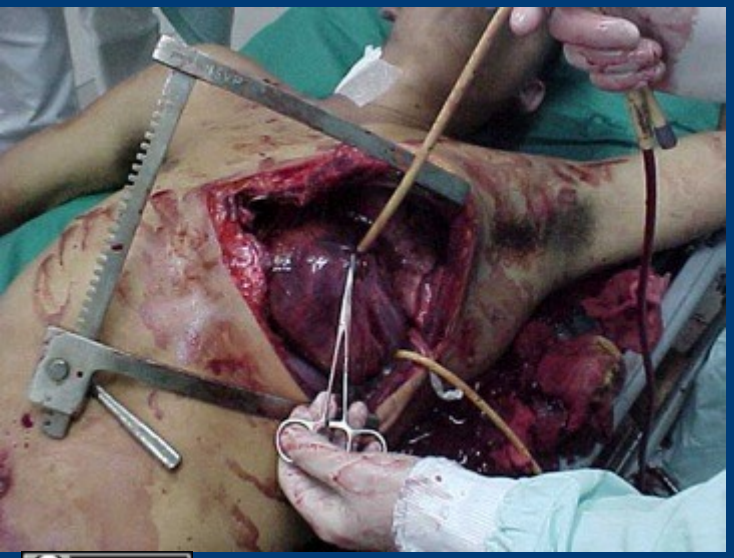
Pericardiocentesis





- Puncture the skin 1-2 cm inferior to xiphoid process
- 45/45/45 degree angle
- Advance needle to tip of left scapula
- Withdraw on needle during advance of needle
- Preferable under ultrasound guidance or EKG lead V attachment
- Complications
  - Aspiration of ventricular blood
  - Laceration of coronary arteries, veins, epicardium/myocardium
  - Cardiac arrhythmia
  - Pneumothorax
  - Puncture of esophagus
  - Puncture of peritoneum

Circulation



- A word about cardiac arrest . . .
  - Care of the trauma patient in cardiac arrest
    - CPR
    - Bilateral Tube Thoracostomy
    - Pericardiocentesis
    - Volume Resuscitation
  - Traumatic Cardiac Arrest due to blunt injury has very low survival rate (< 1%)
    - No point for emergency thoracotomy
  - Selected cases of cardiac arrest due to penetrating traumatic injury may benefit from emergent thoracotomy
    - Pericardial tamponade
    - Cross clamp Aorta

Disability

- Baseline Neurologic Exam
  - Pupillary Exam
    - Dilated pupil – suggests transtentorial herniation on ipsilateral side
  - AVPU Scale
    - Alert
    - Responds to verbal stimulation
    - Responds to pain
    - Unresponsive
  - Gross Neurological Exam – Extremity Movement
    - Equal and symmetric
    - Normal gross sensation
  - Glasgow Coma Scale: 3-15
  - Rectal Exam
    - Normal Rectal Tone
- Note: If intubation prior to neuro assessment, consider quick neuro assessment to determine degree of injury

Disability

GCS ≤ 8
Intubate

- Glasgow Coma Scale
  - Eye
    - Spontaneously opens 4
    - To verbal command 3
    - To pain 2
    - No response 1
  - Best Motor Response
    - Obeys verbal commands 6
    - Localizes to pain 5
    - Withdraws from pain 4
    - Flexion to pain (Decorticate Posturing) 3
    - Extension to pain (Decerebrate Posturing) 2
    - No response 1
  - Verbal Response
    - Oriented/Conversant 5
    - Disoriented/Confused 4
    - Inappropriate words 3
    - Incomprehensible words 2
    - No response 1

Disability

- Key Principles
  - Precise diagnosis is not necessary at this point in evaluation
  - Prevention of further injury and identification of neurologic injury is the goal
  - Decreased level of consciousness = Head injury until proven otherwise
  - Maintenance of adequate cerebral perfusion is key to prevention of further brain injury
    - Adequate oxygenation
    - Avoid hypotension
  - Involve neurosurgeon early for clear intracranial lesions

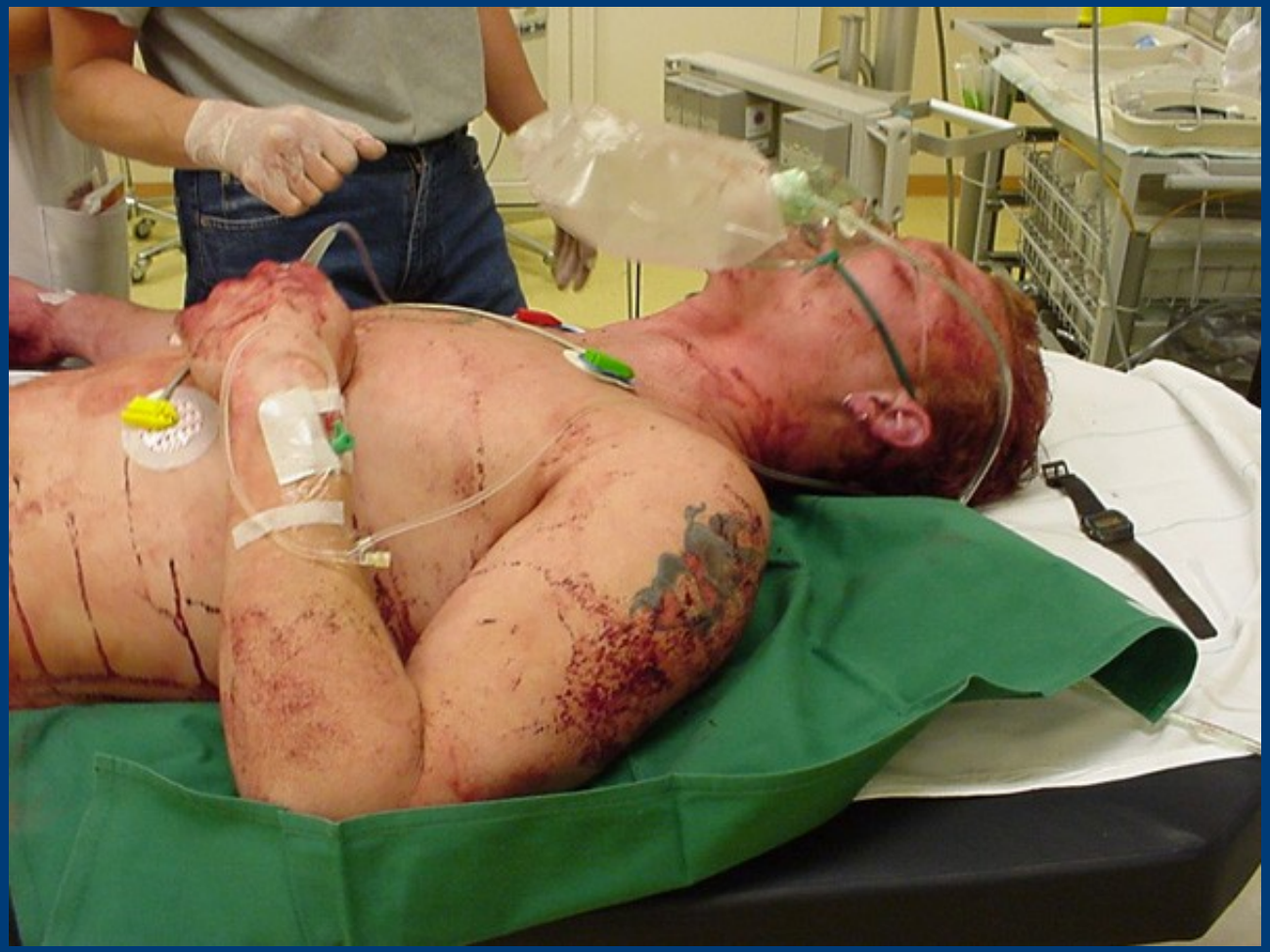
Disability

- Cervical Spinal Clearance
  - Patients must be alert and oriented to person, place and time
  - Not clinically intoxicated with alcohol or drugs
  - Non-tender at all spinous processes
  - No focal neurological deficits
  - No distracting injuries
  - Painless range of motion of neck

Exposure

- Remove all clothing
  - Examine for other signs of injury
  - Injuries cannot be diagnosed until seen by provider
- Logroll the patient to examine patient's back
  - Maintain cervical spinal immobilization
  - Palpate along thoracic and lumbar spine
  - Minimum of 3 people, often more providers required
- Avoid hypothermia
  - Apply warm blankets after removing clothes
  - Hypothermia = Coagulopathy
    - Increases risk of hemorrhage

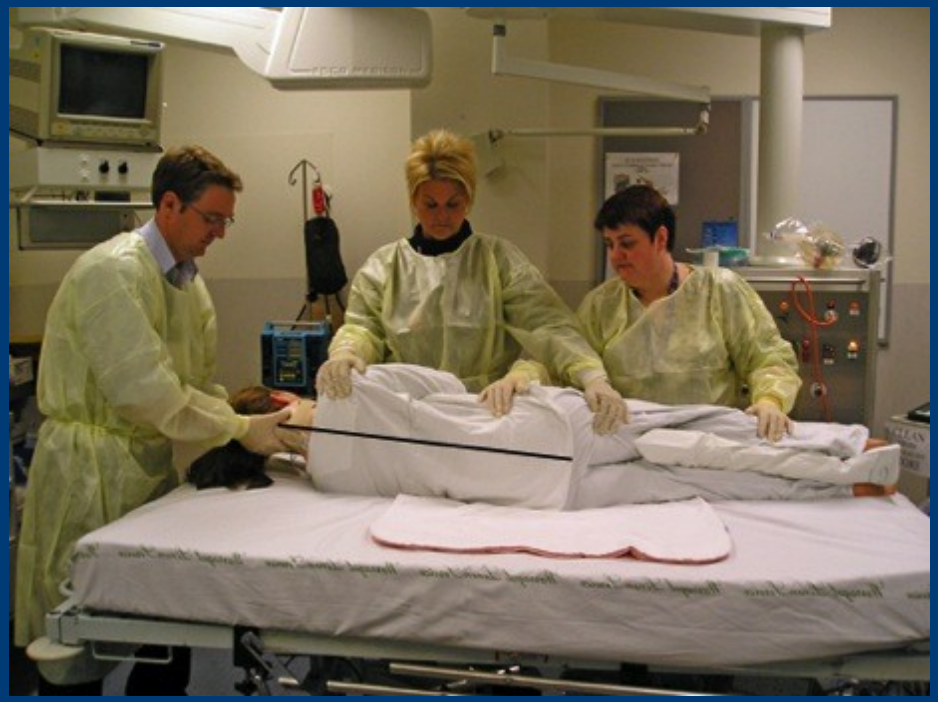
Exposure



Exposure

Trauma Logroll

- One person = Cervical Spine
- Two people = Roll main body
- One person = Inspect back and palpate spine



Secondary Survey

- Secondary Survey is completed after primary survey is completed and patient has been adequately resuscitated.
- No patient with abnormal vital signs should proceed through a secondary survey
- Secondary Survey includes a brief history and complete physical exam

History

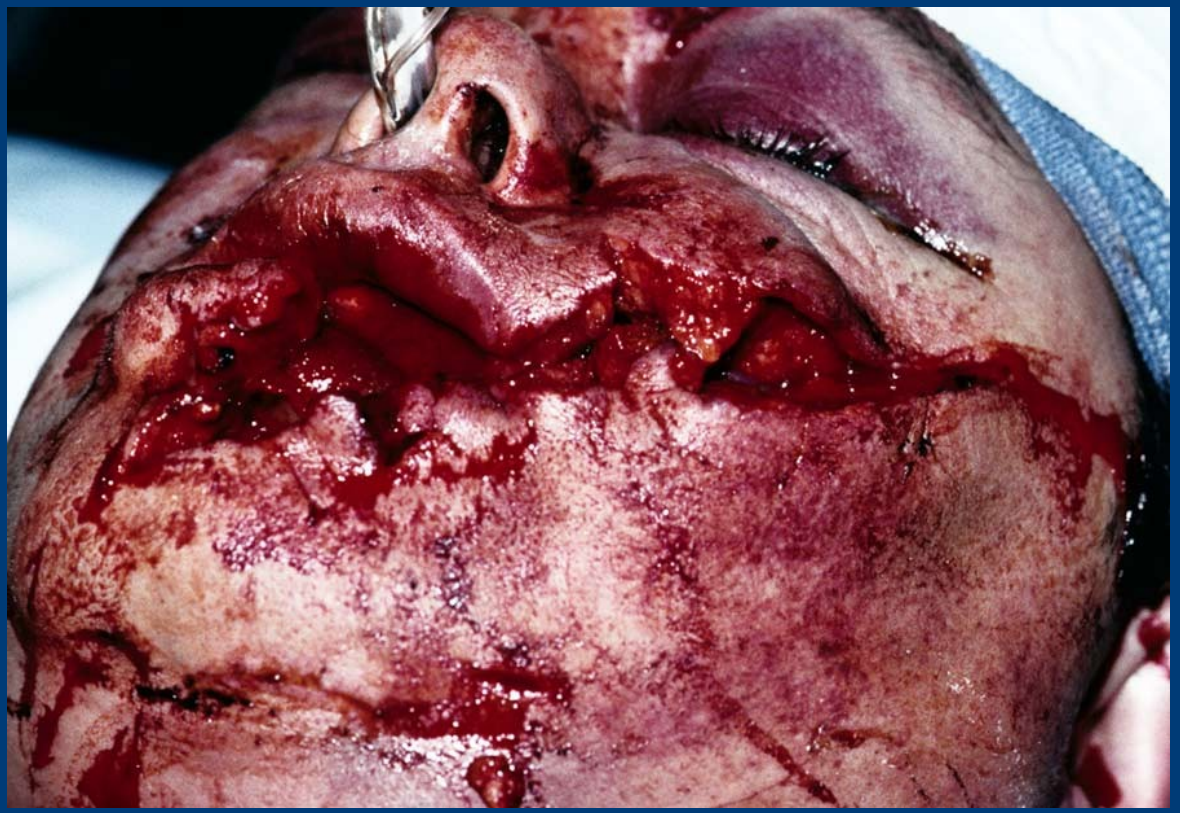
- AMPLE History
  - **A**llergies
  - **M**edications
  - **P**ast Medical History, Pregnancy
  - **L**ast Meal
  - **E**vents surrounding injury, Environment
- History may need to be gathered from family members or ambulance service

Physical Exam

- Head/HEENT
- Neck
- Chest
- Abdomen
- Pelvis
- Genitourinary
- Extremities
- Neurologic

Physical Exam

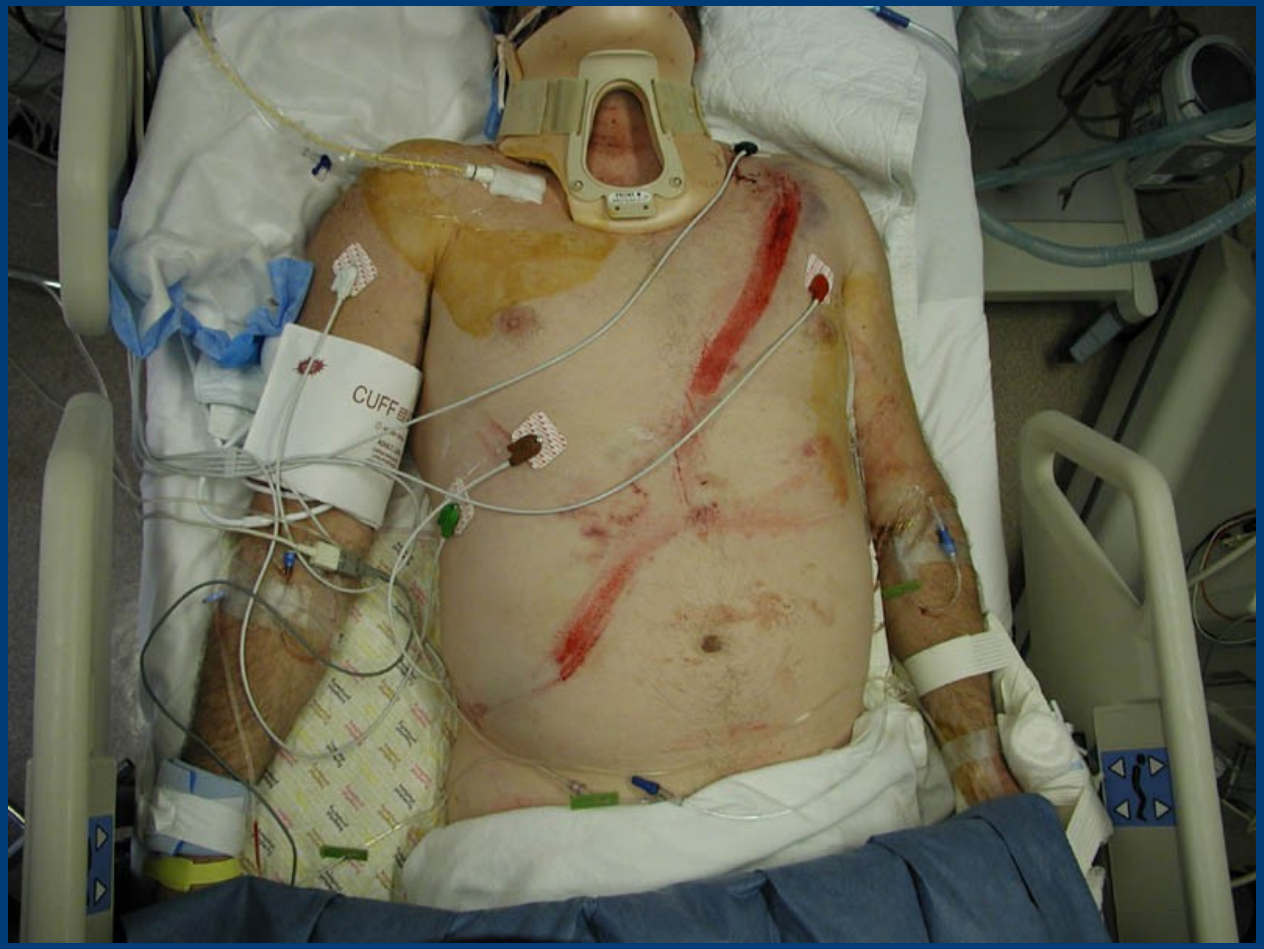
- Difficult Airway



Source Undetermined

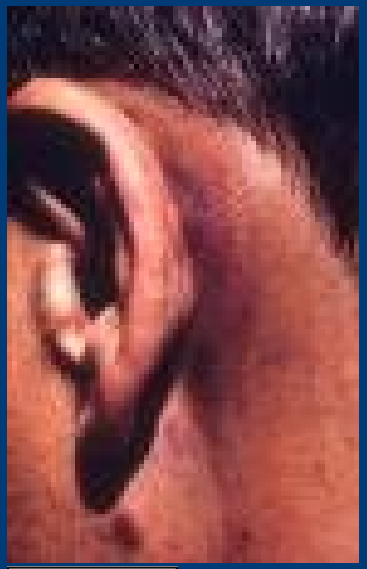
Physical Exam

- Seatbelt sign



Physical Exam

- Battle Sign
- Raccoon's Eyes
- Cullen’s Sign
- Grey-Turner Sign



H. L. Fred and H.A. van Dijk (Wikimedia)

Adjuncts to Secondary Survey

- Radiology
  - Standard emergent films
    - C-spine, CXR, Pelvis
  - ocused bdominal onography in rauma (FAST)
  - Additional films
    - Cat scan imaging
    - Angiography
- Foley Catheter
  - Blood at urethral meatus = No Foley catheter
- Pain Control
- Tetanus Status
- Antibiotics for open fractures

Trauma in Special Populations

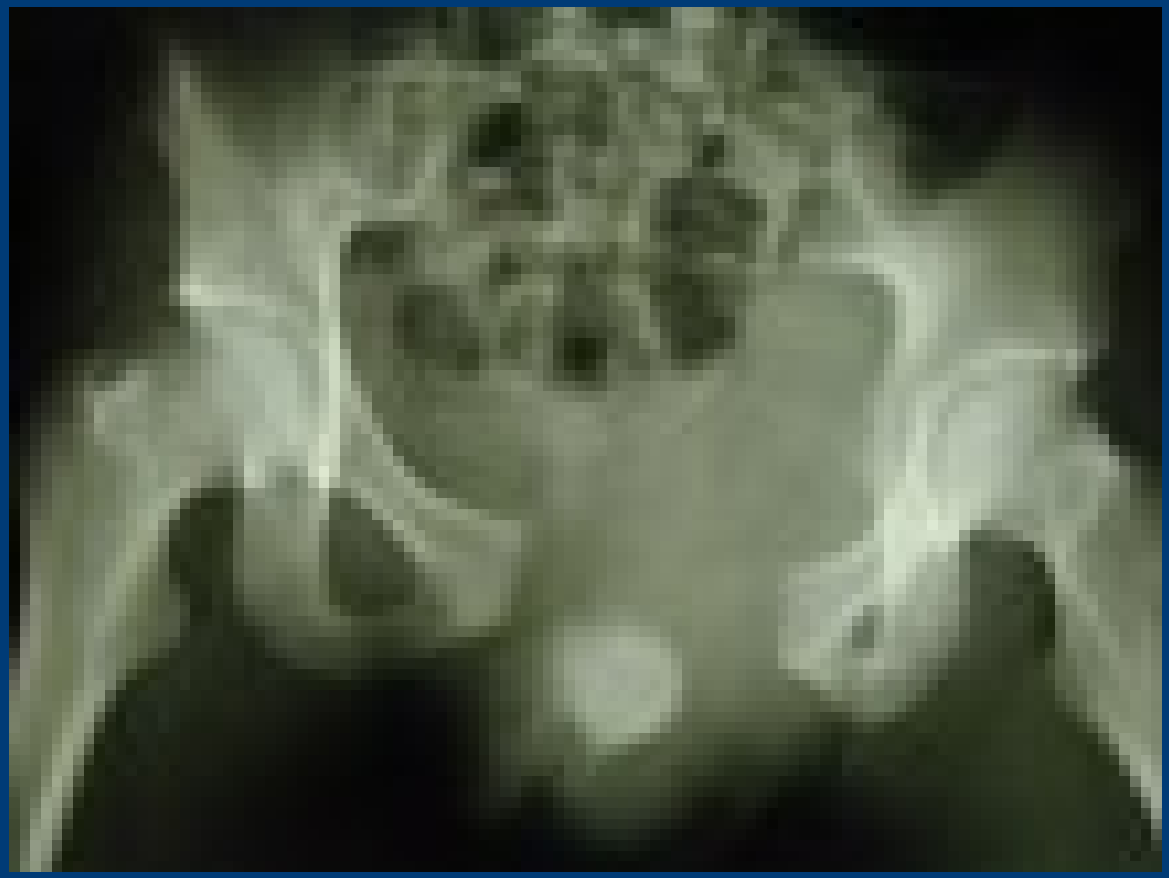
- Pregnancy
  - Supine Hypotensive Syndrome
    - After 20 weeks, enlarged uterus with fetus and amniotic fluid compresses inferior vena cava
    - Decreases venous return and decrease cardiac output
    - Keep pregnant patients in left lateral decubitus position to avoid excessive hypotension
  - Optimal maternal and fetal outcome is determined by adequate resuscitation of mother
  - Fetal Monitoring

Trauma in Special Populations

- Pediatric Trauma Resuscitation
  - Differences in head to body ratio and relative size and location of anatomic features make children more susceptible to head injury, abdominal injury
  - Underdeveloped anatomy leads to chest pliability and less protection of thoracic cage
  - Cardiac Arrest
    - Typically result from respiratory arrest degrading into cardiac arrest
  - Resuscitation
    - Broselow Tape
    - ABCDE

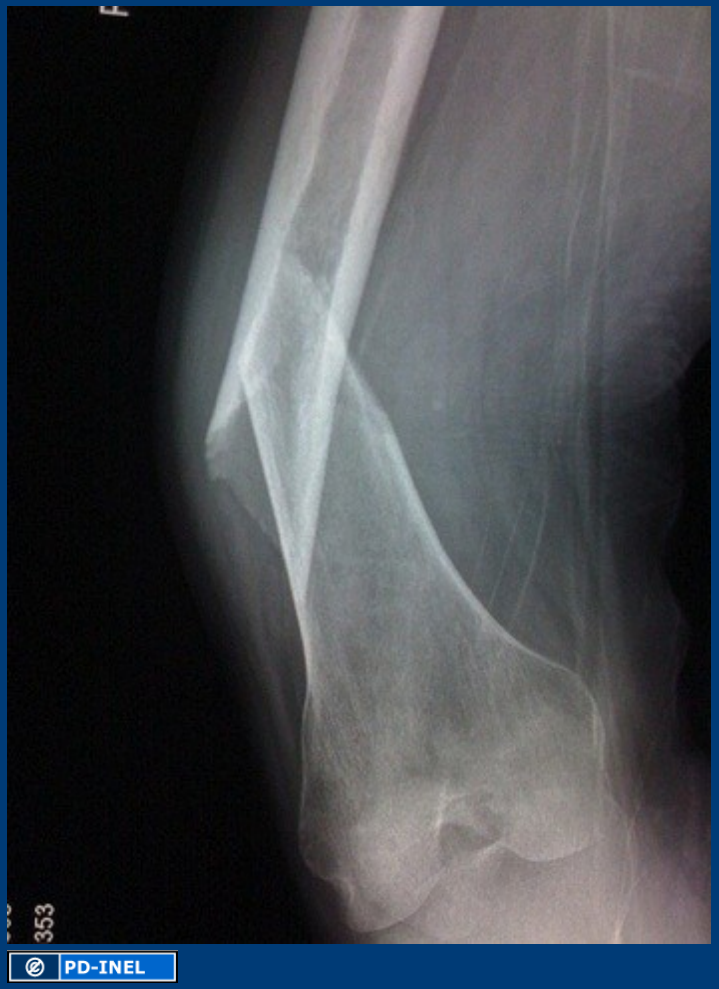
Classic Radiographical Findings

- Pelvic Fracture



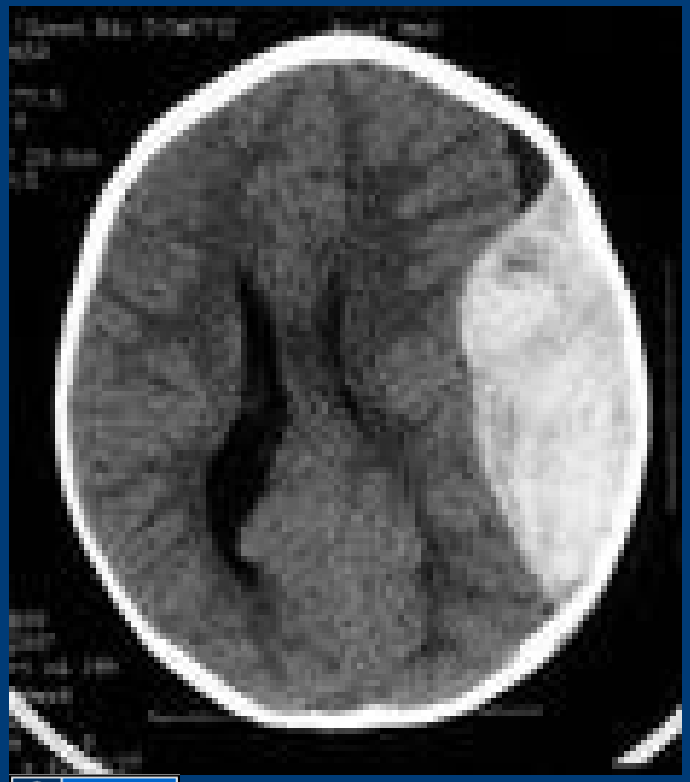
Classic Radiographic Findings

- Femur Fracture

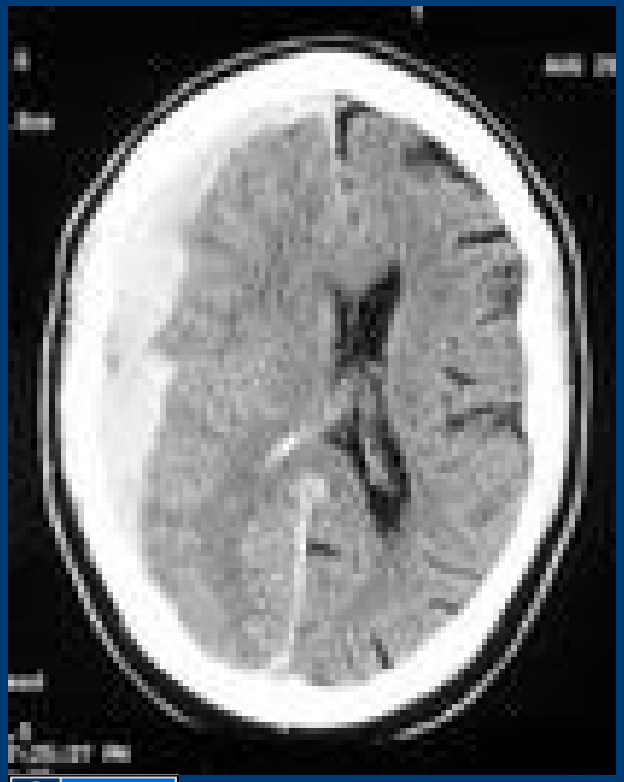


Classic Radiographic Findings

- Epidural Hematoma
  - Middle Meningeal Artery

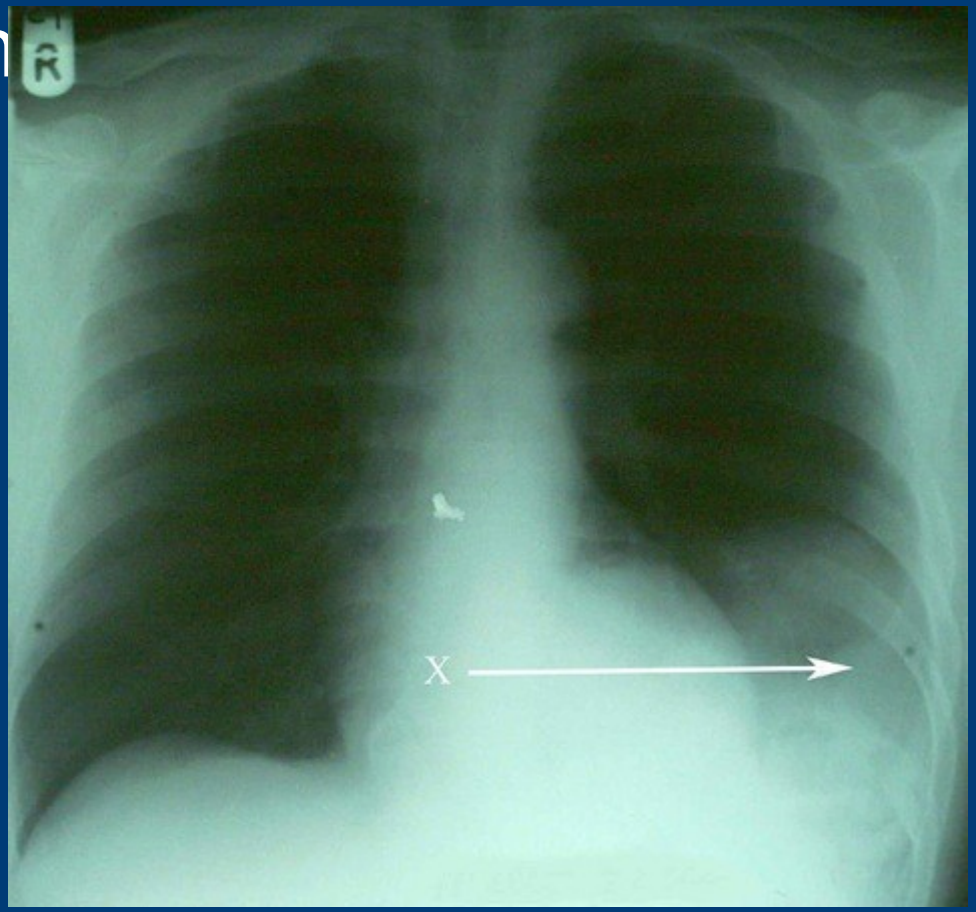


- Subdural Hematoma
  - Bridging Veins



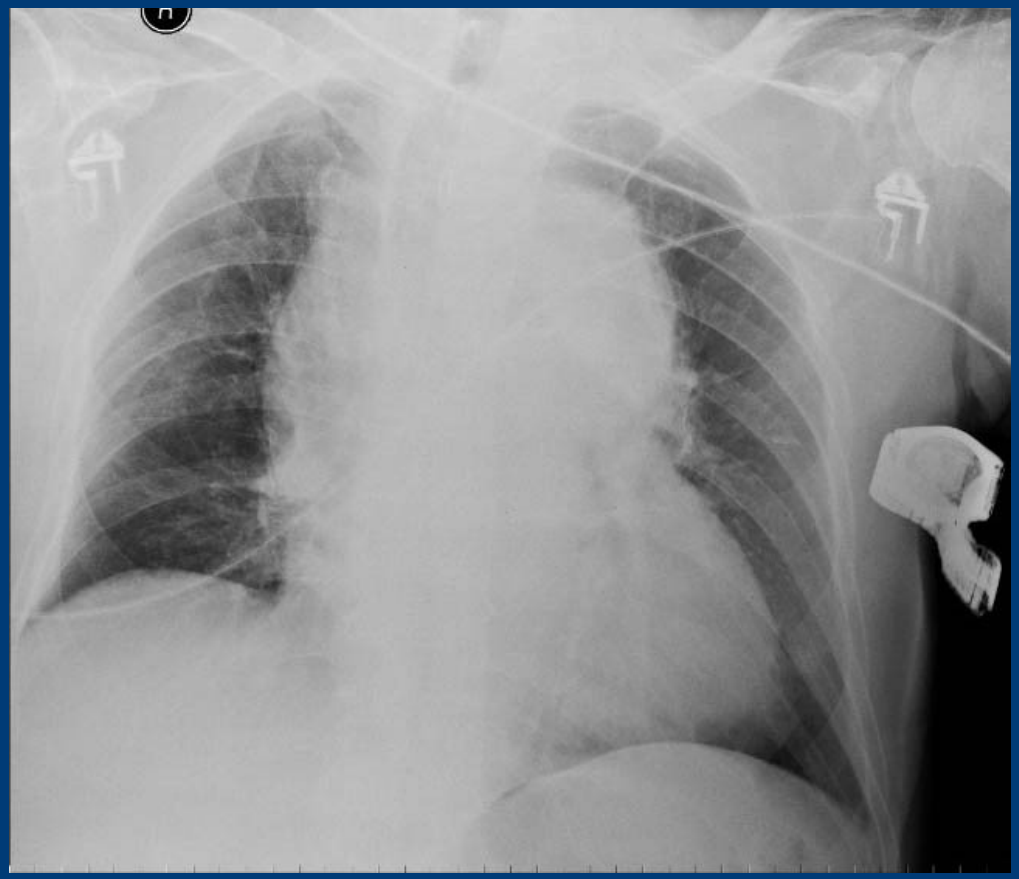
Classic Radiographic Findings

- Diaphragmatic Rupture with spleen herniation



Classic Radiographic Findings

- Widened Mediastinum – Aortic Injury



Definitive Care

- Secondary Survey followed by radiographic evaluation
  - CatScan
  - Consultation
    - Neurosurgery
    - Orthopedic Surgery
    - Vascular Surgery
- Transfer to Definitive Care
  - Operating Room
  - ICU
  - Higher level facility

Case Example

- Mr. Jones – 45 yr male involved in a rollover road traffic accident and was ejected from the vehicle. Patient was unrestrained. Patient was not ambulatory on scene of accident and is brought into trauma bay for evaluation.
  - What concerns you about story?
  - First Steps of Evaluation and Management

Pete Prodoehl (flickr)

Case Example

- Exam
  - Awake, diaphoretic
  - Pulse = 120
  - BP = 90/60
  - RR = 18
  - O2 sat = 94%
- What do you want to do next?

Case Example

- Preparation
- Primary Survey
  - Awake, alert, talking to provider
  - Breathing
    - Absent breath sounds on left
    - What do you want to do next?
  - Circulation
    - Vital Signs?
    - Access?
    - Resuscitation?
  - IV/O2/Monitor
  - Disability
    - GCS = 14
  - Exposure

Case Example

- Chest tube placed
  - Rush of air heard consistent with pneumothorax
- Repeat Vital Signs
  - Pulse 120
  - BP 80/40
  - RR = 15
  - O2 sat = 99% NRBM
- What do you want to do next?
  - Patient complaining of abdominal pain
  - Ecchymosis noted over left flank
  - Resuscitation?

Case Example

- Blood Product Administration
- Transfer to definitive care = Operating Theatre

Conclusion

- Assessment of the trauma patient is a standard algorithm designed to ensure life threatening injuries do not get missed
- Primary Survey + Resuscitation
  - Airway
  - Breathing
  - Circulation
  - Disability
  - Exposure
- Secondary Survey
- Definitive Care