

PAEDIATRIC FORENSIC MEDICINE AND PATHOLOGY

Edited by

Anthony Busuttill

*Emeritus Regius Professor of Forensic Medicine, University of Edinburgh; and Medical Director,
Forensic Medical Services, NHS Lothian, Edinburgh, UK*

Jean W Keeling

*Formerly Consultant Paediatric Pathologist, Royal Hospital for Sick Children,
Edinburgh, UK*

 **HODDER
ARNOLD**
PART OF HACHETTE LIVRE UK

CRC Press
Taylor & Francis Group
6000 Broken Sound Parkway NW, Suite 300
Boca Raton, FL 33487-2742

© 2008 by Taylor & Francis Group, LLC
CRC Press is an imprint of Taylor & Francis Group, an Informa business

No claim to original U.S. Government works
Version Date: 20121026

International Standard Book Number-13: 978-1-4441-0973-3 (eBook - PDF)

This book contains information obtained from authentic and highly regarded sources. Reasonable efforts have been made to publish reliable data and information, but the author and publisher cannot assume responsibility for the validity of all materials or the consequences of their use. The authors and publishers have attempted to trace the copyright holders of all material reproduced in this publication and apologize to copyright holders if permission to publish in this form has not been obtained. If any copyright material has not been acknowledged please write and let us know so we may rectify in any future reprint.

Except as permitted under U.S. Copyright Law, no part of this book may be reprinted, reproduced, transmitted, or utilized in any form by any electronic, mechanical, or other means, now known or hereafter invented, including photocopying, microfilming, and recording, or in any information storage or retrieval system, without written permission from the publishers.

For permission to photocopy or use material electronically from this work, please access www.copyright.com (<http://www.copyright.com/>) or contact the Copyright Clearance Center, Inc. (CCC), 222 Rosewood Drive, Danvers, MA 01923, 978-750-8400. CCC is a not-for-profit organization that provides licenses and registration for a variety of users. For organizations that have been granted a photocopy license by the CCC, a separate system of payment has been arranged.

Trademark Notice: Product or corporate names may be trademarks or registered trademarks, and are used only for identification and explanation without intent to infringe.

Visit the Taylor & Francis Web site at
<http://www.taylorandfrancis.com>

and the CRC Press Web site at
<http://www.crcpress.com>

CONTENTS

<i>Contributors</i>	<i>xiii</i>
<i>Preface</i>	<i>xiv</i>
<i>Acknowledgements</i>	<i>xv</i>
<i>List of abbreviations used</i>	<i>xvi</i>
1 Clinical assessment in suspected child abuse	1
<i>Helen Hammond</i>	
Introduction	1
Alerting signs	2
Types of abuse	3
The need for comprehensive assessment	4
Significant harm	4
The interagency context (flow chart of process)	5
Joint working and the complementary skills of paediatricians and forensic specialists	6
Legislation	7
Consent and confidentiality	8
The process – joint paediatric/forensic examination	8
Documentation and report writing	16
Interpretation of the findings	17
Formulating an opinion	21
Ongoing health care	21
Involvement in ongoing legal and child-care processes	22
References	22
2 Investigation of suspected sexual abuse	24
<i>Jacqueline YQ Mok</i>	
Introduction	24
The colposcope in the medical examination	27
Forensic evidence	27
Skills and experience required	28
Consistent vocabulary	29
Normal female genital anatomy	29
Perianal findings	36
Acute, healing and healed anogenital trauma	37
Female genital findings in sexual abuse	38
Signs of anal abuse	39
Conditions that mimic abuse	40
Screening for sexually transmitted infections	41
Interpretation of clinical and laboratory findings	42
Summary	43
References	44

3	Radiology of child abuse	47
	<i>Maeve McPhillips</i>	
	Role of the radiologist	47
	Radiological investigations	48
	Skeletal injuries	51
	Head injury	60
	Visceral injuries	68
	Soft-tissue injury	69
	Differential diagnosis	69
	Conclusion	73
	References	73
4	Haematological abnormalities that can simulate abuse	76
	<i>Angela Thomas</i>	
	Introduction	76
	Primary haemostasis	78
	Secondary haemostasis	79
	Laboratory tests	81
	Measurements of primary haemostasis	82
	Evaluation of a bleeding patient	82
	Patterns of abnormal results	86
	Normal coagulation screen with a normal platelet count	90
	Abnormalities of platelet number or morphology	94
	Coagulation defects	96
	The neonate	97
	Drugs associated with bleeding	98
	Bone marrow failure syndromes	99
	Systemic disease associated with a bleeding tendency	100
	Activation of coagulation	101
	Conclusion	101
	References	102
5	Biochemical investigations on post-mortem specimens	106
	<i>Denis R Benjamin</i>	
	Introduction	106
	General evaluation	107
	Hypoxia	109
	Inflammation	109
	Anaphylaxis	109
	Infection	110
	Dehydration and electrolytes	110
	Time of death (post-mortem interval)	111
	Endocrine disorders	112
	Genetic metabolic disorders presenting as sudden unexpected death	114
	Technical considerations at the time of autopsy	117
	References	120
6	Ocular involvement in non-accidental injury	125
	<i>Harry Willshaw</i>	
	Introduction	125
	Scope of ocular and adnexal injury	125

Fundus haemorrhages	128
References	134
7 The death scene following the sudden death of a child	137
<i>Anthony Busuttil</i>	
Introduction	137
Scene management	137
The crime scene manager	138
Sequence of events at the death scene	139
Unclothing the body	139
A good look around	139
Sudden infant death syndrome or non-sudden infant death syndrome	140
External petechiae	140
Bruising	140
Abandoned neonates	140
Deaths from trauma	141
Dyadic and multiple deaths	141
Sudden deaths of older children	142
Sensitivity and stress of the investigation	142
Inquests and inquiries	143
References	143
8 Post-mortem examination in babies and children	145
<i>Jean W Keeling</i>	
Introduction	145
Death scene investigation	145
Rectal temperature	146
Medical and family history	146
Other important information	146
Radiological examination	146
Photography	147
Microbiological samples	148
Toxicological investigations	149
Biochemical and metabolic investigations	149
Weights and measurements	150
External examination	150
Estimating blood loss	152
Dissection (infants and older children)	152
Examination of the brain, spinal cord and eye	156
Examination of the newly born	158
Histological samples	162
Retention of organs	163
Exchange of information and multidisciplinary review	163
References	164
9 Pathology of neurological abnormality in early life	166
<i>Waney Squier</i>	
Introduction	166
Clinical manifestations of early brain damage: cerebral palsy	167
Timing of injuries by histology	167

Acquired intra-uterine damage	169
Birth-related injury	173
Stroke in the developing brain	176
Metabolic disorders	177
Infections	177
References	178
10 Fetal and perinatal death	180
<i>Jean W Keeling</i>	
Introduction	180
Definitions	180
The law	181
Background information	182
Concealed pregnancy	182
Unattended delivery	182
Was the baby born alive?	183
Is the baby of sufficient maturity to survive?	187
Is there evidence of prolonged or difficult labour?	187
Are there any significant injuries?	188
Fetal death following maternal injury	190
Is there a natural cause for death?	193
Can I give a cause of death?	193
Should the intrapartum still birth be a medicolegal autopsy?	194
References	195
11 Sudden unexpected death in infancy: sudden infant death syndrome or something else?	198
<i>Jean W Keeling</i>	
Introduction	198
The definition of SIDS	199
Epidemiology	201
Sleeping environment	203
Pathological findings in SUDI	205
Death certification	218
References	219
12 Sudden natural death in infants and children	225
<i>Dick Variend</i>	
Introduction	225
Cardiovascular causes of sudden death	226
X-linked hypohidrotic (anhidrotic) ectodermal dysplasia	235
Intracranial haemorrhage, neoplasms and malformations	236
Gastrointestinal causes	239
Fatal anaphylaxis	239
Sickle cell disease	240
Haemorrhage as a cause of sudden death	240
Respiratory causes of sudden death	240
Epilepsy and sudden death	242
Deaths from acute asthma	243

Diabetes mellitus	243
Genetic metabolic disorders	244
Other bacterial infections	247
Deaths related to obstetric events and premature birth	248
Miscellaneous causes of sudden natural death	248
Sudden unexplained death in older children	249
Sudden natural death in the early neonatal period	249
Sudden death associated with 'intermediate' pathology	249
References	250
13 Recent advances in paediatric toxicology	256
<i>Patrice Mangin and Christian Giroud</i>	
Scope of the problem	256
Specificity of paediatric toxicology	258
Techniques used in drug testing	259
Special techniques for analysis of volatile substances	262
Alternative specimens for drug testing	262
Pitfalls and limitations of drug screens	267
Specific applications	271
The importance of paediatric toxicology in specific cases	274
Conclusions and future considerations in forensic paediatric toxicology	274
References	275
14 Head and neck injuries	282
<i>Robert A Minns and TY Milly Lo</i>	
Definition	282
Epidemiology	283
Non-accidental head injury	294
Traumatic birth injury	300
Primary mechanisms of injury to the brain	302
Secondary mechanisms of brain injury	307
Injury to the cervical spinal cord	311
Genetic influence on recovery from traumatic brain injury	312
References	313
15 Heat-induced injury or death	318
<i>Anthony Busuttill</i>	
Introduction	318
House fire deaths	318
The pathologist's role	319
References	327
16 Asphyxial deaths in children	329
<i>Anthony Busuttill</i>	
Petechiae	329
Scene of death	330
Traumatic asphyxia in children	330
Entrapment asphyxia	330
Foreign body inhalation	330

Plastic bag asphyxia	331
Overlaying and wedging	331
Strangulation	331
Hanging by a ligature	332
Drowning and near drowning	332
Imposed airways obstruction	332
Abuse of inhalants (solvent abuse)	333
Reverse suspension	333
Chemical asphyxia	333
Prevention	333
References	334
17 Accidental injuries in children	336
<i>Anthony Busuttill</i>	
Overview of paediatric trauma	336
Bicycle helmets	338
Falls	339
Playground injuries	340
Sports injuries on snow and ice	340
Riding injuries	341
Agricultural injuries	341
Prevention	341
Older children and substance abuse	341
Accidental poisoning	342
Hypersensitivity	342
References	342
18 Drowning and near drowning	345
<i>John Pearn</i>	
Introduction	345
The causes of childhood drowning: a perspective	345
The drowning medium	346
The pathophysiology of drowning	349
Forensic immersion syndromes	351
References	359
19 Sudden death of children in hospital	362
<i>Jem Berry</i>	
Introduction	362
Definition and frequency	362
Deaths due to natural disease	363
Deaths due to failure to monitor	365
Therapeutic misadventures	366
Deaths due to drug treatment	366
Deaths due to medical devices and procedures	368
Deaths in the dental chair	371
Sudden death in newborn babies	371
Accidents	372
Suicide	373
Filicide and homicide in hospital	373

	Investigation of sudden unexpected death of children in hospital	375
	References	377
20	Road traffic accidents in children	385
	<i>Anthony Busuttill</i>	
	Road traffic fatalities	385
	Investigation of a fatal road traffic collision	387
	Vehicular collisions	390
	Other supervening problems in collisions	391
	Pedestrian injuries	392
	Child cyclists	392
	Diffuse axonal injury	393
	Whiplash injuries	393
	Injuries to children <i>in utero</i>	393
	Other vehicular accidents	393
	References	394
21	Forensic DNA profiling in cases involving children	395
	<i>Alex M Graham and David J Harrison</i>	
	Introduction	395
	Inheritance of genetic material	395
	Forensic DNA analysis: history and techniques	398
	Sample collection and processing	402
	DNA evidence and child sexual offence	403
	Y chromosome short tandem repeat typing	405
	Mixed samples	406
	Additional sample problems and solutions	407
	Mitochondrial DNA	407
	Paternity testing	408
	Identification of body remains and missing persons	411
	Identification of the 'abandoned baby' or fetal material and avenues for identifying the source of an unknown profile	413
	DNA databases	414
	References	414
22	The dentist's role in child abuse and neglect	420
	<i>David Whittaker</i>	
	Introduction	420
	Dental neglect	422
	Facial and oral pathology	422
	The dentist accused of child abuse	425
	Bite marks	425
	References	432
23	Paediatric dental identification	435
	<i>G Howard Moody</i>	
	Introduction	435
	Comparison	435
	Facial reconstruction and dental profiling	440

Age estimation	441
References	444
24 The expert witness and expert testimony	447
<i>Anthony Busuttil</i>	
Introduction	447
Mission statement of the expert	448
Claim to expertise	449
Professional witnesses	449
Opinions	450
Yes or no?	450
Admissibility of expert evidence	450
Communications from the expert witness	452
Declaration by the expert in the report	452
In the witness stand or box	453
Pre-trial communication	453
Conflict of interest	454
Rules of evidence	454
Conclusion	454
Recent developments	454
References	455
<i>Appendix A: Child protection examination forms</i>	<i>457</i>
<i>Appendix B: Tables of standard measurements</i>	<i>471</i>
<i>Index</i>	<i>485</i>



CONTRIBUTORS



Denis R Benjamin

Department of Laboratories
Cook Children's Medical Center
Fort Worth, TX, USA

Jem Berry

Formerly Professor in Paediatric Pathology
Directorate of Pathology
St Michael's Hospital
Bristol, UK

Anthony Busuttill

Formerly Emeritus Regius Professor of Forensic Medicine
University of Edinburgh; and
Medical Director
Forensic Medical Services
NHS Lothian
Edinburgh, UK

Christian Giroud

Institut Universitaire de Medicine Legale
Lausanne, Switzerland

Alex M Graham

Division of Pathology (Forensic Medicine)
University of Edinburgh
Edinburgh, UK

Helen Hammond

Consultant Paediatrician (Community)
Department of Community Child Health
St John's Hospital
Livingston, UK

David J Harrison

Professor of Pathology
Division of Pathology (Forensic Medicine)
The University of Edinburgh
Edinburgh, UK

Jean W Keeling

Formerly Consultant Paediatric Pathologist
Royal Hospital for Sick Children
Edinburgh, UK

TY Milly Lo

Clinical Research Fellow
Department of Child Life and Health
The University of Edinburgh
Edinburgh, UK

Patrice Mangin

Institut Universitaire de Medicine Legale
Lausanne, Switzerland

Maeve McPhillips

Department of Radiology
Royal Hospital for Sick Children
Edinburgh, UK

Robert A Minns

Professor of Paediatric Neurology
Department of Child Life and Health
The University of Edinburgh
Edinburgh, UK

Jacqueline YQ Mok

Consultant Paediatrician
Department of Community Child Health
Royal Hospital for Sick Children
Edinburgh, UK

G Howard Moody

Consultant in Oral Pathology
Edinburgh Dental Institute
Edinburgh, UK

John Pearn

Professor of Paediatrics and Child Health
The University of Queensland
Royal Children's Hospital
Herston, Queensland, Australia

Waney Squier

Consultant Neuropathologist
Radcliffe Infirmary
Oxford, UK

Angela Thomas

Consultant Paediatric Haematologist
Royal Hospital for Sick Children
Edinburgh, UK

Dick Variend

Consultant Paediatric Pathologist (retd)
The Children's Hospital
Sheffield, UK

David Whittaker

Emeritus Professor in Forensic Dentistry
University of Wales
Cardiff, UK

Harry Willshaw

Consultant Paediatric Ophthalmologist
The Birmingham Children's Hospital
Birmingham, UK



PREFACE



The possibility that a child may have been injured, abused, neglected or otherwise ill treated rightly raises the indignation and anxiety of the caring professions and involves law enforcement agencies. However, in the interests of justice and fairness, a person accused of such injury or neglect is entitled to appropriate legal representation at any hearing and is deemed to be innocent until proven guilty. Quite frequently, dubiety and uncertainty linger about whether or not, in any specific situation, observations made, clinically or pathologically, can be interpreted solely as a manifestation of inflicted injury or neglect, or whether there is a possibility that the observed findings could have come about in other, non-criminal, circumstances. These matters necessitate advice from those with experience and expertise in this field.

The aim of this book is to furnish an authoritative, comprehensive text to assist practitioners of medicine and the law dealing with such cases in the appropriate interpretation of these matters and to enable clinical and pathological findings to be presented in an unbiased and dispassionate manner so that the courts are able to better evaluate the specialist evidence put before them.

The investigation and interpretation of findings of alleged ill treatment of infants and children requires a multidisciplinary approach, centred on the child, his or her well-being in both the short term and longer term, as well as that of any siblings within the same environment. All of the available information about any incident must be carefully collected, collated and evaluated. Laboratory data, both clinical and forensic, the results of radiological investigations and information from the examination of the scene where any incident took place should be carefully sought and evaluated against the clinical findings. A team approach is essential, with close collaboration of family physicians, paediatricians involved in both community and hospital practice, the clinical forensic medical examiner and specialist pathologists, together with police and social welfare services. No incident should be looked at in isolation but rather in the context of the child's development and interaction with his or her family, environment and peer group. The survivors of inflicted injury or neglect in childhood must be carefully followed up, protected and their family unit supported.

In this book, some of the topics covered here are relevant specifically to maltreatment in early life, beginning with the examination of an infant or child for whom abuse is suspected, incorporating the family environment and set against criteria for normal development. The difficult problem of suspected sexual abuse of children is considered separately. The extensive clinical experience of the authors of the opening chapters is readily apparent, highlighting, as they do, the pitfalls of incomplete investigation and ill-considered interpretation. The appropriate level of investigation of specific findings, interpretation of investigations and consideration of differential diagnoses are addressed in chapters contributed by a paediatric radiologist, a haematologist and a clinical pathologist, respectively. Those areas requiring specialist clinical expertise and experience – the eyes, mouth and central nervous system – are considered by specialists in those fields with extensive paediatric experience. The examination of the scene of death or injury is discussed as a background to post-mortem examination of the very young. The interpretation of cerebral pathology in the newborn, the investigation of sudden or suspicious perinatal death and sudden death in both infants and older children are addressed by experienced practitioners. Separate consideration is given to sudden or suspicious deaths that occur in hospital.

In subsequent chapters, more general areas of forensic pathology, including asphyxia and thermal injury, drowning, injury to road users and other accidents are addressed from a paediatric viewpoint. A similar approach is evident in the chapters covering toxicological investigation, DNA profiling and dental identification.

The book concludes with consideration of the role of the expert witness in criminal judicial cases and the provision of reports in the civil medicolegal context.

Although the majority of contributors to this text are UK based, the subject matter is presented, as far as possible, without national or geographic bias, so that the contents have international relevance.

Anthony Busuttil
Jean W Keeling
January 2008

ACKNOWLEDGEMENTS

We would like to thank our contributing authors for their hard work and for their patience and ready responses in the light of requests for updates and answers to specific queries. Colleagues in Edinburgh and elsewhere in the UK have read the Editors' contributions and made useful suggestions. JWK thanks Dr Roger Malcomson for his assistance

and expertise in the preparation of the illustrations for her chapters. We would like to thank the many staff at Hodder Arnold with whom we have been involved for their expertise and encouragement; in particular, Philip Shaw and our Project Editor Amy Mulick for their most helpful suggestions in the late stages of manuscript completion.

LIST OF ABBREVIATIONS USED

AA	amino acid	CPP	cerebral perfusion pressure
A&E	accident and emergency	CPR	cardiopulmonary resuscitation
AC	alternating current	CPT	cumulative pressure–time index
ACD	acid–citrate–dextrose	CPT II	carnitine palmitoyltransferase type II
ACTH	adrenocorticotrophic hormone	CPT1D	carnitine palmitoyltransferase type 1 deficiency
ADH	antidiuretic hormone	CPT2D	carnitine plamitoyltransferase type 2 deficiency
ADP	adenosine diphosphate	CSF	cerebrospinal fluid
ADPKD	autosomal dominant polycystic kidney disease	CSM	crime scene manager
AIDS	acquired immune deficiency syndrome	CT	computerized tomography
ALTE	apparent life-threatening events	CVP	central venous pressure
APOE	apolipoprotein E	CVR	cerebrovascular resistance
aPTT	activated partial thromboplastin time	CZE	capillary zone electrophoresis
ARDS	adult respiratory distress syndrome	DAB	DNA Advisory Board
ARVD	arrhythmogenic right ventricular dysplasia	DAI	diffuse axonal injury
ATP	adenosine triphosphate	DAVID	disaster and victim identification
AV	atrioventricular	DC	direct current
AvDO ₂	arteriovenous difference of oxygen	DIC	disseminated intravascular coagulation
βAPP	beta amyloid precursor protein	DMF	decayed, missing and filled teeth
BPA	British Paediatric Association	DNA	deoxyribonucleic acid
BPNA	British Paediatric Neurology Association	DRVVT	dilute Russell's viper venom time
BUN	blood urea nitrogen	DVD	digital versatile disc
CACTD	carnitine acylcarnitine translocase deficiency	ECF	extracellular fluid
CAP	common approach pathway	ECG	electrocardiogram
CAPMI	computer-assisted post-mortem identification	EDH	extradural haemorrhage
CASK	carer-associated serial killing	EDTA	ethylenediaminetetraacetic acid
CBF	cerebral blood flow	EEG	electroencephalography
CD	compact disc	EFE	endocardial fibroelastosis
CESDI	Confidential Enquiry into Stillbirth and Deaths in Infancy	ELISA	enzyme-linked immunosorbent assay
SUDI	Sudden Unexpected Death in Infancy	EM	electron microscopy
CFAM	cerebral function analysing monitor	EMIT	enzyme-multiplied immunoassay technique
CFTR	cystic fibrosis transmembrane conductance regulator	EPP	polypropylene
CHD	congenital heart disease	EPS	expanded polystyrene
CHIRPP	Canadian Hospital Injury Reporting and Prevention Program	EPU	expanded polyurethane
CI	confidence interval	ERG	electroretinography
CK1	cytokeratin 1	ESR	erythrocyte sedimentation rate
CMRO ₂	cerebral metabolic rate for oxygen	EVG	elastic van Geison stain
CMV	cytomegalovirus	FAO	fatty acid oxidation
CNS	central nervous system	FBI	Federal Bureau of Investigation
CNV	copy number variation	FDP	fibrinogen degradation product
COHB	carboxyhaemoglobin	FHM	familial hemiplegic migraine
CODIS	Combined DNA Index System	FII	fabricated or induced illness
CPI	combined paternity index	FLAIR	fluid-attenuated inversion recovery
		FPIA	fluorescent polarization immunoassay

FPP	fitness to practice panel	MDA	3,4-methylenedioxyamphetamine
GAS	group A streptococcal infection	MDMA	3,4-methylenedioxymethamphetamine
GC-MS	gas chromatography-mass spectrometry	MECC	micellar electrokinetic capillary chromatography
GCS	Glasgow Coma Scale	MELAS	mitochondrial encephalomyopathy
GDP	general dental practitioner	MERRF	myoclonic epilepsy with ragged red fibres
GI	gastrointestinal	MFV	mean flow volume
GMC	General Medical Council	MPS	mucopolysaccharide
GMD	genetic metabolic disorder	MRI	magnetic resonance imaging
GOS	Glasgow Outcome Score	mtDNA	mitochondrial DNA
GSD	glycogen storage disease	MS/MS	tandem mass spectrometry
		MSUD	maple syrup urine disease
HbF	fetal haemoglobin	MVC	motor vehicle collision
HCM	hypertrophic cardiomyopathy	MVF	mean flow volume
HDN	haemorrhagic disease of the newborn		
HE	haematoxylin and eosin (e.g. HE stain)	NAAT	nucleic acid amplification test
HELLP	haemolysis, elevated liver enzymes, low platelets	NAHI	non-accidental head injury
		NAI	non-accidental injury
HIE	hypoxic-ischaemic encephalopathy	NAIT	neonatal alloimmune thrombocytopenia
HII	hypoxic-ischaemic injury	NEC	necrotizing enterocolitis
HIV	human immunodeficiency virus	NEQAS	National External Quality Assessment Scheme
HLH	haemophagocytic lymphohistiocytosis		
HMWKS	high-molecular-weight kininogens	NICHD	National Institute of Child Health and Development
HPLC	high-performance liquid chromatography		
HPV	human papillomavirus	NKH	non-ketotic hyperglycinaemia
HSV	herpes simplex virus	NSPCC	National Society for the Prevention of Cruelty to Children
ICD	<i>International Classification of Diseases</i>	OECD	Organisation for Economic Co-operation and Development
ICH	intracranial haemorrhage	OI	osteogenesis imperfecta
ICP	intracranial pressure	OR	odds ratio
ICU	intensive care unit	OTS	ornithine transcarbamylase
IDDM	insulin-dependent diabetes mellitus	OXPHOS	oxidative phosphorylation
IgA	immunoglobulin A		
IgE	immunoglobulin E	Paco ₂	partial pressure of arterial carbon dioxide
IPH	idiopathic pulmonary haemosiderosis	PAI-1	plasminogen activator inhibitor-1
ISS	injury severity score	PBR	Perls' Prussian blue reaction
ITP	idiopathic thrombocytopenic purpura	PCR	polymerase chain reaction
ITU	intensive therapy unit	PDH	pyruvate dehydrogenase
IUGR	intrauterine growth restriction	PET	positron emission tomography
IVF	<i>in vitro</i> fertilization	PICA	posterior inferior cerebellar artery
IVH	intraventricular haemorrhage	PICU	paediatric intensive care unit
		PK	prekallikrein
LCAD	long-chain acyl-CoA deficiency	PL	phospholipid
LCN	low copy number	PM	post-mortem examination
LCHAD	long-chain 3-hydroxyacyl-CoA dehydrogenase	PMCTD	plasma membrane carnitine transporter deficiency
LQTS	long QT syndrome	PSA	phosphate-specific antigen
LM	laser microdissection	PT	prothrombin time
LoC	loss of consciousness	PTA	post-traumatic amnesia
LSD	lysergic acid diethylamide		
MADD	multiple acyl-CoA dehydrogenase deficiency	RBC	red blood cell
MAP	mean arterial pressure	RIA	radioimmunoassay
MCA	middle cerebral artery	RCPCH	Royal College of Paediatrics and Child Health
MCAD	medium chain acyl CoA dehydrogenase deficiency	RFLP	restriction fragment length polymorphism

RI	resistive index	TBI	traumatic brain injury
RiCoF	ristocetin cofactor	TBS	total body surface
RMP	random match probability	TCBD	Traumatic Coma Data Bank
RNA	ribonucleic acid	TCD	transcranial Doppler ultrasound
RPE	retinal pigment epithelium	T/E	testosterone–epitestosterone
RSV	respiratory syncytial virus	TF	tissue factor
		TFPD	trifunctional protein deficiency
SAH	subarachnoid haemorrhage	TFPI	tissue factor pathway inhibitor
SANDS	Stillbirth and Neonatal Death Society	TLC	thin-layer chromatography
SCAD	short-chain acyl-CoA dehydrogenase	TT	thrombin time
SCIWORA	spinal cord injury without radiographic abnormalities	TWGDAM	Technical Working Group on DNA Analysis Methods
SDH	subdural haemorrhage		
SIDS	sudden infant death syndrome	USFA	United States Fire Administration
SIO	senior investigating officer	UV	ultraviolet
SLR	single-lens reflex		
SNP	single nucleotide polymorphism	VEGF	vascular endothelial growth factor
SPD	storage pool disorder	VLCAD	very long-chain acyl-CoA dehydrogenase
SPECT	single photon emission computerized tomography	VLCFA	very long chain fatty acids
STI	sexually transmitted infection	VSA	volatile solvent abuse
STR	short tandem repeat	VWD	von Willebrand's disease
SUDEP	sudden unexpected death due to epilepsy	VWF	von Willebrand factor
SUDI	sudden, unexpected deaths in infancy	VWF:Ag	von Willebrand factor antigen
SWGDAM	Scientific Working Group on DNA Analysis Methods	WARD	weak agonist response defect
		WHO	World Health Organization
TAFI	thrombin activatable fibrinolysis inhibitor	YHRD	Y-STR haplotype reference database
TAR	thrombocytopenia with absent radii	Y-STR	short tandem repeat on the Y chromosome

CLINICAL ASSESSMENT IN SUSPECTED CHILD ABUSE

Helen Hammond

Introduction	1	Consent and confidentiality	8
Alerting signs	2	The process – joint paediatric/forensic examination	8
Types of abuse	3	Documentation and report writing	16
The need for comprehensive assessment	4	Interpretation of the findings	17
Significant harm	4	Formulating an opinion	21
The interagency context (flow chart of process)	5	Ongoing health care	21
Joint working and the complementary skills of paediatricians and forensic specialists	6	Involvement in ongoing legal and child-care processes	22
Legislation	7	References	22

INTRODUCTION

The diagnosis of abuse in children is a difficult intellectual and emotional exercise. It has been described as one of the most demanding tasks in clinical practice requiring time, experience and emotional energy.¹ One of the biggest barriers to the diagnosis is the continuing existence of emotional blocks in the minds of professionals. Paediatricians are accustomed to working in partnership with parents in identifying and treating their child's illness or injury and find it very hard to make the cognitive shift to suspecting that they are the cause of their child's suffering.² In some fields, for example infants presenting with intracranial bleeds or multiple fractures, the differential diagnosis between an underlying medical condition and non-accidental injury is fraught with difficulty. These cases are frequently strongly contested when they reach the Courts, further discouraging paediatricians from becoming involved.

This chapter will describe the knowledge required and the methodical process that needs to be followed in order not only to establish the diagnosis, but also to present the medical evidence in the most effective way in order to protect the child.

Historical Background

Recent years have seen the enactment of new legislation, both in England and in Scotland, concerning the care of

children and further legislation, particularly relating to protecting children from unsuitable adults and effective sharing of information, is expected. Children Acts north and south of the border highlight the responsibilities of parents in safeguarding and promoting their child's health and development as well as their rights to make decision.^{3–5} These Acts build on previous legislation and incorporate the principles of the UN Convention on Human Rights, placing increasing emphasis on the rights of the child to a safe and nurturing upbringing.⁶ The accompanying regulations remind us of the overarching principles on which the legislation has been based; those that are most relevant to the area of child abuse are laid out in Table 1.1.

The Children Act lays particular emphasis on the principle of minimum intervention. This, in the experience of some paediatricians, has led to greater difficulties in

Table 1.1 *Children Acts^{3–5} – overarching principles*

Each child has a right to be treated as an individual
Each child has a right to protection from all forms of abuse, neglect or exploitation
Each child has a right to express his or her personal views
Parents should normally be responsible for the upbringing of their children
Any intervention by a public authority in the life of a child must be properly justified

protecting children from harm in situations when abuse is highly likely to have occurred but a degree of doubt exists.⁷

An understanding of the different standards of proof that relate to civil and criminal proceedings is important to the paediatrician or pathologist in contributing to the child protection process. To secure a criminal conviction it must be proved beyond reasonable doubt that the defendant has abused or neglected the child; whereas in civil proceedings, for example proof of grounds of referral to a children's hearing system in front of the sheriff in the Scottish courts, the standard of proof required is on a balance of probabilities that the child has been ill treated or that a lack of care is likely to impede the child's physical or emotional development. It is possible to proceed therefore to protect the child even in a situation when it cannot be established who ill treated the child or whether there was any deliberate intent to harm (Schedule 1 Offence) or neglect the child.

Guidance for the improvement of our Child Protection Services, health and multi-agency, within the context of recent legislation, has also been given by the government.^{8,9} These documents have been influenced by the recommendations of major enquiries into the handling of cases, for example in Orkney and Cleveland, and, more recently, Lord Laming's Inquiry into the death of Victoria Climbié.¹⁰ The Scottish Executive Health Department produced new guidance in 2000 to promote the development of effective health services for the protection of children.¹¹ More recently, the Child Protection Reform Programme within the Scottish Executive produced a Framework for Standards for protecting children and young people together with a Children's Charter.¹² All the reports, guidelines and legislation emphasize the importance of close interagency working in child protection.

Definition

Table 1.2 sets out an all-embracing definition of abuse, drawing attention to the very considerable amount of abuse that results from omission of physical and emotional care as well as through deliberate ill treatment. It also highlights the impact of that abuse, not only on the immediate well-being of the child, but also on the child's ability to fulfil his or her potential in the longer term. Henry Kempe states '*Child abuse is the difference between a hand on the bottom and a fist in the face.*'¹³ This is very relevant when trying to make the difficult distinction between 'acceptable' punishment and abuse.

Table 1.2 A comprehensive definition of child abuse⁵⁹

Abuse of children is human-originated acts of commission or omission, and human-created or tolerated conditions that inhibit or preclude unfolding and development of the inherent potential of children

Source: David Gil (1981)

It is also important to consider the cultural setting. Roy Meadow reminds us that '*a child is considered to be abused if he or she is treated in a way that is unacceptable in a given culture at a given time.*'¹ The last two clauses are important because not only are children treated differently in different countries, but also within a country; even within a city there are subcultures of behaviour and variations of opinion about what constitutes abuse of children. Standards have also changed over the years with corporal punishment, for example, much less acceptable in Britain now than 10 years ago.

Prevalence

Four per cent of children up to the age of 12 years are brought to the notice of professional agencies (Social Services, Police, National Society for the Prevention of Cruelty to Children [NSPCC]) because of suspected abuse. Studies have also shown that each year at least one child per 1000 under the age of 4 years suffers severe physical abuse (e.g. fractures, subdural haemorrhage, severe internal injury); at present minimum mortality is estimated as 1 in 10 000 but the real figure is almost certainly significantly higher as many cases are undetected.¹⁴

The prevalence of sexual abuse is much less easy to determine accurately because it is so dependent on the definition, ranging from indecent exposure or inappropriate fondling to full penetrative abuse. The resultant damage is also very varied depending on the family situation of the child and whether or not the perpetrator is a family member. A very small proportion of sexual abuse investigations lead to criminal prosecution because of the particular difficulties in corroboration and interpretation of findings in these cases. Determination of the prevalence of emotional abuse, even when it is the main category of abuse for an individual child, is even more problematic.

Prevalence figures are based on samples of adults or parents describing their own or their children's experiences. Based on research reported in 2000 by the National Commission of Inquiry into the Prevention of Child Abuse and Neglect¹⁵ it is estimated that:

- at least 150 000 annually suffer severe physical punishment;
- up to 100 000 each year have a potentially harmful sexual experience;
- 350 000–400 000 live in an environment low in emotional warmth and high in criticism.

ALERTING SIGNS

Health professionals, particularly those working directly with children, may become aware that a child has been abused or neglected in many different ways. They must be alert to this possibility in their everyday clinical practice.

Table 1.3 *Alerting signs*

Unexplained delay in presentation
Changes in detail as the history is repeated
Evasiveness/anger when detail sought
Inconsistency between history and clinical findings/ developmental stage

Children may present directly to the health service with clear evidence of injury or a clear allegation of abuse, either by being brought to the accident and emergency department/taken to their general practitioner or through attendance at the outpatient department with a vague symptom such as abdominal pain or recurrent urinary tract symptoms. In any young child presenting to casualty injured but without an apparently adequate explanation it is very important to consider abuse among the differential diagnoses. A number of alerting signs are clearly recognized and are shown in Table 1.3. Unexplained delay in presenting the child for medical treatment is a very important factor particularly in very young children, as most parents rapidly seek attention if their child sustains any injury and particularly an injury to the head. In children who are under 2 years of age for whom an accidental cause for the injuries is being offered by the parents or carers, it is important to consider carefully whether the findings are consistent with the explanation: for example, could all the injuries have been caused by a simple fall from a swing or does the presence of injuries in different planes and of different ages make this impossible? Is the child at a developmental stage at which such an accident is possible? For example, children are frequently brought in with a number of fractures and described as having 'climbed out of their cot'. In a child of less than seven months of age who is not yet pulling to stand this cannot of course be the correct explanation. Parents giving a false explanation for injury frequently change their story or the detail of their story when pressed and particularly if interviewed separately. It is therefore extremely important that all explanations given are noted in detail in the contemporaneous notes, which should be clearly signed and dated so that such discrepancies can be preserved. This may ultimately be crucial to the success of any subsequent legal proceedings and therefore to the long-term protection of the child.

TYPES OF ABUSE

Seven types of abuse are recognized and these are shown in Table 1.4, together with an eighth category of multiple abuse. It is very important to remember that in many instances a child has been subjected to more than one form of abuse, for example a physically abused child may also be neglected or emotionally abused.

Table 1.4 *Types of abuse*

Physical abuse
Non-accidental head injury – 'shaken baby syndrome'
Physical neglect
Non-organic failure to thrive
Emotional abuse
Sexual abuse
Fabricated and induced illness

A sexually abused child is by definition also being emotionally abused. There are also some recognized associations in patterns of injury, for example sexual abuse may be accompanied by cigarette burns, particularly to the lower body, or injuries from restraining the child, bruising to the inner thighs or ligature marks to the ankles may be present (see Chapter 2). Non-organic failure to thrive has a category of its own separate from physical neglect. These conditions may of course coincide but a child who is physically well cared for may be failing to thrive for emotional reasons, while another child who is neglected in relation to cleanliness, clothing and social needs may maintain adequate rate of physical growth. Emotional abuse as the main cause of harm is extremely difficult to prove although studies increasingly suggest that emotional ill treatment is indeed a more potent cause of significant harm in terms of failure to fulfil potential for growth and development than physical ill treatment.¹⁶ The likelihood of associated emotional factors and overlapping forms of abuse is one of the main reasons why any clinical assessment of a child where abuse is suspected should be a comprehensive one, looking carefully at all aspects of the child's physical health, emotional well-being, growth and development in relation to that expected for his or her chronological age.

Fabricated or induced illness (FII) in a child by a carer (previously known as Munchausen's syndrome by proxy) is probably the most difficult form of abuse to diagnose and treat. There are three main forms, which are not mutually exclusive:

- Fabrication of signs and symptoms, for example the false description of seizures.
- Fabrication of signs and symptoms and falsification of hospital records/charts and specimens of bodily fluids, for example sugar or adult's blood in the child's urine.
- Induction of illness by a variety of means, for example adding salt to feeds or infusions.

International research suggests a very high incidence of death and morbidity in FII – up to 10 per cent of these children die and 50 per cent suffer long-term morbidity.¹⁷ The need for early multi-agency involvement in the identification and successful management of these cases has been emphasized in Government and RCPCH guidance.^{18,19}

THE NEED FOR COMPREHENSIVE ASSESSMENT

As in all other situations in medicine the diagnosis of child abuse is made on the basis of careful history-taking, including the birth history, past medical history, the developmental history and the family and social history as well as on thorough clinical examination and investigation. Serious mistakes may be made if examiners rush to examine a bruise, a burn or, worse still, the hymen or anus, without first taking a careful history not only of the alleged ill treatment or neglect, but also the child's previous history. Only if we approach the examination in this way will we be able to reach a conclusion not only regarding whether or not the child has been subjected to deliberate ill treatment, but also to whether or not the child has suffered or is likely to suffer significant harm. Figure 1.1 summarizes the factors relating to the child's overall health and development that need to be taken into consideration in determining harm. Consideration of this figure makes it clear that the conclusion is like putting together the pieces of a jigsaw, creating a picture of the child within his family and the local community. In order to do this all relevant background information needs to be gathered from the child's health visitor, general practitioner using parent-held records, primary care records and information from community child health and hospital records relating to previous health contacts. Information about the way in which the current incident presented from all those involved needs to be carefully documented, with, in particular, a verbatim account of the carer's description of the events and the symptomatology of the child at all stages. It is important to note that it is not necessary to explain all of the injuries on the basis of one incident. Active young children normally have some bruises on their body as a result of accidents, but several groups of injuries, particularly in locations not normally injured in accidents and particularly when a single accident is being offered as an explanation for all, would be very worrying.²⁰ It is

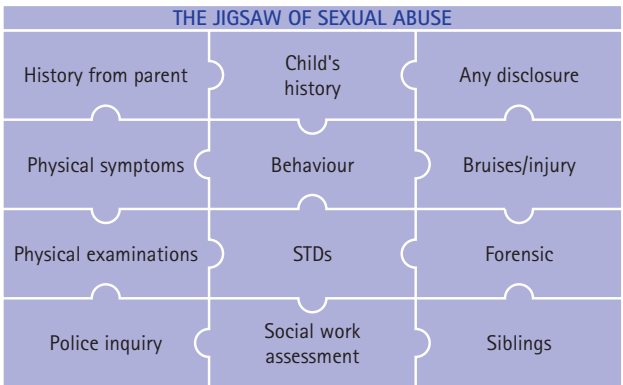


Figure 1.1 The 'jigsaw' in the diagnosis of sexual abuse. (From Hobbs CJ, Hanks HIG, Wynne JM. 1993 Child Abuse and Neglect. A Clinician's Handbook. Edinburgh: Churchill Livingstone, with permission.)



Figure 1.2 The shape of the bruise reflects that of the instrument used.

important to remember that the tiniest injury, which may be of no clinical significance, may be the one that confirms the diagnosis of non-accidental injury, for example a bruise with a clear imprint of the instrument used (Fig. 1.2).

Ultimately the case may be lost or won on the basis of the rigour of the clinical assessment. It is never possible to go back and look again, and it is important not to rely only on the quality of photographs that may not, for some reason, be available or may not show the injuries to be as extensive or worrying as apparent on clinical inspection.

SIGNIFICANT HARM

The term 'significant harm' was introduced into the legislation aimed at protecting children in the Children Act 1989 (England and Wales) and the Children (Scotland) Act 1995 in an attempt to distinguish those children for whom ill treatment and neglect have led or are likely to lead to significant morbidity, including long-term emotional and/or developmental impairment/disability or even death. Unfortunately, although it appears on almost every page of the Act, the term is never itself defined. Although at first sight it might be thought that establishing significant harm in terms of the medical findings and assessment would be much easier than from the legal or social perspectives, in practice it is rarely straightforward. Certainly when presented with a child looking like this (Fig. 1.3), there would seem little doubt; this little girl has a serious injury requiring hospitalization with a risk of long-term scarring. There would be little difficulty in concluding that not only has this child been seriously injured, but also that she has suffered significant harm and is at high risk of further injury if left in her present family situation. In contrast the assessment of a difficult teenager who admits to flouting his parents' authority, using bad language to upset them and returning the physical blows inflicted by his father is more difficult; significant bruising caused by, for example, a slap across the face and ear with full-thickness bruising



Figure 1.3 Inflicted burns on the lower leg of an infant.

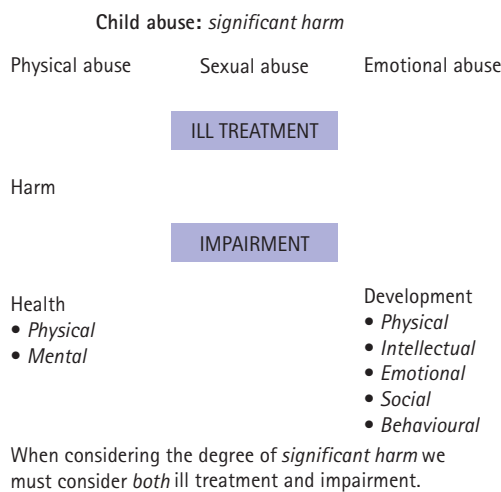


Figure 1.4 Considerations in the assessment of significant harm in the context of child abuse. (Courtesy of Dr MA Lynch, London.)

through the pinna suggests considerable force, but in the absence of previous concerns, physical, developmental or social within his family setting, the significant harm done appears slight and the level of ongoing risk low.

Therefore, as in many other situations in medicine, we are faced with a continuum of presenting signs and symptoms that requires a thoughtful and detailed approach to diagnosis and a clearly expressed opinion in order that we may contribute effectively to the protection of children who are indeed at risk of significant ongoing harm. Figure 1.4 reminds us that it is not only the immediate physical presentation of the child

that is important, but also the clues concerning the standard of care that the child has previously received that we gain from the rest of the physical and developmental assessment of the child, including evidence of long-term impairment from previous injuries or neglect. It reminds us that in many cases more than one kind of abuse is present and of the need to gather information from many sources to complete the picture.

THE INTERAGENCY CONTEXT (FLOW CHART OF PROCESS)

Years of experience and the results of a number of high-profile enquiries have confirmed that to be successful the medical assessment of the child must be an integrated part of the joint police/social work investigation. This ensures that the medical evaluation benefits from the availability of information from the early investigation and that it is timely both in the context of the health care of the child and the requirements of the police and social work processes. It also helps to ensure that the child is protected from unnecessary repeat examinations and the whole investigation is carried out in a child-friendly and sensitive way, ensuring not only appropriate immediate and ongoing health care but also that any medical evidence which is available is gathered effectively and can be used to protect the child whether through civil or criminal proceedings. In order to achieve this, clear and agreed interagency guidelines need to be in place to ensure discussion and meaningful collaboration from the earliest point of referral to the completion of criminal and care processes. Senior professionals in each of the agencies need to share information at the planning stage before any agency responds to the referral and at each subsequent stage thereafter. This process is depicted in Fig. 1.5 and starts with what is locally entitled the *initial (inter-agency) referral discussion* in which senior health, police and social work colleagues share the information relating to the child and family that is already available to their agency and plan the investigation (Fig. 1.6). This discussion usually takes place by phone and will agree the sequence, timing, venue and personnel to be involved in the interviewing and medical examination of the child, and the nature of that examination. In some situations a preliminary medical assessment of the child is required (by the general practitioner, accident and emergency doctor or general paediatrician) when information is vague and an accidental explanation or medical reason for the child's presenting symptomatology may be forthcoming on further enquiry.

In situations of disclosure of sexual abuse or serious physical injury the case should proceed immediately to specialist examination, bringing together paediatric and forensic skills to fulfil all the necessary functions of the comprehensive medical assessment together with evidence gathering in one examination. The timing of this will depend on many factors: medical, forensic and legal (e.g. the time

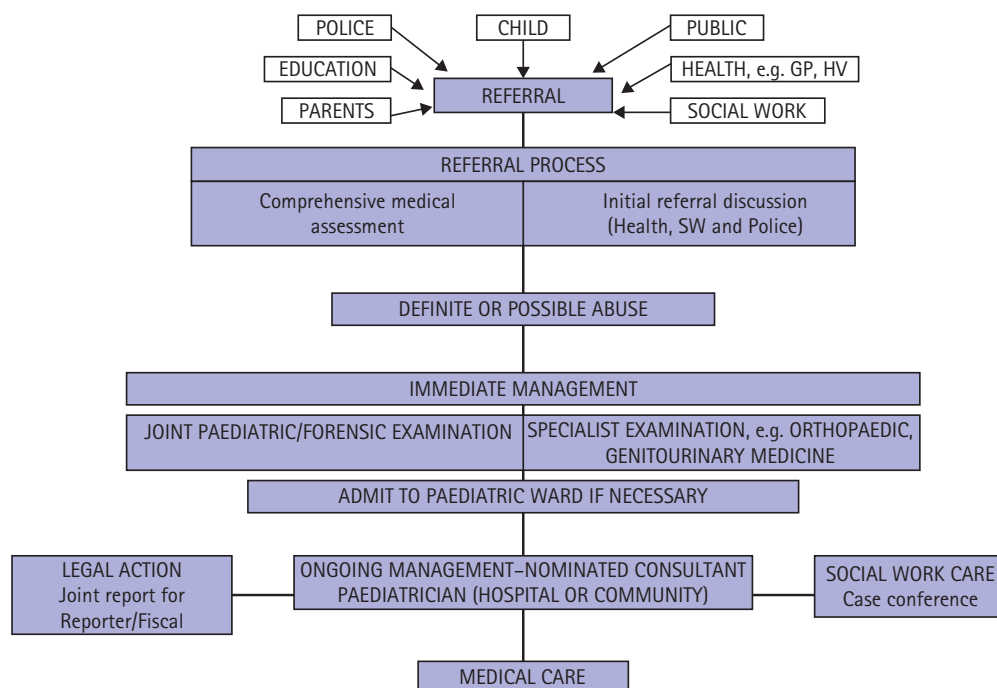


Figure 1.5 Flow chart illustrating the stages in medical assessment of children with suspected abuse or neglect. GP, general practitioner; HV, health visitor; SW, social worker.

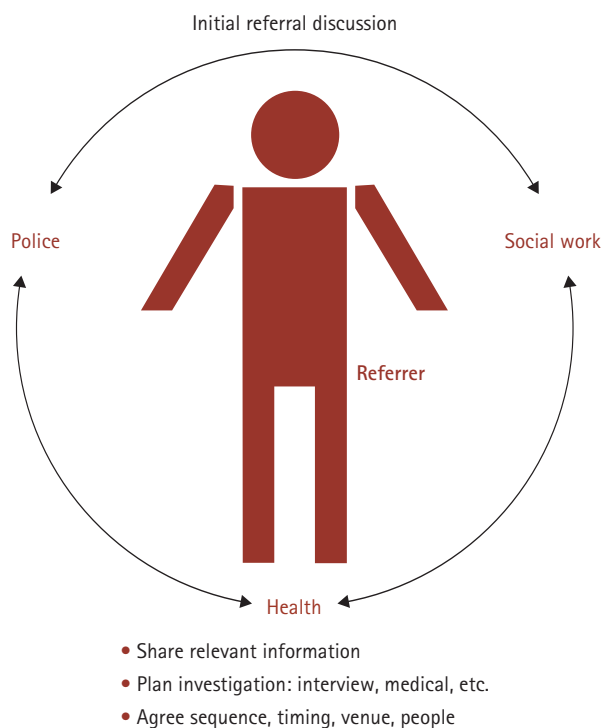


Figure 1.6 Interactions around the initial referral discussion.

between the incident and referral), the nature of the injury (e.g. head injury indicating the need for immediate evaluation) or forensic issues such as the need for immediate examination to secure all trace evidence in acute sexual assault.

The police may be constrained by timescales in relation to their criminal investigation, for example if they have

an alleged perpetrator in custody. In other situations, for example disclosure of historical abuse, a carefully planned interview followed by examination carried out electively during working hours, preferably in a planned specialist clinic, is in the child's and family's best interests.

Immediately following the examination, information concerning the immediate facts and preliminary opinion of the examiners must be made available to the police and their social work colleagues to inform their investigation and contribute to the decision-making about the immediate protection of the child while the investigation continues. In a minority of situations, the child's need for medical treatment will require admission to the ward and at other times a more complex picture of failure to thrive and developmental delay may also indicate the need for admission for further investigation and assessment. Examining doctors must also contribute to the social work child protection process by taking part in case conferences that are held to make decisions about registration on the Child Protection Register and the immediate and ongoing child protection plan, and input into the legal process either in the criminal courts or through the Children's Hearing system.

JOINT WORKING AND THE COMPLEMENTARY SKILLS OF PAEDIATRICIANS AND FORENSIC SPECIALISTS

The evaluation of sexual abuse and severe physical injury requires the involvement of doctors who are skilled in general and social paediatrics and in forensic medicine. The

skills, competencies and facilities required to undertake this are set out in joint guidance produced by the Royal College of Paediatrics and Child Health and Association of Forensic Physicians in April 2002 and updated in 2004.²¹ It is useful to remember that the term *forensic* means ‘the application of scientific methodology to the investigation of crime’, not simply the taking of samples for trace evidence. In most instances of serious physical assault and sexual abuse the working together of two doctors, a paediatrician and a forensic medical examiner (sometimes known as a police surgeon) will be required, bringing together the two sets of skills. Doctors work together in a complementary way, with the paediatrician playing the lead role in the assessment of the child’s development and his or her general physical health, whereas the forensic examiner assists with the description and interpretation of any injuries found, particularly in terms of their possible causation, i.e. whether the cause is likely to be accidental or non-accidental, likely timing and the degree of force required.

The forensic examiner will take the lead in collecting any samples that are required for forensic laboratory analysis, taking care to secure the chain of evidence. As far as possible, photographs of physical injuries should be taken by a police photographer when both doctors are present.

In children in whom sexual abuse is alleged or disclosed, the use of a colposcope with camera facility is essential, so that a continuous video or DVD recording (or series of still photographs) is available for further assessment and, where necessary, viewing by a medical expert instructed by the defence team in relation to any subsequent court procedure. Such recordings are invaluable for peer review. Joint examination also has the benefit of providing internal corroboration of the medical evidence, which is customary in other medicolegal practice. This is of particular importance in Scotland, where legal practice differs from English Common Law. However, clinicians generally find the support of another senior colleague very helpful in reaching an informed opinion in what are so frequently difficult and highly charged circumstances. Appropriate training is obviously of utmost importance, together with ongoing opportunities for continuing medical education and peer review.

The roles of the medical assessment are detailed in Table 1.5, bringing together the needs of the child for medical assessment and treatment with the evidential requirements. The importance of reassurance to the child and family should not be underestimated. Many myths remain in the

minds of children and adults in relation to penetration, pregnancy and infection, and the opportunity to reassure should be one of the considerations taken into account in deciding whether or not to proceed to medical examination.

LEGISLATION

In approaching the gathering and interpretation of the medical evidence in child abuse cases it is useful to have a clear understanding of the nature of the legal processes that may be invoked to protect the child and, in particular, the standard of proof that is required to sustain them and thus to protect the child(ren) from further harm.

In Scotland, criminal proceedings are the responsibility of the Lord Advocate. Procurators fiscal review the evidence gathered by the police during an investigation; they determine whether or not it is in the public interest to prosecute and whether or not there is enough evidence to proceed.

Cases in which physical or sexual assault or serious neglect of a child is alleged may be prosecuted in the High court or sheriff court, depending on the seriousness of the charges laid down in the indictment. That a crime has been committed under Schedule 1 of the Criminal Procedure (Scotland) Act 1995 (offences against children under the age of 17 years to which special provisions apply) must be proven ‘beyond reasonable doubt’ to secure a conviction.²²

Within the Children’s Hearing System in Scotland, grounds of referral are drawn up when there is evidence to suggest that a child is at risk of suffering significant harm from abuse and neglect unless compulsory measures of care are put in place. These grounds may be denied by the parents/carers, leading to legal proceedings before the sheriff. Evidence, including medical facts and opinion, is led by the reporter and is open to cross-examination by lawyers acting for the family and the child. Here the standard of proof required is lower, with the sheriff reaching a decision ‘on the balance of probability’ as the civil standard. It is important to note that in these proceedings it is not necessary to identify the person or persons to blame, often a major difficulty in child abuse cases, particularly in those involving infants. These procedures are described and discussed by Wilkinson and Norrie.²³ Once the grounds of referral have been established, the case is sent back to the reporter who will convene a Children’s panel to determine what action is required to protect the child.

Inevitably legal proceedings are lengthy and often delayed. Children at risk from abuse and neglect require urgent protection, which can be secured though the recent Children Act legislation both in England and Wales (1989) and Scotland (1995). Through this legislation, Child Protection Orders (sect. 57), Child Assessment Orders (sect. 55) and Exclusion Orders (sect. 76 – to remove the alleged perpetrator from the home) have been put in place to allow the investigation to continue at an appropriate pace, while ensuring the protection of the child(ren). Before granting these orders the sheriff may require initial documentation

Table 1.5 Role of medical assessment

To secure any medical treatment required
To gather medical and forensic evidence
To gather relevant background: medical, family and social
To gather information on the child’s growth, development and emotional state
To initiate ongoing medical care (including psychological or psychiatric care, treatment of sexually transmitted disease)
To reassure the child and the family

of the medical evidence, which may, if necessary, be submitted in the handwritten format, including injuries depicted by line drawings.

CONSENT AND CONFIDENTIALITY

Child abuse cases regularly raise issues of confidentiality, particularly for doctors working with young people in sexual health or mental health services and those working with parents or carers in general practice or psychiatric departments. These issues are explored in detail in a recent working party report produced by the Royal College of Paediatrics and Child Health (RCPCH) in 2004.²⁴ The document reminds medical practitioners that 'the doctor's primary duty is to act in the child's best interests. If there is a conflict of interests between doctor and parents or parents and child then the child's needs are paramount'. Recent General Medical Council (GMC) guidance in the UK issued in 2004²⁵ makes it clear that when any practitioner suspects that a child may be being abused or neglected he must share the information promptly with an appropriate person or statutory agency when he believes that to be in the child's best interests. The GMC also issued specific guidance in relation to the sharing of information about children and young people in 2007.²⁶ In a situation when the practitioner believes it may not be in the child's best interests to refer the matter on, he should discuss the matter with an experienced colleague and be prepared to justify any decision not to disclose. Some leeway is left in this advice in order to allow colleagues, particularly in the mental health services, to prepare a patient for referral when a child is not considered to be currently at risk, for example if an adult patient reports previous abuse by a father with whom she is no longer living. Of course, care must be taken in deciding to delay referral, as the alleged perpetrator may be a danger to other children.

Obtaining informed consent to examination and to the subsequent sharing of information also raises anxieties, which have been clarified, to some extent, by the recent Children Scotland Act legislation. In 1991 the Age of Legal Capacity (Scotland) Act clarified the position in Scotland by making the age of 16 years the age at which all youngsters (apart from those with a disability) attain the ability to give their own consent but making it clear that prior to that age any child who was felt competent to understand the significance of the examination and treatment should be asked to give his or her own consent.²⁷ It also establishes that it is the doctor's responsibility to make a decision as to whether or not the child is competent to give consent. When the doctor decides the child is competent then the child's consent must be sought and the parents no longer have a right to make the decision for the child, although they would be expected to give the child appropriate guidance and support in reaching a decision. It must be remembered that the wishes of a child deemed competent to give consent must be respected when he or she refuses that consent.

The nature and circumstances of the child's medical, developmental and social condition will of course have an important bearing on whether or not the child is competent to give consent. Giving his or her own consent for examination for sexual abuse, which may lead to the imprisonment of a parent, raises much more complex issues about a child's ability to consent and also to the meaning of the phrase *fully informed*, which is taken to imply that *the child understands fully the implications of the examination*.

Increasingly, as all forms of legal proceedings become more adversarial in nature, aspects of the examination, including the seeking of consent, are brought into question and a failure to properly seek documented consent may lead to the medical evidence being deemed inadmissible.

THE PROCESS – JOINT PAEDIATRIC/FORENSIC EXAMINATION

In arranging and carrying out a joint examination the paediatrician takes responsibility for ensuring that the child receives a high standard of medical care at the same time as contributing to the gathering of the best medical evidence.²⁸ This examination should be seen as the start of the therapeutic process for the child as well as a vital part of the interagency investigation.²⁹ In order to achieve this high standard, a dedicated facility offering privacy, warmth, good lighting, photography, video colposcopy and laboratory services in a context that is child-friendly is essential (Fig. 1.7). Examination, particularly for sexual abuse, is



Figure 1.7 Consultation room with video colposcopy facility.

much more likely to be successful if the child feels relaxed. Attention to the general environment in terms of play facilities, food and drink when an investigation has been prolonged, supportive nursing care and replacement clothing and shower facilities where appropriate are all-important. In the majority of situations the child is well although he or she may be subdued and anxious. Kind reassurance will enable the child to take an active part in the discussion and examination and to benefit from the explanation and reassurance at the end of the examination. Wherever possible children should be asked for consent even when formal consent is the responsibility of the accompanying adult. It is important to explain the process very carefully to the child and to allow him or her to see the examination couch, the colposcope and video equipment, and to introduce the child to all of the adults who are present.

When young children are involved, however, it is preferable for the child to be occupied by an appropriately trained nurse or familiar adult while the police and social workers discuss the information available from the earlier investigation and any disclosures that the child may have made and the background medical history is taken from the accompanying adult. Ideally, this can be used as an opportunity for the nurse to make a brief assessment of the developmental status of the child and his or her emotional well-being.

Joint paediatric/forensic examination of the acutely ill child is often problematic and clinical care must, of course, come first. In some situations, for example, severe non-accidental head injury, the child may present with acute encephalopathy with a falling Glasgow Coma Scale score, seizures and/or cardiorespiratory compromise and is clearly not fit to be examined in any detail. However, failure to conduct even a brief joint examination may lead to the loss of significant medical evidence that may be crucial to the final diagnosis. Medical photography may offer a way of rapidly documenting the superficial injuries at that time when meticulous measurement and drawing is not possible. Similarly in children subjected to burns or scalds that will be covered by dressings, or children with long bone fractures that will require splinting, an opportunity for rapid documentation looking, for example, for bruising consistent with a gripping and twisting injury should be sought. At present, that opportunity is frequently missed, as the possibility of non-accidental injury is frequently not raised before emergency treatment is completed. When a full joint examination has not been possible due to the clinical state of the child, a clear plan to return to jointly examine the child when the clinical state improves, or indeed if the child dies, should be made and documented in the hospital case notes. Particular care should be taken in planning the examination of a child when the referrers describe inflicted abdominal or head injuries even where the child is described as clinically well. In offering advice the paediatrician must be aware of the potential risks of intra-abdominal or intracranial bleeding, which may cause

an apparently well child to deteriorate rapidly over a number of hours following injury.

Presenting History

Before proceeding to the physical examination, wherever possible it is vital to obtain a complete and full history both of the events that have led to the presentation of the child and past medical history/family and social history, including the wider history of previous information known to police, social workers and education staff about the child and his or her family. When an accidental explanation is being offered by the parents or carers for physical injury it is vital to obtain a very detailed account of the alleged incident, preferably from individual witnesses, including the precise location of the child before and after the event (e.g. in exactly what position did the child land, which part of his body hit the floor or obstacle first). Also, information on the precise location of the adults who allegedly witnessed and intervened in the event, including exactly the condition in which they found the child after the incident and what attempts they made to resuscitate him or her. Information may already be available from the police about the locus but they may need to revisit this after the examination, for example to look at precise features of a staircase, bunk beds, etc. or to look for bloodstains, semen, etc. It is important to document clearly the source of each piece of information, i.e. those details that have been provided by a carer or witness directly or information from an investigative interview reported by police or social workers. This information can be gathered from the professionals attending the assessment while a caring adult occupies the child. Details of the child's past medical history should then be sought from the parent or carer. General information about the child's birth history, developmental history and information about significant illnesses or operations requiring hospitalization should all be sought and documented. In infants and toddlers, particular attention should be paid to any history of prematurity, intra-uterine growth restriction or difficulties at the birth. When failure to thrive is part of the presentation, particular care should be taken about the feeding history, any history of gagging or choking, vomiting or diarrhoea, abdominal distension or repeated chest infections. When children present with bruising, care should be taken in seeking any history of bruising or bleeding tendency in this child and a history of recent viral illness (see Chapter 4). A history of bleeding, bruising tendency and joint laxity in the extended family should then be sought. When a suspicion of possible cigarette burns has been raised, care should be taken to seek any history of skin disorder, particularly eczema in the child and again in the wider family. In the child presenting with a fracture, previous fractures in this child and/or family members suggesting the possibility of some form of brittle bone disease should be sought.

When allegations of possible sexual abuse are being made, careful history relating to urinary symptoms (urgency, frequency, dysuria), including episodes of documented infection, should be noted together with information around any genital or anal symptomatology, for example pain, itching, discharge, bleeding from the vulva, pain or bleeding on defaecation, constipation or soiling, together with the pattern of symptomatology particularly in relation to timing of access to the alleged perpetrator.

Family medical history should be sought in the usual way but including, in particular, information as noted above that is suggestive of bleeding tendency or bone fragility (including hearing loss). In addition, information on the growth of the natural parents and any information suggestive of significant physical or mental illness, drug or alcohol misuse should be noted.

Social History

Information on the social situation in the family home should be sought from the attending carer but will of course be available in much more detail through the primary care team, social work records and from the ongoing investigation. Of particular note are a history of domestic violence and/or drug and alcohol misuse, all known to predispose to physical and emotional abuse and neglect of children.³⁰ An indication of the level of deprivation within the family home and the local community should be sought, together with information or any previous concerns about the care of this child and his or her siblings.

Presenting History Taken from the Parent

Once a background medical history of the child has been carefully explored with the parent or carer, the examining doctor should seek information about signs and symptoms that the parent might have observed in relation to the alleged abuse or neglect. For example in physical injury, particularly in relation to possible burns, precise detail of the signs of damage to the skin is vital. For example, did this lesion start with a small area of erythema or a blister? Over what time frame did it progress to the current appearance? Did other lesions appear at the same or different times and what was their precise location? Were they itchy or painful? Has any treatment been applied? In alleged head injury, has there been any period of loss or altered consciousness, vomiting or features suggestive of seizure activity?

If a child is able to give his or her own account, again it is important to ask for symptomatology, particularly immediately following the alleged incident: for example in alleged strangulation, did the child feel dizzy, was there any effect on the child's vision, ability to swallow, breathe, etc.? Have there been any subsequent symptoms?

In alleged sexual abuse relevant history in relation to urinary, genital or bowel symptoms should be sought and for a post-pubertal child information about the normal menstrual cycle, including whether or not the child uses pads, tampons or both. It is also important to ask for information relating to general well-being following the alleged incident, for example is the child continuing to sleep and eat well, has there been, for example, the recurrence of nocturnal enuresis or night terrors? How was the child doing at school? Have there been any problems with ongoing relationships at school or at home? When a history of rectal bleeding or anal abuse is put forward it is extremely important to establish the child's normal bowel habit and in particular whether there have been any periods of severe constipation requiring medical treatment. It is important to seek information about the mental health of the child, particularly the teenager, and to at least consider the possibility of self-inflicted injury.

Information from the Child

Having gathered as much information as possible about the medical, family and social context of this presentation together with the early detail from the police about the precise incident, it is then appropriate to proceed to the direct assessment of the child. It is extremely important at this stage to consider carefully who should be in the room during the discussion with the child and, most importantly, during the physical examination of the child. When the child is able to give an opinion (certainly from the age of 8 years onwards) his own view on who should be present should be sought. Care should be taken to develop a rapport with the child by general conversation (e.g. preferred activities, how he is getting along at school, a local football team, etc.). It should then be possible to move on to talking about what has happened.

Although it is entirely inappropriate to go over the statement which the child has given at joint interview, it is often necessary, particularly in relation to sexual abuse, to clarify the child's terminology and when a child has multiple bruises it can also be very helpful for the simple question 'how did that happen?' to be asked, which may enable the child to indicate clearly which injuries were associated with which blow and to increase his credibility by indicating clearly that a particular injury had an accidental origin, for example falling from his bike. Children use many words for their private parts and these vary widely across the country. For example locally, 'flower' is a common word for the vulva, sometimes 'china' is taken to stand for vagina; however, in another part of Scotland 'fluffy' is taken to mean vagina. It is extremely important not to jump to any conclusions, particularly when trying to help the police to establish whether an alleged assault was rape or a less serious sexual offence. The medical examination offers us the only real opportunity to clarify directly what

the child means by her 'flower' or 'fluffy' by asking her to point directly to it with one finger. (It will subsequently be important to clarify the police's understanding of the child's terminology.) It may also be useful to go over directly with the child the nature of any history of genitourinary symptoms, rectal bleeding, menstrual cycle, whether or not protection was used in any under-age sexual intercourse (e.g. condoms). With older youngsters it is important to ask about intake of drugs or alcohol, particularly around the time of the alleged incident. At all times it is important to ask open-ended questions and to do so in the presence of the investigating police officer. It is helpful to hear the child give a clear accidental explanation to some injuries, as this establishes his credibility, his language and understanding.

Before proceeding to examination it is very important to ask the accompanying adults what explanation and information have already been given to the child about the need for medical examination and the likely nature of it. It is then important to ensure that a full explanation has been offered to the parents when seeking fully informed consent; this should be carefully documented. Where the child is old enough to give their own informed consent, similar care must be taken to explain to the child exactly what is required and why and to allow time for the child to explore the examination room and the video colposcopy equipment when detailed examination of the anus and genitalia is required.

In discussing the need for medical examination it is important to emphasize the therapeutic aspects of the examination, i.e. the importance of being able to describe any injuries present and frequently to exclude significant physical injury or transmitted infection and to arrange appropriate follow-up and treatment if required. As noted above it is important to ensure that the child is comfortable with all accompanying persons and that non-essential adults are asked to wait outside.

Examination

The examination of a child who may have been abused or neglected should follow the same format as any other clinical assessment and must include a complete physical examination, including measurement of growth and a brief assessment of development. It must be meticulously and contemporaneously documented, including accurate quotes of any explanation given by the adult or child. In particular, the general examination should include careful assessment of the child's hair, teeth and skin, as these are good indicators of the child's general well-being. Additionally, a note of the child's cleanliness, appropriateness or not of clothing, and his or her demeanour should be made during assessment. Any superficial injury should be carefully measured, documenting the vertical and then the horizontal measurement in centimetres together with the

distance from the nearest anatomical reference point. A careful note of the pattern of injury, for example colour, speckled appearance from fabric weave, loss of skin surface and direction of injury, should be included. It must be remembered that it may be the smallest injury that confirms the non-accidental nature of a child's presentation. Careful drawings should be made, preferably on diagrams within a proforma, numbering each injury (Fig. 1.8) (the full proforma and consent form can be found in Appendix A, p. 457). These will be vital to compare with the photographic documentation. Measurements of weight and height (and head circumference where appropriate) must be plotted carefully on up-to-date population growth charts.

Examination of the genitalia and anus should normally be undertaken as part of the general examination in any young child when abuse is suspected and in any child when the allegations, medical history or findings suggest that sexual abuse in any form may have taken place. The anus and genitalia should be examined using the colposcope for light and magnification and to obtain photographic documentation through video recording (or the taking of a

Confidential medical information	
EDINBURGH AND LoTHIANS CHILD PROTECTION OFFICE	
Joint Paediatric/Forensic Examination/ Specialist Paediatric Examination of Child who may have been Abused or Neglected	
Place of Examination	Name of Examination(s)
Child's surname	Forename(s)
Known as	
Address	Date of Birth
	Sex
	CHI No.
GP	Date of Examination
Address	Time of Examination
Child accompanied to clinic by (please tick) Mother <input type="checkbox"/> Father <input type="checkbox"/> SW <input type="checkbox"/> Police <input type="checkbox"/> Other <input type="checkbox"/>	
School/Nursery Attended	
BACKGROUND INFORMATION (e.g. previous concerns re. developmental delay, poor growth, possible episodes of NAI)	
Family/Social History	

Page 1 of 12

Figure 1.8 Initial page of the locally used examination proforma (the proforma is presented in full in Appendix A, p. 457).

series of still photographs). This allows detailed examination of the labia majora, labia minora, posterior fourchette, vestibule, hymen and urethral meatus, and the anus.

This examination is discussed in more detail in Chapter 2. Examination findings should be documented in detail, again using line drawings and using the convention of the clock face to locate any abnormalities and recent or healed injuries. In undertaking an examination it is again important to recognize that it may be superficial injury, for example a bite mark or imprint injury, that corroborates the sexual assault described by the child, when other, perhaps more specific examination (i.e. anogenital) is inconclusive.

The same careful attention to detail is required in the gathering of the samples that will be processed through the forensic laboratory. This part of the examination is usually led by the forensic examiner who has specialist training in this area and will ensure (together with the attending police officer), for example, that the chain of evidence is maintained. This particularly applies to the examination of the sexually assaulted child when swabs are taken from the vulva, vagina, anus, mouth and skin areas (depending on the history) when looking for semen and saliva, samples and combing of head and pubic hair, and samples of nails and blood, as appropriate, again depending on the history. These investigations may confirm sexual assault when physical findings are normal. When an acute assault has occurred, the child's clothing will be carefully gathered. These details are further described in Chapter 7. The nature of the samples taken should be documented carefully and all specimens carefully labelled and signed by both examiners and the attending police officer. Finally, the paediatrician and police surgeon will oversee the taking of photographs of any injuries by the identification branch of the police. On occasions when there is a medical differential diagnosis, for example on certain skin lesions, medical photography can also be very valuable in enabling a second opinion to be more rapidly obtained.

Immediately following the examination when the paediatrician and the forensic examiner have had an opportunity to confer and possibly to review the video recording, a preliminary conclusion should be reached and communicated clearly to the attending police and social workers. This allows the agencies to plan the further investigation of alleged abuse and also to contribute to their planning for the immediate protection of the child while the investigation is ongoing. It is very important to document precisely the preliminary opinion that is given so that this can be included and, if necessary, modified in the subsequent typed report.

As much information as possible should be shared with the parent and the child, but it may be necessary to withhold some detail, for example of the suggested mechanism of specific injuries, when police investigations are at an early stage and the accompanying parent may be implicated in the abuse. Once a conclusion has been reached on the likelihood of abuse and the possibility of differential

diagnoses, a plan of the investigations necessary to exclude or confirm possible alternative explanations for the child's presentations can be made.

Investigations

Investigations that should be considered in the context of possible physical abuse or neglect include: haematology, clotting studies, biochemistry and tests to exclude malabsorption or other organic causes of failure to thrive where appropriate. Skeletal survey is generally recommended in any child under 2 years of age presenting with non-accidental injury and in older children for whom history or medical findings suggest that it is indicated. Computerized tomography (CT) or magnetic resonance imaging (MRI) of the head should be undertaken in alleged shaking injury, as described in Chapters 3 and 14, and must be considered in any situation of inflicted physical injury in a very young child. In children presenting with multiple fractures without adequate explanation it is important to consider the possibility of osteogenesis imperfecta or other forms of brittle bone disease and to consider carefully what investigations should be undertaken if a diagnosis of non-accidental injury is to be sustained. In the majority of cases the correct diagnosis can be achieved by the taking of a careful history, particularly including the family history, careful examination, and expert radiological review. In considering radiological investigation it is extremely important to take into consideration the risks of exposure to radiation and to consider carefully the indications, discussing the requirements with an experienced paediatric radiologist.

Assessment of Growth and Development

Assessment of the physical growth and developmental stages of the child is crucial to forming an opinion on the significant harm that the child may have or is likely to suffer. Satisfactory growth measurements may be charted during the paediatric/forensic examination and an age-appropriate developmental history confirmed by brief observation. However, in many situations, particularly involving very young children, more detailed evaluation of growth and development is required, including reference to previous health records, particularly those held by the health visitor.

Growth is an important indicator of a child's well-being – both physical and emotional. Placed in the context of previous measurements and the subsequent trend in growth once a child is protected, the pattern of growth can be a vital piece of medical evidence in establishing grounds of referral for ill treatment or neglect (Fig. 1.9).

It is essential to obtain information about the height of the natural parents in order to calculate the target height of the child and determine whether or not the child's current

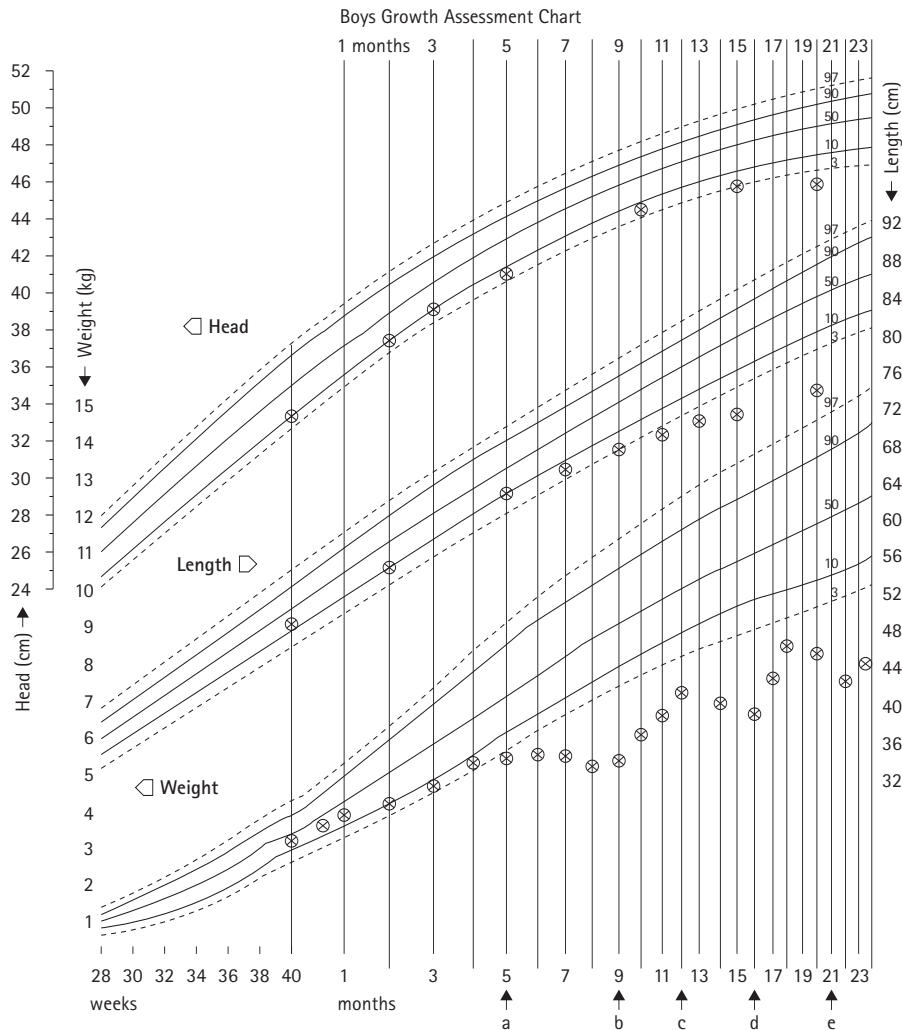


Figure 1.9 Growth chart of non-organic failure to thrive shows weight gain when the child is removed from the home environment. (Chart published by Castlemead Publications, Welwyn Garden City.) a, referred; b, admitted urti.; c, home; d, readmitted; e, fostered.

growth is appropriate for his or her family. The association between failure to thrive and child abuse and neglect is well established; however, the precise definition of failure to thrive remains controversial and its causation in most cases multifactorial. It is also important to note that the word 'thrive' is derived from the Norse *thrifa* to grasp, meaning 'to grow strong and healthy' and therefore is not just about a child's weight but relates to all parameters of growth, height, weight, head circumference and developmental status. The underlying mechanism is undernutrition, with the child either not offered, not taking in or not able to utilize appropriate nutrition.³¹ Early studies tended to define failure to thrive as all children who fall below the third centile in terms of weight gain; however, by definition 3 per cent of our population fall below the third centile if the charts accurately reflect our population. Among these children, clearly there will be some who are genetically small, but other genetically large children may be significantly failing to thrive while their weights are well above the third centile. Work of the Parkin Project in Newcastle identified children

as failing to thrive when they lay in the slowest growing 5 per cent of the population.³² This is equivalent to a fall from the 50th to the 10th centile over a 6-month period. Their work also clearly showed that the surveillance weight measurement at 6 weeks of age was a good predictor of future stature in the well-nourished child, confirming that birth weight is a poor predictor, reflecting maternal and intra-uterine factors rather than the innate growth potential of the child. Therefore, in evaluating a child's growth pattern it is important to obtain the 6 weeks' surveillance weight and length and all other available measurements between that point and the current position.

The work of Wright³³ in Newcastle in the 1990s confirms the difficulty distinguishing between non-organic and organic failure to thrive. The term non-organic failure to thrive is sometimes considered to be synonymous with abuse or neglect of the child's need. However, studies clearly show that there are some children in whom investigation produces no clear organic cause but who continue to fail to thrive despite the best intentions of their parents.

Frequently these children have been of very low birth weight and/or have developed significant feeding problems during infancy. In investigating the child with failure to thrive in whom abuse or neglect is suspected, it is extremely important to exclude the recognized organic causes (for example cystic fibrosis, coeliac disease, cardiac disease or recurrent infection should be considered) and, ideally, demonstrate that the poor growth pattern is *reversible* through offering a period of normal care and nutrition.

Before reaching a conclusion it is important to ask the question, 'what is this child's capacity to grow?'. Careful review of the medical history and examination findings must be undertaken to exclude the possibility that intra-uterine growth retardation has led to failure to thrive, recognizing that studies show that almost 20 per cent of very-low-birth-weight babies remain very small.³³ The possibility should also be excluded that neurological impairment underlies difficulties with feeding³⁴ or that neonatal problems necessitating repeated intubation and tube feeding have delayed the normal processes of learning to feed such that the child has missed a critical period for developing the skills.³⁵ It is important to note here that the child may have missed the critical period because of neglect with the parents not offering or not encouraging the child to explore an appropriate range of solid foods at the appropriate stage, usually around the 6- to 7-month stage. Studies have shown that hunger, satiety and taste preferences are present in normal children by 24 months of age;³⁶ again these opportunities may be missed because of organic illness or because of physical or emotional deprivation.

In the literature, there is a growing body of evidence of the importance of behavioural issues in children's feeding and the importance of the mother's touch; 'maternal, physical and social interaction with her child in promoting feeding and growth' is well described in an article by Polan and Ward (1994).³⁷ How the child responds to being fed and how the parent then responds to them profoundly influences how the feeding behaviour develops and whether or not the child becomes a competent feeder. If the parent responds to a child's early difficulties with dogged determination, prolonging the mealtime and disregarding the child's protests and continuing to present food of a flavour or texture the child dislikes then the child may respond by refusing to eat at all. The child then learns to associate eating with confrontational negative experiences. As a result, although physical factors may have been important in the causation of early under nutrition, behavioural factors become the main determinant in prolonging it.

It is important therefore to recognize that the term *failure to thrive* is not a diagnosis but a description of a physical state resulting from a multiplicity of interacting factors that often change in their individual significance over time. In order to come to any conclusion about causation or required intervention, particularly if there is any suggestion of the need for child protection procedures, a multidisciplinary assessment that looks at all these aspects of the individual child and family in its local community is essential.

When the child's developmental status is a cause for concern, again it is extremely important to attempt to quantify that assessment and demonstrate the change over time and particularly to chart recovery following successful intervention (e.g. if the child is placed in a substitute family setting). Accurate developmental diagnosis involves careful observation of physical, social, communication and cognitive abilities. The work of Mary Sheridan³⁸ provides a developmental scale consisting of an inventory of abilities and milestones. Although it can be regarded as a simple form of psychometric test, the method of administration is not rigorously standardized and normative data consist only of approximate mean ages at which the various milestones are reached. This scale should be used primarily as a guide to normal development. It can be used to describe in terms of age equivalence, i.e. how many months behind its chronological age a child is on the particular axis of development. Although useful, it is not as specific nor as able to chart change over time as quantified assessments, for example the Griffiths Developmental Scales that are particularly helpful in identifying the profile of developmental progress, highlighting, for example, when a child is particularly lagging behind in social communication skills but making better progress in relation to motor skills.³⁹ The more specialist scales, for example the Reynel Developmental Language Scales, measure specific problems in speech and language development.⁴⁰ In applying these tests it is very important to recognize the limitations particularly in children who have a specific impairment or disability, for example visual impairment. When concern is based around the cognitive development of a child, tools such as the Denver Developmental Screening Test are useful.⁴¹ It is important to recognize that the application of psychometric tests is restricted to suitably qualified persons and it would usually be necessary to refer the child on for more specialist assessment when significant concerns have been raised.

Even when drawing an early conclusion about the developmental status of the child it is very important to consider whether the child has failed to demonstrate that skill because he is unable to achieve it, either because of specific physical/neurological impairment or in keeping with global developmental delay; alternatively, is he failing to cooperate because he is tired or hungry, upset or anxious or unable to understand what it is which is expected of him? If an age-appropriate skill is not achieved even in optimum conditions (which may require a follow-up assessment) is this because of limited opportunity, a lack of encouragement to explore the environment and learn new skills or because of underlying neurodevelopmental delay or disability? These questions are of course the key to the assessment of the impact of social deprivation and ill treatment on the presentation of the child.

The negative behaviours demonstrated by children who have been subjected to emotional deprivation and abuse are well recognized but not specific (Table 1.6). They range from the withdrawn, apathetic child at one extreme to the

Table 1.6 *Negative behaviours associated with abuse*

Withdrawn/apathetic
Attention seeking
Disruptive
Aggressive
Wetting/soiling
School refusal/truancy
Eating disorders

attention-seeking, disruptive and aggressive child at the other end of the spectrum. School attendance is frequently an area of difficulty with patterns of school refusal or truancy. Some show recurrence of wetting and soiling; in others, serious eating disorders are the presenting complaint. Again, the detailed assessment of these children, producing documentation that can be of use in achieving successful intervention, is dependent on specialist assessments by psychologists, psychiatrists and therapists as well as paediatricians.

In summary, careful assessment of growth and development are invaluable in the clinical assessment of the abused child, both as an indicator of the level of care that the child has received and as part of the investigation of any underlying medical explanation for the child's condition. It is vital to the assessment of the child's ability to sustain an accidental injury in the way described, i.e. could the child have climbed out of the cot as described, could the child have inflicted this injury on himself? In a recent case of a four-year-old child with penile injury (Fig. 1.10), careful occupational therapy assessment demonstrated that the child did not have the fine motor skills required to inflict this injury on himself, even if the pain and bleeding had not prevented him from doing so. Assessment of the child's emotional state and language skills are also very important in interpreting the child's account of alleged ill treatment and in considering his or her ability to testify in any subsequent court proceeding.

Emotional Abuse

As predicted by Kemp and Helfer⁴² in 1980, the recognition of emotional abuse as a specific category of child abuse and neglect has followed on slowly after the recognition of the physical forms of child maltreatment. This was despite the fact that it was clearly recognized as a cause for concern within the UN Convention of Rights of the Child (UNICEF 1989, ratified by the UK in 1991). For example, Article 19 of the Convention mentions protection from 'all forms of physical or mental violence, injury or abuse, neglect or negligent treatment, maltreatment or exploitation including sexual abuse'. Emotional abuse is now included as one of the categories for which a child's name may be entered on the Child

**Figure 1.10** Incised penile injury in 4-year-old boy.

Protection Register in the UK. For this purpose it is defined in the recent revision of the joint working guidance, Working Together to Safeguard Children 2006 as

the persistent emotional maltreatment of children such as to cause severe and persistent adverse effects on the child's emotional development. It may involve conveying to children that they are worthless or unloved, inadequate or valued only insofar as they meet the needs of another person.⁴³

Some level of emotional abuse occurs in all forms of ill treatment of a child though it may occur alone. Emotional abuse however remains difficult to define and quantify, particularly as the main category of abuse. This is reflected in the relatively low percentage of children registered under this category in the UK, 18 per cent in 2000. The concern is not simply the recognition of negative interactions between parents and their children but the persuasiveness, persistence and inflexibility of these in causing significant harm.⁴⁴ Much of what is described as constituting emotional abuse is culturally relative and therefore will vary in different societies.⁴⁵ Glaser (2002)⁴⁶ describes the dimensions of emotionally abusive or inappropriate relationships as

(a) persistent negative attitudes, for example, denigration, blame, belittling, harsh discipline and over control, (b) promoting insecure attachment for example making the child's continued care by the parent contingent on the child's good behaviour and (c) inappropriate developmental expectations

and considerations, (d) emotional unavailability, (e) failure to recognize a child's individuality in psychological boundaries for example failure to acknowledge a child's personality, worth and wishes, (f) cognitive distortions and inconsistencies for example mystification or unpredictable parental responses.

Because these behaviours and attitudes affect both emotion and cognition, Glaser prefers the term *psychological maltreatment* to *emotional abuse*. Faced with these attitudes and behaviours, children adopt different modes of coping depending on their personality and resilience. Some will become withdrawn, others indiscriminately attention seeking, others seek gratification through food and may be accused by their parents of stealing food and others are described by their parents as showing disordered behaviours by acting out in a way that elicits further negative parental response. Some indication of these features may be identified through the presenting history or through information gathered from the health visitor or education setting. Quantifying the degree of current or future harm is fraught with difficulty but would require the specialist input of psychology and psychiatry services. Successful intervention is even more difficult to achieve, as even when parents accept the potentially damaging nature of their interactions, sustaining a change in behaviour leading to reduction in the extent of harm and a reversal of damage is hard to achieve. Early recognition by the clinician of signs of emotional abuse is therefore extremely important, allowing for the possibility of preventative treatment.⁴⁷

The neglect of a child's emotional and social needs is even more difficult to demonstrate adequately in terms of providing medical evidence that will convince a court. We all recognize the very long-term effects of early lack of bonding, stimulation and positive interaction on emerging language skills, even from the early weeks and months of life. This has been very well documented particularly by Rutter (1975),⁴⁷ who has described the patterns of behaviour and developmental difficulty that are seen in children

from such emotionally and socially deprived backgrounds. Such children lack confidence, are unable to express their feelings or make choices, and remain apprehensive and vulnerable unless very early intervention is achieved.

A particularly difficult area of practice relates to fabricated or induced illness (previously known as Munchausen syndrome by proxy), when, again, meticulous documentation of the repeated presentations together with expert assessments from psychologists or psychiatrists are essential to reaching a diagnosis and protecting the child. Guidance on the health and multi-agency assessment in these cases is contained within RCPCH and Department of Health guidance published in 2002.^{17-19,48,49} Meadow drew attention to this form of abuse through a case study in 1977 in which he described the deliberate fabrication of bizarre symptoms.⁴⁹ Subsequently, many manifestations of fabricated and induced illness have been recognized, including recurrent seizures, deliberate suffocation of infants and salt poisoning. Detailed assessment of the adults caring for the child is essential to gaining an understanding of the nature of the ill treatment in these cases. Is this a parent who is thriving on the ward and is less worried by the child's illness than the staff? Is the carer assuming the sick role by proxy to gain attention or are they genuinely concerned about the child and exaggerating genuine symptoms and signs to get the attention they feel their child needs? The work of Eminson and Postlethwaite⁴⁸ helps us to understand the continuum between neglectful carers, those accessing health care appropriately and carers who seek unnecessarily frequent health contacts from over-anxiety to those who deliberately exaggerate, invent or induce illness. This is illustrated in Figure 1.11.

DOCUMENTATION AND REPORT WRITING

The importance of careful documentation in ultimately achieving a successful outcome for the child at the centre

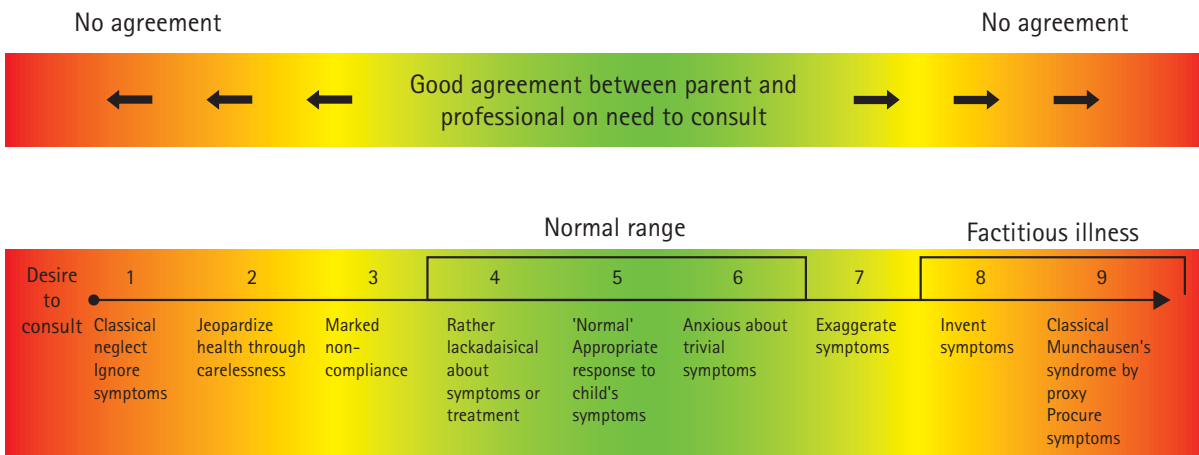


Figure 1.11 The spectrum of fabricated and induced illness.⁴⁸

of a child abuse investigation cannot be over emphasized. The documentation must record an accurate picture of the child, the injuries and the story, together with the background medical, family and social history on which the opinion was based so that this can be recreated often months later for any court proceedings. It must be possible for legal, professional and lay members of the jury not only to understand the basic information, but also to follow the logical thinking through the differential diagnosis to the opinion. It is likely that all documentation from the earliest handwritten notes to the final typed Soul and Conscience reports will be available for scrutiny and to form the basis of not only the prosecution or reporter's case, but also to be tested through cross-examination (the writers of the report are providing fact and opinion as if under oath to the court). The high standard of documentation required is best achieved by using a proforma; an example is included in Appendix A, p. 457. Not only does this act as a vehicle to collate contemporaneous handwritten notes, but also it acts as a prompt throughout the history-taking examination, investigation and conclusion, reminding the clinician, for example, to ask specific history relating to genitourinary symptoms, sanitary protection, etc. in alleged sexual abuse, to clearly record the methodology, for example the use of the colposcope, and the position of the child during the examination, and to document who was present at different stages during the consultation and who was the primary source of the information provided. It includes a record of the specimens taken and their precise source and a record can be made of any further investigation that is required and who will take responsibility for these actions. The proforma provides a vehicle for recording a joint initial opinion, making it easy to see how conclusions have been reached. Clear documentation of the obtaining of informed consent including consent to photo-documentation and the provision of a report for the police and procurator fiscal will be included.

The clear headings of the proforma then provide a template for the preparation of the Soul and Conscience report that should be written jointly by the paediatric and forensic doctors and signed by both. Again, in writing this report a logical train of thought must be evident, leading from facts to opinion with clear reasoning and in language accessible to non-medical personnel. The report should start by identifying the examiners, their skill and experience, and their responsibility to the patient. It should detail the time and location of the examination and summarize the information available prior to examination, summarize the presentation, past medical, family and social history, and describe the process of examination. It must detail the examination findings/their photo-documentation and any investigations that have been carried out, together with any results that are already available. It must give as clear a conclusion and opinion as the available facts allow, clearly taking into account any factors that are at odds with that opinion. It should indicate any areas for which

further information is awaited or specialist medical opinion has been sought, for example the results of screening for sexually transmitted diseases, ophthalmological (see Chapter 6) or orthopaedic opinion.

INTERPRETATION OF THE FINDINGS

During the course of the clinical assessment it is important to start to think about the differential diagnosis, always trying to keep an open mind on the likelihood that there may be an underlying medical problem or accidental explanation for the child's presentation or indeed that there may have been self-injury rather than inflicted or non-accidental injury. It is important to start thinking about the timing in relation to the injuries and to start to consider whether the gathered facts are consistent with the history or allegations and whether they are supportive or diagnostic of abuse. In attempting to reach a conclusion, consider whether there is any missing or conflicting information. The overall pattern of injury may in itself be highly suspicious either in terms of the extent of bruising, different ages or a particular pattern of injury. The nature of the observed injury may indicate a higher level of force would be required than the accidental explanation offered. The explanation may or may not be consistent with the observed developmental stage or physical size of the child.

To answer the question 'could it have happened this way?' it may be necessary to ask the police to revisit the scene after the examination to consider, for example, could the child have thrown herself out of the cot and if so could she have hit her head against the bedside table? If this child ran across the room would the door handle be at the right height to cause this periorbital bruise? It is important to fetch the alleged implement not only to check consistency (size, shape and pattern) with the imprint bruise, but also to corroborate the child's story, for example 'He always kept the stick under his side of the mattress'.

As noted in an earlier section quantified assessment of the child's development stage using Griffiths or Bayley's motor scales may be essential to demonstrate that a particular accidental explanation could not be correct.

Bruises are present in about 90 per cent of physically abused children but are also of course associated with normal activity in childhood. It is therefore the *pattern* of injury that is crucial as well as the timing. A number of studies have shown the differences in frequency and distribution of bruises in non-abused and abused populations.⁵⁰ In 1982, Robertson *et al.*⁵¹ showed that bruises to the head and neck are particularly associated with non-accidental injury, seen in only 6.5 per cent of the normal population and 60 per cent of the abused children. The face is the most commonly bruised site in fatally abused children.⁵² Some areas of the body are rarely bruised accidentally at any age, for example neck, buttocks and hands in children under two.⁵³ Bruises on the buttocks, lower back and outer thighs



Figure 1.12 Showers of petechial haemorrhages on the upper neck and face following attempted strangulation.

are often related to punishment.⁵⁴ Injuries to the inner thighs and genital area may suggest either sexual abuse or punishment for enuresis. Bruising, particularly showers of petechiae and purpura, over the head and neck particularly around the eyes, behind the ears and inside the mouth suggest mechanical asphyxia, for example as in strangulation or compression of the chest (Fig. 1.12). Sibert *et al.* (2002)⁵⁵ explored the possibility of developing a scoring system to assist in estimating the probability that the pattern of bruising in a given child is non-accidental. Their method of recording bruising by site, maximum dimension and shape was easy to use and showed clear differences between cases and control subjects in the total length of bruises. A scoring system was developed, which discriminated well between the two groups; by including a variable that indicated whether a bruise had a recognizable shape, the discrimination was even better. They concluded that this system has potential to aid the diagnosis. It is important to remember that no site is in itself pathognomonic of non-accidental injury and that a careful history and examination is essential in reaching the right conclusion in all cases.²⁰

Accurate timing of bruises by naked eye examination is not possible. There is wide intra- and interobserver variation in description and estimates of age both in the clinical situation and from photographs.⁵⁶ However, most examiners would feel confident about distinguishing between generations of bruises, for example those that are very recent i.e. less than 18 hours old (showing no yellowing) and frequently accompanied by other signs, for example tenderness and swelling, to those that appear older than 18 hours and those that appear very old. This is very important if one incident is being postulated as a whole explanation for the pattern of injury, for example a fall from a swing.

The pattern of individual injuries or groups of injuries may be highly specific for non-accidental injury. Forceful striking of the skin with an object may leave a clearly identifiable imprint, e.g. of the sole of a slipper or the buckle of a belt. On impact, blood vessels under the central zone of

the impact are emptied and so do not leak blood into the skin whilst the edges are stretched as the instrument digs into the skin, tearing the small blood vessels and leaving two lines of dermal haemorrhage when the object is removed. In addition to the imprint, which may be left by an open hand slap (Fig. 1.13) or forceful grip, we may also see characteristic fingertip bruises, pinch marks or semicircular abrasions from the fingernail of a poking finger. A kick from the toe of a shoe may produce a characteristic bruise with a curved upper outline and a sharply demarcated lower edge with a pale centre. Bruising in association with bite marks is very characteristic whether or not the skin is abraded (Fig. 1.14) (see Chapter 22). Ties or ligatures cause a circumferential band around limbs or the neck.



Figure 1.13 Open slap; the imprint of individual fingers is apparent.



Figure 1.14 Bite mark; in this site the bite could not be self inflicted (compare with Fig. 1.16).

Fabric imprint (not to be confused with petechiae) leaves a characteristic appearance where an object or hand has impacted forcefully through clothing.

Characteristic patterns also result from the tracking of blood through tissue planes following blunt trauma. It explains a well-recognized phenomenon of bruises 'coming out' and also provides a potential trap in suggesting that new bruises have appeared despite protection from the alleged perpetrator. For example, a bruise from a fractured femur may appear around the knee several days later, a child with repeated injuries to the left side of the face appears to develop a 'new' bruise along the left jaw line during admission. 'Crimping' bruising, i.e. linear bruising running parallel to the curved edge of the buttocks where they meet in the midline, is characteristic of forceful slapping (Fig. 1.15). Periorbital bruising may appear following a blow to the forehead above the hairline, not to be confused with bilateral periorbital bruising in association with a fracture to the base of the skull. It is also important to remember that a linear edge to a bruise may relate to its infliction over a bony plane rather than the nature of any implement.

The position of bruises relative to each other is also highly significant. For example, a multiple row of small round or oval bruises from the knuckles in a fist blow or opposing pinching bruises on each side of the upper arm or the thorax of an infant when a child is gripped by fingers and thumb. Bilateral bruises on the throat and along the jaw line in gripping or manual strangulation (these may be accompanied by nail abrasions). It is also always important to consider the possibility of self-infliction, particularly where a pattern of injury is unusual (Fig. 1.16). The child in this figure was admitted as a possible case of meningococcal septicaemia; however, psychiatric assessment revealed that she was isolated and unhappy and making a silent cry for help.

Having carefully described the bruising and reached an opinion on the likely causation it is important to comment on the degree of force likely to have been required to



Figure 1.15 Crimping bruising of the buttocks of a 4-month-old infant, with sparing of tissue within the gluteal fold.

produce this pattern of injury. It is not possible to give a precise answer to this question as many studies have shown that there is no direct correlation between the nature of the bruise and the force used, but it is customary to describe the force as mild, moderate or severe. Severe would usually be accompanied by internal or bony injury. It must be remembered, however, that even fatal internal injury may result from inflicted trauma, for example a kick to the abdomen with only minimal superficial injury, and that asphyxia, for example through smothering, may lead to the death of an infant without producing any evidence of superficial injury.⁵⁷

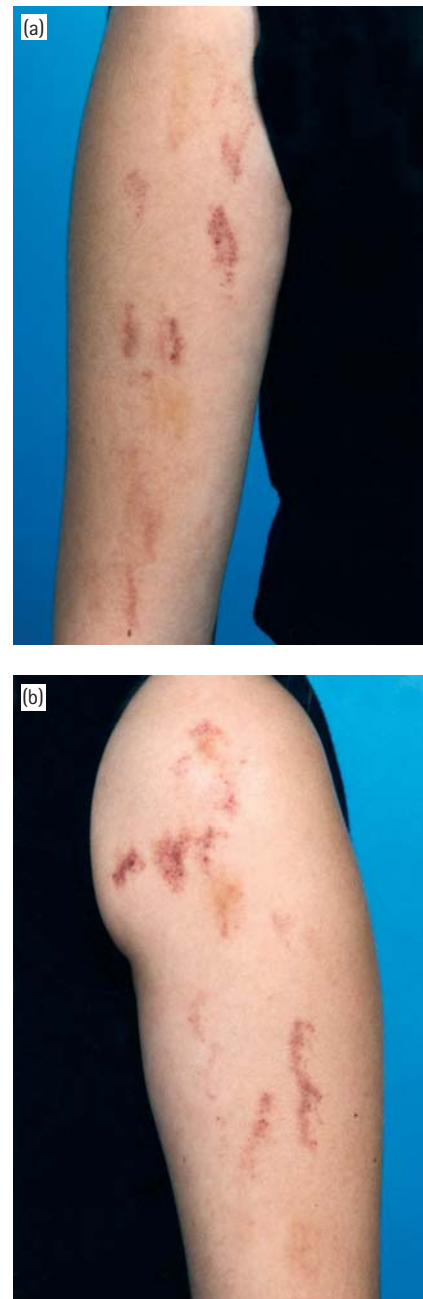


Figure 1.16 (a and b) Self-inflicted bruising caused by biting, initially diagnosed as possible meningococcal infection.



Figure 1.17 Burns from a fireguard. (a) Patterned burns on the backs of the calves; (b) fireguard with corresponding structure.

Physical evidence from the scene is also crucial in the interpretation of thermal injury, as discussed in Chapter 15. This includes, for example, the need to check the temperature of water of a radiator or the height of a fireguard in determining whether the incident could have occurred in the way described (Fig. 1.17). Again it is important to consider whether a child at his or her developmental level is likely to have got him or herself into the necessary position and stayed in that position long enough to sustain the injury.⁵⁸

In considering whether there may be a medical explanation for the child's presentation the precise history and pattern of bony injury are again crucial. Depending on the nature of the presentation, specific possibilities will arise and will need to be clearly excluded even when they appear unlikely. For example, in an infant with multiple fractures of different ages careful consideration needs to be given to the possibility of some form of bone fragility, for example osteogenesis imperfecta, as an underlying cause. Careful attention to family history, looking for individuals with a history of repeated fractures, presence of blue sclerae, problems with dentition and sensorineural deafness need to be sought together with an expert opinion on the radiological appearances and careful demonstration of normal

biochemistry. In a very young infant who has been born prematurely the possibility of increased bone fragility through deficiencies in bone metabolism needs to be considered. In an older child with nutritional deficiency the possibility of rickets needs to be excluded. In cases when significant problems exist in excluding osteogenesis imperfecta, fibroblast culture may be considered although recognizing that it is only positive in 85 per cent of cases and takes at least 3 months to be reported. Readily accessible, rapid and reliable genetic testing is eagerly awaited.

Haematological disease must be excluded in children presenting with a pattern of excessive bruising, for example leukaemia, haemophilia, von Willebrand's disease and idiopathic thrombocytopenia. With the exception of von Willebrand's disease, exclusion is relatively straightforward and is discussed further in Chapter 4. The possibility of Henoch-Schönlein purpura should also be considered but the characteristic pattern of purpura together with the preceding illness usually avoids confusion. Again, careful attention to the presenting history, past medical and family history should prevent any difficulty. However, it is particularly important in infants that no suggestion of abuse is raised until basic haematology and clotting studies have been performed unless the pattern of bruising is diagnostic of non-accidental injury. Even in situations when the pattern of injury is consistent with non-accidental injury it is important to exclude an underlying bruising tendency as a contributory factor to the presentation.

Skin disorders regularly cause difficulty in the differential diagnosis of non-accidental injury; for example, nummular (discoid) eczema and bullous impetigo presenting lesions suggestive of cigarette burns, and lichen sclerosus et atrophicus presenting with fresh vulval bleeding suggestive of sexual abuse (Fig. 1.18). Again a careful history and examination should lead to the correct diagnosis but problems may occur for example in differentiating bullous impetigo from cigarette burns if a clear history of the evolution of the lesions is not forthcoming (Fig. 1.19). Where doubt exists, observation of the child on the ward, together with bacteriological cultures from the lesions, will frequently resolve the matter.

The difficulty in distinguishing non-organic from organic failure to thrive has been described earlier in this chapter. The potent effect of emotional abuse, as well as deliberate neglect and starvation, is well recognized in causing growth failure as noted above. Ultimately evidence of reversibility is the best confirmation of the diagnosis. Differentiating between organic illness and fabricated or induced illness may be highly problematic. In some units covert video surveillance has been put in place but this raises many ethical and moral dilemmas and must only be undertaken within the context of a multi-agency investigation. It is important to recognize, however, the very significant morbidity and mortality attached to this form of child abuse so that any concerns about this possibility can be clearly recorded.



Figure 1.18 Lichen sclerosus et atrophicus, initially referred as possible sexual abuse.

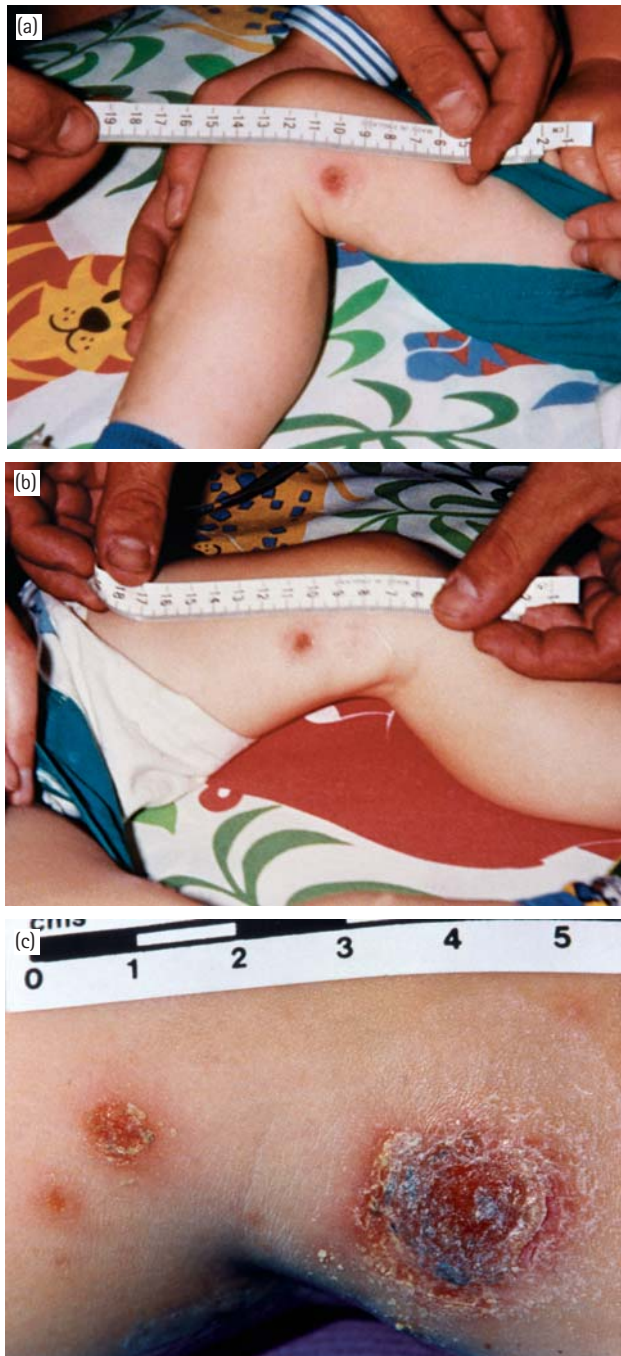


Figure 1.19 (a and b) Bullous impetigo, initially diagnosed as possible cigarette burns. (c) The true nature of the lesion becomes apparent over time.

FORMULATING AN OPINION

The interpretation of the findings at the end of the assessment should include comment on the degree of harm that has been sustained and the prognosis. This includes both the morbidity from the injury itself, in other words the pain and distress caused and the pain and distress caused by any necessary treatment, for example anaesthetic, skin grafting or hospitalization. When available, some information about the immediate recovery, any secondary complications of the injury relating to infection or blood loss and likely long-term scarring is useful; in relation to brain injury, information on the implications of periods of hypoxia and cerebral oedema in addition to the underlying brain injury should be sought. Some indication about the likely long-term recovery period, the likelihood of neurological damage affecting mobility or learning ability, and the long-term effect of undernutrition/deprivation and of emotional damage. In sexual abuse particularly, the impact of abuse on long-term emotional well-being and the likely need for psychiatric, psychological intervention should be considered.

The conclusion reached and opinion offered must take into account not only all the information gathered during the clinical evaluation of the child, but also their interpretation both in the light of the examiner's experience and in the context of the current medical literature. The final opinion offered in the Soul and Conscience report should also take into account findings from the interagency investigation and the results of any expert opinion that has been sought, for example paediatric radiological interpretation of the radiographs or imaging, and the views of an orthopaedic or ophthalmological consultant. When further information is still awaited, this needs to be clearly indicated and when that becomes available a supplementary report is sent to the procurator fiscal.

ONGOING HEALTH CARE

The paediatrician taking the lead role in the comprehensive assessment of the child should also take a lead role in ensuring ongoing health care. Different interventions will be required at different stages, for example immediate medical or surgical input to the acutely injured child, input

from the genitourinary medicine service or the obstetrics services in the aftermath of sexual abuse. The need for immediate or longer term involvement of psychology or psychiatry services should be clearly identified. The young child's developmental delay or failure-to-thrive needs, coordinated multidisciplinary (and probably multi-agency) input and unexplained genitourinary symptoms require follow-up. The child with brain injury will require long-term input from neurology services and the multidisciplinary child development team. In this group of vulnerable children it is particularly important that plans for these interventions are clearly put in place at the outset, as changes of carer and changes of workers may mitigate against well-coordinated care.

INVOLVEMENT IN ONGOING LEGAL AND CHILD-CARE PROCESSES

In the past there has been a tendency for paediatric and forensic services to lie outside the interagency child protection investigation and plan undertaken by police and social work, with inputs often limited to a request for a 'snapshot' forensic examination, attendance at case conference to explain the findings and possibly a citation to give evidence in court. The importance of integration of the health inputs at every stage in the process is now well recognized but requires considerable effort to sustain effectively. Paediatric and forensic doctors have a great deal to offer to the process of investigation and ultimately to the protection of the child through effective gathering and presentation of the medical evidence within the context of the total picture. The role of the medical examiners is central in situations when the only evidence of abuse is medical, for example in non-accidental head injury, asphyxial injury or multiple fractures. These cases are among the most problematic, frequently involving very young infants for whom the risks of subsequent and escalating injury are high if they are returned to their families. However, in the face of no previous concerns, workers in other agencies are reluctant to accept that these parents, apparently devastated by their child's condition, could have deliberately injured their child.

In these situations the paediatric or forensic doctor can play a vital role in explaining the meaning and significance of the medical findings together with the level of risk of future significant harm. In this regard the paediatrician with a responsibility only for the child is well placed to act as an advocate for him or her in a process where parents' views are strongly presented by themselves and their legal representatives.

Increasingly, paediatricians, alongside their forensic colleagues, are being cited to speak to the medical evidence in legal proceedings both relating to child-care processes (Children's Hearing system in Scotland, Family courts in England) and the criminal procedures. Successful presentation of the evidence is crucial not only to the protection of

this child, but also to his or her siblings and potentially other children in the wider community. In preparing to give evidence it is important to gain an update on the child's progress, his or her growth, development, physical and emotional well-being and undertake a review of the relevant recent literature. If this leads to any modification of the opinion given then this needs to be discussed at an early stage with the reporter or procurator fiscal concerned and a supplementary report provided. In preparing for court it is very important to make sure that all of the information is available, i.e. that copies of the photographs have been obtained and checked against the drawings so that they can be described accurately. It is important to be aware both of the nature of the particular legal process and therefore the level of proof that is required (balance of probabilities or beyond reasonable doubt). It is also very important to be aware of the precise grounds of referral or details of the indictment so that it is clear what the prosecutor or reporter is trying to use the medical evidence to establish or refute. It is helpful to consider the strengths and weaknesses of the medical evidence and the likely lines of enquiry or challenge by the defence team in order to be well prepared for cross-examination.

At the outset of an investigation into possible or alleged abuse or neglect it is rarely possible to predict which cases will progress to criminal prosecution. It is therefore important to approach the evaluation and evidence gathering in any case in the anticipation that the technique, findings and opinion offered will be subjected to rigorous scrutiny under cross-examination. Even in cases when no legal proceedings follow, careful evaluation of a child's presentation may offer opportunities to initiate interagency intervention, including health promotion, and so to prevent significant harm and hopefully break the cycle of abuse and deprivation repeating through subsequent generations.

REFERENCES

- 1 Meadow R. *ABC of Child Abuse*, 3rd edn. London: BMJ Publishing Group, 1997.
- 2 Stanton J, Simpson A. Murder misdiagnosed as SIDS: a perpetrator's perspective. *Arch Dis Child* 2001; 85:454-9.
- 3 Children Act 1989 (England and Wales). London: Her Majesty's Stationery Office, 1989.
- 4 Children Act 2004 (England and Wales). London: Her Majesty's Stationery Office, 2004.
- 5 Children (Scotland) Act 1995. London: Her Majesty's Stationery Office, 1995.
- 6 UN Convention on the Rights of the Child (1989).
- 7 Speight N, Wynne J. Is the Children Act failing severely abused and neglected children? *Arch Dis Child* 2000; 82:192-6.
- 8 *Scottish Health and Interagency Guidance: Protecting Children: A Shared Responsibility. Guidance on Interagency Cooperation*. The Scottish Office, 1999.
- 9 *Working Together to Safeguard Children*. HM Government 2006. London: Her Majesty's Stationery Office, 2006.
- 10 Laming Lord (2003) *The Victoria Climbié Inquiry. Report of an inquiry by Lord Laming*. London: The Stationery Office.

- 11 *A Shared Responsibility. Guidance for Health Professionals in Scotland.* Edinburgh: Scottish Executive Health Dept, 2000.
- 12 *Protecting Children and Young People: Framework for Standards.* Edinburgh: Scottish Executive, 2004.
- 13 Kempe CH. Sexual abuse, another hidden pediatric problem. *Pediatrics* 1978; 62:382-9.
- 14 Department of Health. *Child Protection: Messages from Research.* London: Her Majesty's Stationery Office, 1995.
- 15 Cawson P, Wattam C, Brooker S, Kelly G. *Child Maltreatment in the United Kingdom. A study of the prevalence of child abuse and neglect.* London: NSPCC, 2000.
- 16 Hart S, Beggeli N, Grassard M. Evidence for the effects of psychological maltreatment. *J Emotional Abuse* 1998; 1:27-58.
- 17 McClure RJ, Davis PM, Meadow SR, Sibert JR. Epidemiology of Munchausen Syndrome by Proxy: non-accidental poisoning and non-accidental suffocation. *Arch Dis Child* 1996; 75:57-61.
- 18 Royal College of Paediatrics and Child Health. *Fabricated or Induced Illness by Carers.* London: RCPCH, 2001.
- 19 Department of Health. *Safeguarding Children in Whom Illness is Fabricated or Induced.* London: Department of Health, 2006.
- 20 Maguire S, Mann MK, Sibert J, Kemp A. Are there patterns of bruising in childhood which are diagnostic or suggestive of abuse? A systematic review. *Arch Dis Child* 2005; 90:182-6.
- 21 Royal College Paediatrics and Child Health and Association of Forensic Physicians. *Guidance on paediatric and forensic examinations in relation to possible child sexual abuse.* London: RCPCH and Association of Forensic Physicians, 2004.
- 22 Criminal Procedure (Scotland) Act 1995.
- 23 Wilkinson AB, Norrie KMck. *Parent and Child*, 2nd edn. Edinburgh: W Green, 1999.
- 24 Royal College of Paediatrics and Child Health. *Responsibilities of Doctors in Child Protection Cases with Regard to Confidentiality.* London: RCPCH, 2004.
- 25 General Medical Council. *Confidentiality: Protecting and Providing Information.* London: General Medical Council, 2004.
- 26 General Medical Council. *0-18 years: Guidance for All Doctors.* London: General Medical Council, 2007.
- 27 Age of Legal Capacity (Scotland) Act 1991.
- 28 Mok J, Busuttil A, Hammond HF. Joint paediatric forensic examination. *Child Abuse Review* 1997; 7:194-203.
- 29 De San Lazaro C. Making paediatric assessment in suspected sexual abuse, a therapeutic experience. *Arch Dis Child* 1995; 73:174-6.
- 30 Cleaver H, Unell I, Aldgate J. *Children's Needs: Parenting Capacity, the impact of parental mental illness, problem alcohol and drug use, and domestic violence on children's development.* London: The Stationery Office, 1999.
- 31 Skuse DH. Non-organic failure to thrive: a reappraisal. *Arch Dis Child* 1985; 60:170.
- 32 Wright CM. Identification and management of failure to thrive: a community perspective. *Arch Dis Child* 2000; 82:5-9.
- 33 Kelleher KJ, Casey PH, Bradley RH et al. Risk factors and outcomes for failure to thrive in low-birthweight premature infants. *Pediatrics* 1993; 91:941-8.
- 34 Ramsay M, Gisel EG, Boutry M. Non-organic failure to thrive: growth failure secondary to feeding skills difficulties. *Dev Med Child Neurol* 1993; 35:285-97.
- 35 Illingworth RS, Lister J. The critical or sensitive period, with special reference to certain feeding problems in infants and children. *J Pediatr* 1964; 65:839-48.
- 36 Harris G, Booth DA. *Monographs in Clinical Pediatrics.* New York: Harwood Academic, 1993, pp. 61-84.
- 37 Polan HJ, Ward MJ. Role of the mother's touch in failure to thrive: a preliminary investigation. *J Am Acad Child Adolescent Psychiatry* 1994; 33:1098-105.
- 38 Sheridan M. *Children's Developmental Progress: from Birth to Five Years.* Windsor: NFER, 1975.
- 39 Griffiths R. *The Abilities of Young Children.* Amersham: Association for Research in Infant and Child Development, 1975.
- 40 Reynell J. *Reynell Developmental Language Scales.* Windsor: NFER - Neilson Publishing, 1969.
- 41 Applebaum AS. Developmental retardation in infants as a concomitant of physical child abuse. *J Abnormal Child Psychol* 1977; 5:417-23.
- 42 Kemp CH, Helfer RE. *The Battered Child.* London: University of Chicago Press, 1980.
- 43 Department of Education and Skills. *Working Together to Safeguard Children.* London: The Stationery Office, 2006.
- 44 Glaser D, Prior. Predicting emotional abuse and neglect. In Browne K, Hanks H, Stratton P, Hamilton C (eds) *Early Prediction and Prevention of Child Abuse: a Handbook.* Chichester: Wiley, 2002.
- 45 Korbin JE. Cross cultural perspectives and research directions for the 21st century. *Child Abuse Neglect* 1991; 15:67-77.
- 46 Glaser D. Emotional abuse and neglect (psychological maltreatment): a conceptual framework. *Child Abuse Neglect* 2002; 26:697-714.
- 47 Rutter M. *Helping Troubled Children.* London: Penguin Books, 1975.
- 48 Eminson DM, Postlethwaite RJ. Factitious illness: recognition and management. *Arch Dis Child* 1992; 67:1510-16.
- 49 Meadow R. Munchausen by proxy: the hinterland of child abuse. *Lancet* 1997; ii:343-45.
- 50 Buchanan MF. The recognition of non-accidental injury in children. *Practitioner* 1985; 229:815-19.
- 51 Robertson DM, Barbor P, Hull D. Unusual injury? Recent injury in normal children and children with suspected non-accidental injury. *BMJ* 1982; 285:1399-401.
- 52 De Silva S, Oates RK. Child homicide: the extreme of child abuse. *Med J Aust* 1993; 158:300-1.
- 53 Sugar NF, Taylor JA, Feldman KW. Bruising in infants and toddlers: those who don't bruise rarely bruise. *Arch Paediatr Adolescent Med* 1999; 153:399-403.
- 54 Newson J, Newson E. *The Extent of Parental Physical Punishment in the UK.* London: APPROACH, 1989.
- 55 Dunston FD, Guildee ZE, Kontosk, et al. A scoring system for bruise patterns: a tool for identifying abuse. *Arch Dis Child* 2002; 86:330-3.
- 56 Stephenson T, Bialas Y. Estimation of the age of bruising. *Arch Dis Child* 1996; 74:53-5.
- 57 Meadow R. Suffocation, recurrent apnoea and sudden infant death. *J Paediatr* 1990; 117:351-7.
- 58 Barber MA, Sibert JR. Diagnosing physical child abuse: the way forward. *Postgrad Med J* 2000; 76:743-9.
- 59 Gil DG. Physical abuse of children. Findings and implications of a nationwide survey. *Pediatrics* 1969; 44(Suppl.):857-64.

References

1 Chapter 1. Clinical Assessment in Suspected Child Abuse

12 Protecting Children and Young People: Framework for Standards. Edinburgh: Scottish Executive, 2004.

13 Kempe CH. Sexual abuse, another hidden pediatric problem. Pediatrics 1978; 62:382-9.

14 Department of Health. Child Protection: Messages from Research. London: Her Majesty's Stationery Office, 1995.

15 Cawson P, Wattam C, Brooker S, Kelly G. Child Maltreatment in the United Kingdom. A study of the prevalence of child abuse and neglect. London: NSPCC, 2000.

16 Hart S, Binggeli N, Grassard M. Evidence for the effects of psychological maltreatment. J Emotional Abuse 1998; 1:27-58.

17 McClure RJ, Davis PM, Meadow SR, Sibert JR. Epidemiology of Munchausen Syndrome by Proxy: non-accidental poisoning and non-accidental suffocation. Arch Dis Child 1996; 75:57-61.

18 Royal College of Paediatrics and Child Health. Fabricated or Induced Illness by Carers. London: RCPCH, 2001.

19 Department of Health. Safeguarding Children in Whom Illness is Fabricated or Induced. London: Department of Health, 2006.

20 Maguire S, Mann MK, Sibert J, Kemp A. Are there patterns of bruising in childhood which are diagnostic or suggestive of abuse? A systematic review. Arch Dis Child 2005; 90:182-6.

21 Royal College Paediatrics and Child Health and Association of Forensic Physicians. Guidance on paediatric and forensic examinations in relation to possible child sexual abuse. London: RCPCH and Association of Forensic Physicians, 2004.

22 Criminal Procedure (Scotland) Act 1995.

23 Wilkinson AB, Norrie KMCK. Parent and Child, 2nd edn. Edinburgh: W Green, 1999.

- 24 Royal College of Paediatrics and Child Health. Responsibilities of Doctors in Child Protection Cases with Regard to Confidentiality. London: RCPCH, 2004.
- 25 General Medical Council. Confidentiality: Protecting and Providing Information. London: General Medical Council, 2004.
- 26 General Medical Council. 0-18 years: Guidance for All Doctors. London: General Medical Council, 2007.
- 27 Age of Legal Capacity (Scotland) Act 1991.
- 28 Mok J, Busuttil A, Hammond HF. Joint paediatric forensic examination. Child Abuse Review 1997; 7:194-203.
- 29 De San Lazaro C. Making paediatric assessment in suspected sexual abuse, a therapeutic experience. Arch Dis Child 1995; 73:174-6.
- 30 Cleaver H, Unell I, Aldgate J. Children's Needs: Parenting Capacity, the impact of parental mental illness, problem alcohol and drug use, and domestic violence on children's development. London: The Stationery Office, 1999.
- 31 Skuse DH. Non-organic failure to thrive: a reappraisal. Arch Dis Child 1985; 60:170.
- 32 Wright CM. Identification and management of failure to thrive: a community perspective. Arch Dis Child 2000; 82:5-9.
- 33 Kelleher KJ, Casey PH, Bradley RH et al. Risk factors and outcomes for failure to thrive in low-birthweight premature infants. Pediatrics 1993; 91:941-8.
- 34 Ramsay M, Gisel EG, Boutry M. Non-organic failure to thrive: growth failure secondary to feeding skills difficulties. Dev Med Child Neurol 1993; 35:285-97. special reference to certain feeding problems in infants and children. J Pediatr 1964; 65:839-48. 36 Harris G, Booth DA. Monographs in Clinical Pediatrics. New York: Harwood Academic, 1993, pp. 61-84. 37 Polan HJ, Ward MJ. Role of the mother's touch in failure to thrive: a preliminary investigation. J Am Acad Child Adolescent Psychiatry 1994; 33:1098-105. 38 Sheridan M. Children's Developmental Progress: from Birth to Five Years. Windsor: NFER, 1975. 39 Griffiths R. The Abilities of Young Children. Amersham:

Association for Research in Infant and Child Development, 1975. 40 Reynell J. Reynell Developmental Language Scales. Windsor: NFER - Neilson Publishing, 1969. 41 Applebaum AS. Developmental retardation in infants as a concomitant of physical child abuse. *J Abnormal Child Psychol* 1977; 5:417-23. 42 Kemp CH, Helfer RE. *The Battered Child*. London: University of Chicago Press, 1980. 43 Department of Education and Skills. *Working Together to Safeguard Children*. London: The Stationery Office, 2006. 44 Glaser D, Prior. Predicting emotional abuse and neglect. In Browne K, Hanks H, Stratton P, Hamilton C (eds) *Early Prediction and Prevention of Child Abuse: a Handbook*. Chichester: Wiley, 2002. 45 Korbin JE. Cross cultural perspectives and research directions for the 21st century. *Child Abuse Neglect* 1991; 15:67-77. 46 Glaser D. Emotional abuse and neglect (psychological maltreatment): a conceptual framework. *Child Abuse Neglect* 2002; 26:697-714. 47 Rutter M. *Helping Troubled Children*. London: Penguin Books, 1975. 48 Eminson DM, Postlethwaite RJ. Factitious illness: recognition and management. *Arch Dis Child* 1992; 67:1510-16. 49 Meadow R. Munchausen by proxy: the hinterland of child abuse. *Lancet* 1997; ii:343-45. 50 Buchanan MF. The recognition of non-accidental injury in children. *Practitioner* 1985; 229:815-19. 51 Robertson DM, Barbor P, Hull D. Unusual injury? Recent injury in normal children and children with suspected nonaccidental injury. *BMJ* 1982; 285 :1399-401. 52 De Silva S, Oates RK. Child homicide: the extreme of child abuse. *Med J Aust* 1993; 158:300-1. 53 Sugar NF, Taylor JA, Feldman KW. Bruising in infants and toddlers: those who don't bruise rarely bruise. *Arch Paediatr Adolescent Med* 1999; 153:399-403. 54 Newson J, Newson E. *The Extent of Parental Physical Punishment in the UK*. London: APPROACH, 1989. 55 Dunston FD, Guildee ZE, Kontosk, et al. A scoring system for bruise patterns: a tool for identifying abuse. *Arch Dis Child* 2002; 86:330-3. 56 Stephenson T, Bialas Y. Estimation of the age of bruising. *Arch Dis Child* 1996; 74:53-5. 57 Meadow R. Suffocation, recurrent apnoea and sudden infant death. *J Paediatr* 1990; 117:351-7. 58 Barber MA, Sibert JR. Diagnosing physical child abuse: the way forward. *Postgrad Med J* 2000; 76:743-9. 59 Gil DG. Physical abuse of children. Findings and implications of a nationwide survey. *Pediatrics* 1969; 44(Suppl.):857-64.

2 Chapter 2. Investigation of Suspected Sexual Abuse

- 1 Schechter MD, Roberge L. Sexual exploitation. In Helfer RE, Kempe CH (eds) *Child Abuse and Neglect: The Family and the Community*. Cambridge, MA: American Academy of Pediatrics, 1978.
- 2 Jaffe AC, Dynneson L, ten Bonsel RW. Sexual abuse of children: an epidemiological study. *Am J Dis Child* 1975; 129:689-92.
- 3 Kempe CH. Sexual abuse, another hidden pediatric problem. *Pediatrics* 1978; 62:382-9.
- 4 Finkelhor D. Current information on the scope and nature of child sexual abuse. *The Future of Children* 1994; 4:31-53.
- 5 Jones LM, Finkelhor D, Kopiec K. Why is sexual abuse declining? A survey of state child protection administrators. *Child Abuse & Neglect* 2001; 25:1139-58.
- 6 Dunne MP, Purdie DM, Cook MD et al. Is child sexual abuse declining? Evidence from a population-based survey of men and women in Australia. *Child Abuse & Neglect* 2003; 27:141-52.
- 7 Hobbs CJ, Wynne JM. Child sexual abuse: an increasing rate of diagnosis. *Lancet* 1987; ii:837-45.
- 8 Summit RC. The child sexual abuse accommodation syndrome. *Child Abuse & Neglect* 1983; 7:177-93.
- 9 Mok JYQ, Busuttil A, Hammond HF. The joint paediatric-forensic examination in child abuse. *Child Abuse Rev* 1998; 7:194-203.
- 10 Levitt CJ. Sexual abuse in children: A compassionate yet thorough approach to evaluation. *Postgrad Med* 1986; 80:201-15.
- 11 De San Lazaro C. Making paediatric assessment in suspected sexual abuse a therapeutic experience. *Arch Dis Childh* 1995; 73:174-6.
- 12 The Royal College of Paediatrics and Child Health and Faculty of Forensic and Legal Medicine. Guidance on paediatric forensic examinations in relation to possible child sexual abuse. September 2007.

13 Royal College of Paediatrics and Child Health. Child protection companion. London, RCPCH, 2006.

14 Kendall-Tackett KA, Meyer Williams L, Finkelhor D. Impact of sexual abuse on children: A review and synthesis of recent empirical studies. *Psychol Bull* 1993; 113:164-80.

15 Berliner L, Elliott DM. Sexual abuse of children. In Briere J, Berliner L, Bulkley C et al (eds) *The APSAC handbook on child maltreatment*. Thousand Oaks, CA: Sage, pp. 51-71.

16 Levitt CJ. The medical examination in child sexual abuse: A balance between history and exam. *J Child Sex Abuse* 1992; 1:113-21.

17 Myers JEB. The role of the physician in presenting verbal evidence of child abuse. *J Pediatr* 1986; 109:409-11.

18 Ferrell J. Foley catheter balloon technique for visualising the hymen in female adolescent sexual abuse victims. *J Emerg Nurs* 1995; 21:585-6.

19 Starling SP, Jenny C. Forensic examination of adolescent female genitalia: the Foley catheter technique. *Arch Pediatr Adolesc Med* 1997; 151:102-3.

20 Persaud DI, Squires JE, Rubin-Remer D. Use of Foley catheter to examine estrogenised hymens for evidence of sexual abuse. *J Pediatr Adolesc Gynecol* 1997; 10:83-5.

21 Lauber A, Souma G. Use of toluidine blue for documentation of traumatic intercourse. *Obstet Gynecol* 1982; 60:644-8.

22 McCauley J, Gorman RL, Guzinski G. Toluidine blue in the detection of perineal lacerations in pediatric and adolescent sexual abuse victims. *Pediatrics* 1986; 86:1039-43.

23 Teixeira WR. Hymenal colposcopic examination in sexual diagnosis of sexual abuse in the pediatric age group. *Child Abuse & Neglect* 1986; 10:111-14. 25 Muram D, Elias S. Child sexual abuse: genital tract findings in prepubertal girls. II. Comparison of colposcopic and unaided examinations. *Am J Obstetr Gynecol* 1989; 160:333-5. 26 Adams JA, Phillips P, Ahmad M. The usefulness of colposcopic photographs in the evaluation of suspected child sexual abuse. *Adolesc Pediatr*

Gynecol 1990; 3:75-82. 27 Muram D, Jones CE. The use of video-colposcopy in the gynecologic examination of infants, children, and young adolescents. *Adolesc Pediatr Gynecol* 1993; 6:154-6. 28 McCann JJ. The colposcopic genital examination of the sexually abused prepubertal female. *Adolesc Pediatr Gynecol* 1993; 6:123-8. 29 Hobbs C, Wynne J. Use of the colposcope in examination for sexual abuse. *Archives of Disease in Childhood* 1996; 75:539-42. 30 Heger AH. Twenty years in the evaluation of the sexually abused child: has medicine helped or hurt the child and the family? *Child Abuse & Neglect* 1996; 20:893-7. 31 Willott GM, Cross MA. The detection of spermatozoa in the mouth. *J Forensic Sci Soc* 1986; 26:125-8. 32 Willott GM, Allard JE. Spermatozoa - their persistence after sexual intercourse. *Forensic Sci Int* 1982; 19:133-54. 33 Davies A, Wilson EM. The persistence of seminal constituents in the human vagina. *Forensic Science* 1974; 3:45-55. 34 Christian CW, Lavelle JM, De Jong AR et al. Forensic evidence findings in prepubertal victims of sexual assault. *Pediatrics* 2000; 106:100-4. 35 Finkel MA, Ricci LR. Documentation and preservation of visual evidence in child abuse. *Child Maltreatment* 1997; 2:322-30. 36 Finkel MA. Technical conduct of the CSA medical examination. *Child Abuse & Neglect* 1998; 22:555-66. 37 Block RW, Palusci VJ. Child Abuse Pediatrics: A new pediatric subspecialty. *J Pediatr* 2006; 148:711-12. 38 Brayden RM, Altemeier WA III, Yeager T, Muram D. Interpretations of colposcopic photographs: Evidence for competence in assessing sexual abuse. *Child Abuse & Neglect* 1991;15:69-76. 39 Adams JA, Wells R. Normal versus abnormal genital findings in children: how well do examiners agree? *Child Abuse & Neglect* 1993; 17:663-75. 40 Paradise JE, Winter MP, Finkel MA et al. Influence of history on physicians' interpretation of girls' genital findings. *Pediatrics* 1999; 103:980-6. 41 Butler-Sloss E. Report of the inquiry into child abuse in Cleveland 1987. London: HMSO. 42 Adams JA. Grand rounds: medical issues and case studies. Significance of medical findings in suspected sexual abuse: moving towards consensus. *J Child Sex Abuse* 1992; 1:91-9. 43 Adams JA, Harper K, Knudson S. A proposed system for the classification of anogenital findings in children with suspected sexual abuse. *Adolesc Pediatr Gynecol* 1992; 5:73-5. 44 American Academy of Pediatrics Committee on Child Abuse and Neglect. Gonorrhea in prepubertal children. *Pediatrics* 1998; 101:134-5. 45 Adams JA. Approach to the interpretation of medical and laboratory findings in suspected child sexual abuse: a 2005 revision. *The APSAC Advisor* 2005; Summer:7-13. 46 Royal College of Physicians of London. Physical Signs of Sexual Abuse in Children. London: Lavenham Press, 1997. 47 Royal College of Paediatrics and Child Health. The physical signs

of child sexual abuse. An evidence-based review and genitalia in girls selected for non-abuse: review of hymenal morphology and non-specific findings. *J Pediatr Adolesc Gynecol* 2002; 15:27-35.

49 Berenson AB. Appearance of the hymen at birth and one year of age: A longitudinal study. *Pediatrics* 1993; 91:820-5.

50 Berenson AB. A longitudinal study of hymenal morphology in the first 3 years of life. *Pediatrics* 1995; 95:490-6.

51 Yordan EE, Yordan RA. The hymen and Tanner staging of the breast. *Adolesc Pediatr Gynecol* 1992; 5:76-9.

52 McCann J, Wells R, Simon M, Voris J. Genital findings in prepubertal girls selected for nonabuse: a descriptive study. *Pediatrics* 1990; 86:428-39.

53 Berenson AB, Heger, AH, Hayes, JM et al. Appearance of the hymen in prepubertal girls. *Pediatrics* 1992; 89:387-94.

54 McCann J, Voris J, Simon M, Wells R. Comparison of genital examination techniques in prepubertal girls. *Pediatrics* 1990; 85:182-7.

55 Gardner JJ. Descriptive study of genital variation in healthy, nonabused premenarchal girls. *J Pediatr* 1992; 12:251-7.

56 Berenson AB, Chacko MR, Wiemann CM et al. A case-control study of anatomic changes resulting from sexual abuse. *Am J Obstet Gynecol* 2000; 182:820-34.

57 Berenson A, Heger, A, Andrews, S. Appearance of the hymen in newborns. *Pediatrics* 1991; 87:458-65.

58 Emans SJ, Woods ER, Flagg NT, Freeman A. Genital findings in sexually abused, symptomatic and asymptomatic girls. *Pediatrics* 1987; 79:778-85.

59 Heppenstall-Heger A, McConnell G, Ticson L et al. Healing patterns in anogenital injuries: a longitudinal study of injuries associated with sexual abuse, accidental injuries, or genital surgery in the preadolescent child. *Pediatrics* 2003; 112:829-37.

60 Kerns DL, Ritter ML, Thomas RG. Concave hymenal variations in suspected child sexual abuse victims. *Pediatrics* 1992; 90:265-72.

- 61 Hobbs CJ, Wynne JM, Thomas AJ. Colposcopic genital findings in prepubertal girls assessed for sexual abuse. Arch Dis Child 1995; 73:465-9.
- 62 Cantwell H. Vaginal inspection as it relates to child sexual abuse in girls under thirteen. Child Abuse & Neglect 1983; 7:171-6.
- 63 White ST, Ingram DL, Lyna PR. Vaginal introital diameter in the evaluation of sexual abuse. Child Abuse & Neglect 1989; 13:217-24.
- 64 Kerns DL. Cool science for a hot topic. Child Abuse & Neglect 1989; 13 :177-8.
- 65 Paradise JE. Predictive accuracy and the diagnosis of sexual abuse: a big issue about a little tissue. Child Abuse & Neglect 1989; 13:169-76.
- 66 Heger A, Emans SJ. Introital diameter as the criterion for sexual abuse. Pediatrics 1990; 85:222-3.
- 67 Hobbs CJ, Wynne JM. Buggery in childhood: a common syndrome of child abuse. Lancet 1986; ii:792-6.
- 68 McCann J, Voris J, Simon M, Wells R. Perianal findings in prepubertal children selected for nonabuse: a descriptive study. Child Abuse & Neglect 1989; 13:179-93.
- 69 Priestley B. Reflex anal dilatation and abuse. Lancet 1987; ii:1396.
- 70 Stanton A, Sunderland R. Prevalence of reflex anal dilatation in 200 children. BMJ 1989; 298:802-3.
- 71 Clayden G. Reflex anal dilatation associated with severe chronic constipation in children. Arch Dis Childh 1988; 63:832-6.
- 72 Agnarsson U, Warde C, McCarthy G, Evans N. Perianal appearances in childhood constipation. Arch Dis Childh 1990; the importance of anal examination. Child Abuse & Neglect 1989; 13:195-210. 74 Berenson AB, Somma-Garcia, A, Barnett, S. Perianal findings in infants 18 months of age and younger. Pediatrics 1993; 91:838-40. 75 Finkel MA. Anogenital trauma in sexually abused children. Pediatrics 1989; 84:317-22. 76 McCann J, Voris J, Simon M. Genital injuries resulting from sexual abuse: a longitudinal study. Pediatrics 1992; 89:307-17. 77 McCann J, Voris J. Perianal

injuries resulting from sexual abuse: a longitudinal study. *Pediatrics* 1993; 91:390-3. 78 Muram D. Child sexual abuse: Relationship between sexual acts and genital findings. *Child Abuse & Neglect* 1989; 13:211-16. 79 Adams J, Harper K, Knudson S, Revilla J. Examination findings in legally confirmed child sexual abuse: it's normal to be normal. *Pediatrics* 1994; 94:310-17. 80 Adams JA, Knudson, S. Genital findings in adolescent girls referred for suspected sexual abuse. *Arch Pediatr Adolesc Med* 1996; 150:850-7. 81 Heger A, Ticson L, Valesquez O, Bernier R. Children referred for possible sexual abuse: medical findings in 2384 children. *Child Abuse & Neglect* 2002; 26:645-59. 82 Slaughter L, Brown CRV, Crowley S, Peck R. Patterns of genital injury in female sexual assault victims. *Am J Obstetr Gynecol* 1997; 176: 609-16. 83 Kellogg ND, Menard SW, Santos. A. Genital anatomy in pregnant adolescents: 'Normal' does not mean 'Nothing happened'. *Pediatrics* 2004; 113:e67-9. 84 Paradise JE, Campos JM, Friedman HM, Frishmuth G. Vulvovaginitis in premenarchal girls: clinical features and diagnostic evaluation. *Pediatrics* 1999; 70:193-8. 85 Straumanis JP, Bocchini JA. Group A beta-hemolytic streptococcal vulvovaginitis in prepubertal girls: a case report and review of the past twenty years. *Pediatric Infect Dis J* 1990; 9:845-8. 86 Pierce AM, Hart CA. Vulvovaginitis: causes and management. *Arch Dis Childh* 1992; 67:509-12. 87 Jenny C, Kirby P, Fuquay D. Genital lichen sclerosus mistaken for child sexual abuse. *Pediatrics* 1981; 83:597. 88 Handfield-Jones SE, Hinde FR, Kennedy CT. Lichen sclerosus et atrophicus in children misdiagnosed as sexual abuse. *BMJ* 1987; 294:1404-5. 89 Muhlendahl KE. Suspected sexual abuse in a 10-year-old girl. *Lancet* 1996; 348:30. 90 Bond GR, Dowd MD, Landsman I, Rimsza M. Unintentional perineal injury in prepubescent girls: A multicenter, prospective report of 56 girls. *Pediatrics* 1995; 95:628-31. 91 Kellogg ND, Parra JM. Linea vestibularis: a previously undescribed normal genital structure in female neonates. *Pediatrics* 1991; 87:926-9. 92 Kellogg ND, Parra JM. Linea vestibularis: follow-up of a normal genital structure. *Pediatrics* 1993; 92:453-6. 93 Johnson CF. Prolapse of the urethra: Confusion of clinical and anatomic characteristics with sexual abuse. *Pediatrics* 1991; 87:722-5. 94 Wallis SM, Walker-Smith J. Case report: an unusual case of Crohn's disease in a West Indian child. *Acta Paediatr Scand* 1976; 65:749-51. 95 Sellman SPB, Hupertz VF, Reece RM. Crohn's disease presenting as suspected abuse. *Pediatrics* 1996; 97:272-4. 96 Friedrich WN, Grambsch P, Broughton D et al. Normative sexual behavior in children. *Pediatrics* 1991; 88:456-64. 97 Friedrich WN, Fisher J, Broughton D et al. Normative sexual transmission of sexually transmitted infections: an

infrequent occurrence. *Pediatrics* 1984; 74:217-25.

99 American Academy of Pediatrics. Sexually transmitted diseases. In Pickering LK (ed.) Report of the Committee on Infectious Diseases, 26th edn. Elk Grove Village, IL: Ballinger, 2003, pp. 157-67.

100 American Academy of Pediatrics Committee on Child Abuse and Neglect. The evaluation of sexual abuse of children. *Pediatrics* 2005; 116:506-12.

101 Ingram DL, Everett D, Lyna PR et al. Epidemiology of adult sexually transmitted disease agents in children being evaluated for sexual abuse. *Pediatr Infect Dis J* 1992; 11:945-50.

102 Robinson AJ, Watkeys JEM, Ridgway GI. Sexually transmitted organisms in sexually abused children. *Arch Dis Childh* 1998; 79:356-8.

103 Ingram DM, Miller WC, Schoenbach VJ et al. Risk assessment for gonococcal and chlamydial infections in young children undergoing evaluation for sexual abuse. *Pediatrics* 2001; 107:e73-80.

104 Thomas A, Forster G, Robinson A, Rogstad K. for the Clinical Effectiveness Group (Association of Genitourinary Medicine and the Medical Society for the Study of Venereal Diseases). National guideline for the management of suspected sexually transmitted infections in children and young people. *Sex Trans Infect* 2002; 78:324-31.

105 Handley J, Dinsmore W, Maw R et al. Anogenital warts in children; sexual abuse or not? *Int J STI & AIDS* 1993; 4:271-9.

106 Siegfried E, Rasnick-Conley J, Cook S et al. Human papillomavirus screening in pediatric victims of sexual abuse. *Pediatrics* 1998; 101:43-7.

107 Steele AM, de San Lazaro C. Transhymenal cultures for sexually transmissible organisms. *Arch Dis Childh* 1994; 71:423-7. usefulness of vaginal washes in premenarcheal girls as a diagnostic procedure for sexually transmitted infections. *Pediatr Infect Dis J* 1996; 15:651-66. 109 Mok JYQ. Routine HIV testing after child sexual abuse? *Child Abuse Rev* 1998; 7:63-9. 110 Muram D, Speck PM, Gold SS. Genital abnormalities in female siblings and friends of child victims of sexual abuse. *Child Abuse & Neglect* 1991; 15:105-10. 111 Bays J, Chadwick, D. Medical diagnosis of

the sexually abused child. Child Abuse & Neglect 1993; 17:91-110. 112 Muram D. Child sexual abuse. Curr Opin Obstetr Gynecol 1993; 5:784-90. 113 De Jong AR, Rose M. Legal proof of child sexual abuse in the absence of physical evidence. Pediatrics 1991; 88:506-11. 114 Kerns DL. Triage and referrals for child sexual abuse medical examinations: Which children are likely to have positive medical findings? Child Abuse & Neglect 1998; 22:515-18. 115 Chadwick DL, Krous HF. Irresponsible testimony by medical experts in cases involving the physical abuse and neglect of children. Child Maltreatment 1997; 2:313-21. 116 Adams JA. The role of photo documentation of genital findings in medical evaluations of suspected child sexual abuse. Child Maltreatment 1997; 2:341-7. 117 Mok JYQ, Busuttil A. Medical examinations for Child Sexual Abuse in Scotland: good enough practice? Child Abuse Review 2004; 2004; 13:324-37. 118 Jenny C. Pediatric fellowships in child abuse and neglect: the development of a new subspecialty. Child Maltreatment 1997; 2:356-61. 119 Emans SJ, Woods ER, Allred EN, Grace E. Hymenal findings in adolescent women: impact of tampon use and consensual sexual activity. J Pediatr 1994; 125:153-60.

3 Chapter 3. Radiology of Child Abuse

1 Caffey J. Multiple fractures in the long bones of infants suffering from subdural haematoma. *AJR* 1946; 56:163-73.

2 Guthkelch AN. Infantile subdural haematoma and its relationship to whiplash injuries. *BMJ* 1971; 2:430-1.

3 Caffey J. On the theory and practice of shaking infants. Its potential residual effects of permanent brain damage and mental retardation. *Am J Dis Child* 1972; 124:161-9.

4 Kleinman PK, Belanger PL, Karellas A, Spevak MR. Normal metaphyseal radiologic variants not to be confused with system in suspected or alleged nonaccidental injury, including the mimics. *Topics MR Imaging* 2007; 18:53-74.

29 Suh DY, Davis PC, Hopkins KL, et al. Nonaccidental pediatric head injury: diffusion-weighted imaging findings. *Neurosurgery* 2001; 49:309-20.

30 Hart BL, Dudley MH, Zumwalt RE. Post mortem cranial MRI and autopsy correlation in suspected child abuse. *Am J Forensic Med Pathol* 1996; 17:217-24.

31 Sty JR, Starshak RJ. The role of bone scintigraphy in the evaluation of the suspected abused child. *Radiology* 1983; 146:369-75.

32 Mandelstam SA, Cook D, Fitzgerald M, Ditchfield MR. Complementary use of radiological skeletal survey and bone scintigraphy in detection of bony injuries in suspected child abuse. *Arch Dis Child* 2003; 88:387-90.

33 Carty HML. Fractures caused by child abuse. *J Bone Joint Surg Br* 1993; 75B:849-57.

34 Rao P, Carty H. Non-accidental injury: review of the radiology. *Clin Radiol* 1999; 54:11-24.

35 Taitz J, Moran K, O'Meara M. Long bone fractures in children under 3 years of age: is abuse being missed in emergency department presentations? *J Paediatr Child Health* 2004; 40:170-4.

36 Worlock P, Stower M, Barbor P. Patterns of fractures in accidental and non-accidental injury in children: a comparative study. *Br Med J Clin Res Ed* 1986; 293:100-2.

37 Kleinman PK, Marks SC, Richmond JM, Blackbourne BD.

Inflicted skeletal injury: a postmortem radiologic-histopathologic study in 31 infants. AJR 1995; 165: 647-650.

38 Grayev AM, Boal DKB, Wallach DM, Segal LS. Metaphyseal fractures mimicking abuse during treatment for clubfoot. Pediatr Radiol 2001; 31:559-63.

39 O'Connell AM, Donoghue VB. Can classic metaphyseal lesions follow uncomplicated caesarean section? Pediatr Radiol 2007; 37:488-91.

40 Kleinman PK, Marks SC, Blackbourne B. The metaphyseal lesion in abused infants: a radiologic-histopathologic study. AJR 1986; 146:895-905.

41 Bulloch B, Schubert CJ, Brophy PD, et al. Cause and clinical characteristics of rib fractures in infants. Pediatrics 2000; 105:E48.

42 Cadzow SP, Armstrong KL. Rib fractures in infants: red alert! The clinical features, investigations and child protection outcomes. J Paediatr Child Health 2000; 36:322-6.

43 Durani Y, DePiero AD. Images in internal medicine. Ann Emerg Med 2006; 47:210-15.

44 Rizzolo PJ, Coleman PR. Neonatal rib fracture: birth trauma or child abuse? J Family Practice 1989; 29:561-3.

45 Kleinman PK, Marks SC, Adams VI, Blackbourne BD. Factors affecting visualization of posterior rib fractures in abused infants. AJR 1988; 150:635-8.

46 Kleinman PK, Schlesinger AE. Mechanical factors associated with posterior rib fractures: laboratory and case studies. Pediatr Radiol 1997; 27:87-91.

47 Kleinman PK, Marks SC, Nimkin K, et al. Rib fractures in 31 abused infants: postmortem radiologic-histopathologic study. Radiology 1996; 200:807-10.

48 Feldman KW, Brewer DK. Child abuse, cardiopulmonary resuscitation and rib fractures. Pediatrics 1984; 73:339-42.

49 Spevak MR, Kleinman PK, Belanger PL, et al. Cardiopulmonary resuscitation and rib fractures in infants. A post-mortem radiologic-pathologic study. JAMA 1994;

50 Dolinak, D. Rib fractures in infants due to cardiopulmonary resuscitation efforts. *Am J Forensic Med Pathol* 2007; abuse: radiologic-histopathologic correlates. *Investigative Radiology* 1992; 27:715-22. 52 Kleinman PK, Zito JL. Avulsion of the spinous processes caused by infant abuse. *Radiology* 1984; 151:389-91. 53 Rooks VJ, Sisler C, Burton B. Cervical spine injury in child abuse. Report of 2 cases. *Pediatr Radiol* 1998; 28:193-5. 54 Cullen JC. Spinal lesions in battered babies. *J Bone Joint Surg Br* 1975; 57B:364-6. 55 Lonergan GJ, Baker AM, Morey MK, Boos SC. Child abuse: radiologic-pathologic correlation. *Radiographics* 2003; 23:811-45. 56 Kogutt MS, Swischuk LE, Fagan CJ. Patterns of injury and significance of uncommon fractures in the battered child syndrome. *Am J Roentgenol Radium Ther Nucl Med* 1974; 121:143-149. 57 Kleinman PK, Shelton YA. Hangman's fracture in an abused infant: imaging features. *Pediatr Radiol* 1997; 27:776-7. 58 Nimkin K, Spevak MR, Kleinman PK. Fractures of the hands and feet in child abuse: Imaging and pathologic features. *Radiology* 1997; 203:233-6. 59 Carty H. The non-skeletal injuries of child abuse: part II the body. In *The Year Book of Paediatric Radiology*, Borsod County Teaching Hospital, Miskolc, 1991; 3:25-34. 60 Hechter S, Hoyer D, Manson D. Sternal fractures as a manifestation of abusive injury in children. *Pediatr Radiol* 2002; 32:902-6. 61 Ablin DS, Greenspan A, Reinhart MA. Pelvic injuries in child abuse. *Pediatr Radiol* 1922; 22:454-7. 62 O'Connor JF, Cohen J. In Kleinman PK (ed.) *Diagnostic Imaging of Child Abuse*. Baltimore: Williams and Wilkins, 1987, p. 112. 63 Prosser I, Maguire S, Harrison SK, et al. How old is this fracture? Radiologic dating of fractures in children: a systematic review. *AJR* 2005; 184:1282-6. 64 Haviland J, Ross Russell RI. Outcome after severe nonaccidental head injury. *Arch Dis Child* 1997; 77:504-7. 65 Jayawant S, Rawlinson A, Gibbon F, et al. Subdural haemorrhages in infants: population based study. *BMJ* 1998; 317:1558-61. 66 King SJ, Boothroyd AE. Cranial trauma following birth in term infants. *Br J Radiol* 1998; 71:233-8. 67 Lo TYM, McPhillips M, Minns RA, Gibson RJ. Cerebral atrophy following shaken impact syndrome and other non-accidental head injury. *Pediatric Rehabilitation* 2003; 6:47-55. 68 Lloyd DA, Carty H, Patterson M, et al. Predictive value of skull radiography for intracranial injury in children with blunt head injury. *Lancet* 1997; 349:821-4. 69 Billmire ME, Myers PA. Serious head injury in infants: accident or abuse? *Pediatrics* 1985; 75:340-2. 70 Warrington SA, Wright CM, ALSPAC Study Team. Accidents and resulting injuries in premobile infants: data from the ALSPAC study. *Arch Dis*

Child 2001; 85:104-7. 71 Robertson DM, Barbor P, Hull D. Unusual injury? Recent injury in normal children and children with suspected nonaccidental injury. BMJ 1982; 285:1399-401. 72 Helfer RE, Slovis TL, Black M. Injuries resulting when small children fall out of bed. Pediatrics 1977; 60:533-5. 73 Kravitz H, Driessen G, Gomberg R and Korach A. Accidental falls from elevated surfaces in infants from birth to one year of age. Pediatrics 1969; 44 (Suppl.):869-76. 74 Stoodley N. Neuroimaging in non-accidental head injury: if, when, why and how? Clin Radiol 2005; 60:22-30. 75 McPhillips M. Non-accidental injury in the young infant. In Rutherford M (ed.) MRI of the Neonatal Brain. London: WB Saunders, 2002, pp. 261-71. 76 Newton RW. Intracranial haemorrhage and non-accidental natural history of subdural haemorrhage in babies and relation to obstetric factors. Lancet 2004; 363:846-851.

78 Looney CB, Smith JK, Merck LH, et al. Intracranial hemorrhage in asymptomatic neonates: prevalence on MR images and relationship to obstetric and neonatal risk factors. Radiology 2007; 242:535-541.

79 Tung GA, Kumar M, Richardson RC, et al. Comparison of accidental and nonaccidental traumatic head injury in children on noncontrast computed tomography. Pediatrics 2006; 118:626-33.

80 Duhaime AC, Alario AJ, Lewander WJ, et al. Head injury in very young children: mechanisms, injury types and ophthalmologic findings in 100 hospitalized patients younger than 2 years of age. Pediatrics 1992; 90:179-85.

81 Ewing-Cobbs L, Kramer L, Prasad M, et al. Neuroimaging, physical, and developmental findings after inflicted and noninflicted traumatic brain injury in young children. Pediatrics 1998; 102:300-7.

82 Hymel KP, Makoroff KL, Laskey AL, et al. Mechanisms, clinical presentations, injuries, and outcomes from inflicted versus noninflicted head trauma during infancy: results of a prospective, multicentered, comparative study. Pediatrics 2007; 119:922-9.

83 Case ME, Graham MA, Handy TC, et al. Position paper on fatal abusive head injuries in infants and young children. Am J Forens Med Path 2001; 22:112-22.

84 Wells RG, Vetter C, Laud P. Traumatic low attenuation subdural fluid collections in children younger than 3 years. Arch Pediatr Adolesc Med 2003; 157:1005-10.

85 McPhillips M. Initial and sequential MRI in non-accidental head injury. In Minns RA, Brown JK (eds.) Shaking and other Non-accidental Head Injuries in Children. London: MacKeith Press, 2005, pp. 262-70.

86 Ordia IJ, Strand R, Gilles F, Welch K. Computed tomography of contusional clefts in the white matter in infants. J Neurosurg 1981; 54:696-8.

87 Han BK, Towbin RB, de Courten-Myers G, et al. Reversal sign on CT: Effect of anoxic ischaemic cerebral injury in children. Am J Neuroradiol 1989; 10:1191-8.

88 Kleinman PK, Zito JL, Davidson RI, Raptopoulos V. The subarachnoid spaces in children: normal variations in size. Radiology 1983; 147:455-7.

89 Kapila A, Trice J, Spies WG, et al. Enlarged cerebrospinal fluid spaces in infants with subdural hematomas. Radiology 1982; 142:669-72.

90 Libicher M, Tröger J. US measurements of the subarachnoid space in infants: normal values. Radiology 1992; 184:749-51.

91 Wilkinson AG, Cooke R, Tallur KK, et al. Pericerebral space measurements in infants: sonographic determination. Paper presented at Hydrocephalus 2005 International Consensus Meeting, Queenstown, New Zealand, August 2005.

92 Fessell DP, Frankel DA, Wolfson WP. Sonography of extraaxial fluid in neurologically normal infants with head circumference greater than or equal to the 95th percentile for age. J Ultrasound Med 2000; 19:443-7.

93 Nimkin K, Teeger S, Wallach MT, et al. Adrenal hemorrhage in abused children: imaging and post mortem findings. AJR 1994; 162: 661-3.

94 Ng CS, Hall CM, Shaw DG. The range of visceral manifestations of non-accidental injury. Arch Dis Child 1997; 77:167-74.

95 Barnes PM, Norton CM, Dunstan FD, et al. Abdominal injury due to child abuse. Lancet 2005; 366:234-5.

96 Touloukian RJ. Abdominal visceral injuries in battered children. Pediatrics 1968; 42:642-6. battered child syndrome: Report of 2 cases with skeletal involvement. Am J

Roentgenol Radium Ther Nucl Med 1975; 125:456-61. 98 Sivit CJ, Ingram JD, Taylor GA, et al. Post traumatic adrenal hemorrhage in children. CT findings in 34 patients. AJR 1992; 158:1299-302. 99 Kleinman PK, Brill PW, Winchester P. Resolving duodenaljejunal hematoma in abused children. Radiology 1986; 160:747-50. 100 Fulcher AS, Das Narla L, Brewer WH. Gastric hematoma and pneumatosis in child abuse. Am J Roentgenol 1990; 155:1283-4. 101 Ablin DS, Reinhart MA. Esophageal perforation by a tooth in child abuse. Pediatr Radiol 1992; 22:339-41. 102 McDowell HP, Fielding DW. Traumatic perforation of the hypopharynx: an unusual form of abuse. Arch Dis Child 1984; 59:888-9. 103 Kleinman PK, Spevak MR, Hansen M. Mediastinal pseudocyst caused by pharyngeal perforation during child abuse. Am J Roentgenol 1992; 158:1111-13. 104 Ablin DS, Greenspan A, Reinhart MA. Pelvic injuries in child abuse. Pediatr Radiol 1992; 22:454-7. 105 Carty H. Case report; child abuse - necklace calcification - a sign of strangulation? Br J Radiol 1993; 66:1186-8. 106 Twomey EL, Naughten ER, Donoghue VB, Ryan S. Neuroimaging findings in glutaric aciduria type 1. Pediatr Radiol 2003; 33:823-30. 107 Hartley LM, Khwaja OS, Verity CM. Glutaric aciduria type 1 and nonaccidental head injury. Pediatrics 2001; 107:174-5. 108 Shaw JCL. Copper deficiency and non-accidental injury. Arch Dis Child 1988; 63: 448-455. 109 Sillence D. Osteogenesis imperfecta. An expanding panorama of variants. Clin Orthop 1981; 159:11-25. 110 Pozzati E, Poppi M, Gaist G. Acute bilateral extradural hematomas in a case of osteogenesis imperfecta congenital. Neurosurgery 1983; 13:66-8. 111 Gahagan S, Rimsza ME. Child abuse or osteogenesis imperfecta: how can we tell? Pediatrics 1991; 88:987-92. 112 Wardinsky TD, Vizcarrondo FE, Cruz BK. The mistaken diagnosis of child abuse: a three-year USAF medical center analysis and literature review. Mil Med 1995; 160:15-20. 113 Paterson CR, Burns J, McAllion SJ. Osteogenesis imperfecta: the distinction from child abuse and the recognition of a variant form. Am J Med Genet 1993; 45:187-92. 114 Chapman S, Hall CM. Non-accidental injury or brittle bones. Pediatr Radiol 1997; 27:106-10. 115 Miller MN, Hangartner TN. Temporary brittle bone disease: association with decreased fetal movement and osteopenia. Calc Tiss Int, 1999; 64:137-43. 116 Mendelson KL. Critical review of 'temporary brittle bone disease'. Pediatr Radiol 2005; 35:1036-40. 117 Rodríguez JI, Palacios J, Ruiz A, et al. Morphological changes in long bone development in fetal akinesia deformation sequence: An experimental study in curarized rat fetuses. Teratology 1992; 45:213-21. 118 Knight DJ, Bennet GC. Non-accidental injury in osteogenesis imperfecta: a case report. J Pediatr Orthop 1990; 10:542-4. 119 Duncan AA, Chandy J. Case report: multiple neonatal

fractures - dietary or deliberate? Clin Radiol 1993;
48:137-9. Further Reading Kleinman PK (ed.) Diagnostic
Imaging of Child Abuse, 2nd edn. Baltimore: Mosby, 1998.

4 Chapter 4. Haematological Abnormalities that Can Simulate Abuse

10 Johnson CF, Coury DL. Bruising and hemophilia: accident or child abuse? *Child Abuse and Neglect* 1988; 12:409-415.

11 Smith. S.M, Hanson. R. 134 battered children: a medical and psychological study. *British Medical Journal* 1974; 3:666-670.

12 Knight DJ, Bennet GC. Non-accidental injury in osteogenesis imperfecta: case report. *J Pediatr Orthop* 1990; 10:542-544.

13 Altieri MF. Child abuse. When to be suspicious and what to do then. *Postgrad Med* 1990; 87:153-162.

14 Ladebauche P. Childhood trauma. When to suspect abuse. *Reg Nurs J* 1997; 60:38-42.

15 Roberts R. When you suspect abuse: what next? *The Practitioner* 1997; 241:322-326.

16 Daly KC, Siegel RM. Henoch-Schönlein purpura in a child at risk of abuse. *Arch Pediatr Adolesc Med* 1998; 152:96-98.

17 Laposata ME, Laposata M. Children with signs of abuse: when is it not child abuse? *Am J Clin Pathol* 2005; 123(Suppl. 1): S119-124.

18 Sibert J. Bruising, coagulation disorder and physical child abuse. *Blood Coagulation Fibrinolysis* 2004; 15(Suppl. 1): S33-39.

19 Johnson CF. Inflicted injury versus accidental injury. *Pediatr Clin North Am* 1990; 37:791-814.

20 Wilson EF. Estimation of the age of cutaneous contusions in child abuse. *Pediatrics* 1977; 60:750-752.

21 Schwartz AJ, Ricci R. How accurately can bruises be aged in abused children? Literature review and synthesis. *Pediatrics* 1996; 97:254-257.

22 Stephenson T, Bialas Y. Estimation of the age of bruising. *Arch Dis Child* 1996; 74:53-55.

23 Munang LA, Leonard PA, Mok JY. Lack of agreement on colour description between clinicians examining childhood bruising. *J Clin Forensic Med* 2002; 9:171-174.

24 Sugar NF, Taylor JA, Feldman KW. Bruises in infants and toddlers: those who don't bruise rarely bruise. Puget Sound Pediatric Research Network. Arch Pediatr Adolesc Med 1999; bruise patterns: a tool for identifying abuse. Arch Dis Child 2002; 86:330-333. 26 Hamilton M, Jenkins B, Dunstan F et al. Prospective analysis of bruising in children with and without an inherited bleeding disorder. Blood 2006; 108:304a-305a. 27 Kunicki TJ, Nugent DJ, Staats SJ et al. The human fibroblast class II extracellular matrix receptor mediates platelet adhesion to collagen and is identical to the platelet glycoprotein Ia-IIa complex. J Biol Chem 1988; 263:4516-4519. 28 Roberts HR, Monroe DM, Oliver JA et al. Newer concepts of blood coagulation. Haemophilia 1998; 4:331-334. 29 Bazjar L, Morser J, Neisheim M. TAFI, or plasma procarboxypeptidase B, couples the coagulation and fibrinolytic cascades through the thrombin-thrombomodulin complex. J Biol Chem 1996; 271:16603-16608. 30 MacFarlane RG. An enzyme cascade in the blood clotting mechanism and its function as a biochemical amplifier. Nature 1964; 202:498-499. 31 Davie EW, Ratnoff OD. Waterfall sequence for intrinsic blood clotting. Science 1964; 145:1310-2. 32 Perry DJ. Factor VII deficiency. Br J Haematol 2002; 118:689-700. 33 Clauss A. Rapid physiological coagulation methods in determination of fibrinogen. Acta Haematol (Basel) 1957; 17:237-246. 34 Mackie IJ, Kitchen S, Machin SJ, Lowe GDO. Guidelines on fibrinogen assays. Br J Haematol 2003; 121:396-404. 35 Medical Devices Agency. MDA Evaluation Report: fibrinogen assay reagents and methods. MDA 2000/01 ISBN184182 139X. Norwich: Her Majesty's Stationery Office. 36 Sutor A. The bleeding time in pediatrics. Semin Thromb Hemostasis 1998; 24:531-543. 37 Valeri CR, MacGregor H, Cassidy G, Tinney R, Pompei F. Effects of temperature on bleeding time and clotting time in normal male and female volunteers. Crit Care Med 1995; 23:698-704. 38 van den Burg PJ, Hospers J.E, van Vliet M et al. Changes in haemostatic factors and activation products after exercise in healthy subjects with different ages. Thromb Haemostasis 1995; 74:1457-1464. 39 Lowe GDO. Blood viscosity and cardiovascular disease. Thromb Haemostasis 1992; 67:494-498. 40 Jakob E, Sutor A. Interaction of platelet aggregation and granulocyte function (Abstract). Ann Haematol 1991; 62:78. 41 Sohngen D, Hattstein E. Heyell A et al. Hematological parameters influencing the Thrombostat 4000. Semin Thromb Hemostasis 1995; 21(Suppl. 2):20-24. 42 Ivy AC, Shapiro F, Melnick P. The bleeding tendency in jaundice. Surg Gynaecol Obstet 1935; 60:781-784. 43 Lethagen S, Kling S. New bleeding time devices with retractable blades evaluated in children, healthy volunteers and patients with prolonged bleeding

time. *Thromb Haemostasis* 1993; 70:595-597. 44 Feusner JH. Normal and abnormal bleeding times in neonates and young children utilizing a full standardized template technic. *Am J Clin Pathol* 1980; 74:73-77. 45 Andrew M, Castle V, Mitchell L, Paes B. Modified bleeding time in the infant. *Am J Hematol* 1989; 30:190-191. 46 Andrew M, Paes B, Bowker J, Vegh P. Evaluation of an automated bleeding time device in the newborn. *Am J Hematol* 1990; 35:275-277. 47 Michelson AD. Flow cytometry: a clinical test of platelet function (Review). *Blood* 1996; 87:4925-4936. 48 Michelson AD. Platelet function in the newborn. *Semin childhood. Measuring aggregation and release reaction in whole blood. Semin Thromb Hemostasis* 1998; 24:513-521.

50 Harrison P, Robinson M, Leisner R et al. The PFA-100: a potential rapid screening tool for the assessment of platelet dysfunction. *Clinical Laboratory Haematology* 2002; 24:225-232.

51 Harrison P. The role of PFA-100® testing in the investigation and management of haemostatic defects in children and adults. *Br J Haematol* 2005; 130:3-10.

52 Andrew M, Vegh P, Johnston M et al. Maturation of the hematopoietic system during childhood. *Blood* 1992; 80: 1998-2005.

53 Lane DA, Scully MF, Thomas DP et al. Acquired dysfibrinogenaemia in acute and chronic liver disease. *Br J Haematol* 1977; 35:301-308.

54 Weigart AL, Schafer AI. Uremic bleeding: pathogenesis and therapy. *Am J Med Sci* 1998; 316:94-104.

55 Mannucci PM, Giangrande PLF. Acquired disorders of coagulation. In Bloom AL, Forbes CD, Thomas DP, Tuddenham EGD (eds) *Haemostasis and thrombosis*. London: Churchill Livingstone, 1994, vol. 2, pp. 249-268.

56 Giannelli F, Green PM. The molecular basis of haemophilia A and B. *Baillière's Clin Haematol* 1996; 9:211-228.

57 Casaña P, Martínez F, Haya S, Espinós C, Aznar JA. Significant linkage and non-linkage of type 1 von Willebrand disease to the von Willebrand factor gene. *Br J Haematol* 2001; 115:692-700.

58 Bolton-Maggs PHB, Young Wa-Yin, McCraw AH et al. Inheritance and bleeding in factor XI deficiency. *Br J*

Haematol 1988; 69:521-528.

59 Brown J, Melinkovich P. Henoch-Schönlein purpura misdiagnosed as suspected child abuse: a case report and literature review. JAMA 1986; 256:617-618.

60 Menter A. Symmetrical purpura doesn't mirror child abuse. JAMA 1987; 257:486.

61 Perrot LJ. Masque ecchymotique. Specific or nonspecific indicator for abuse. Am J Forensic Med 1989; Pathology 10:95-7.

62 Rooms L, Fitzgerald N, McClain KL. Hemophagocytic lymphohistiocytosis masquerading as child abuse; presentation of three cases and review of central nervous system findings in hemophagocytic lymphohistiocytosis. Pediatrics 2003; 111:636-640.

63 Pearson RW, Triplett DA. Factor XI assay results in the CAP survey (1981). Am J Clin Pathol 1982; 78(Suppl. 4):615-620.

64 UK NEQAS for blood coagulation Survey 118, September 1999.

65 Martin CM, Engstrom PF, Barrett O. Surreptitious selfadministration of heparin. JAMA 1970; 212:475-476.

66 Blanchette VS, Dean J, Lillicrap D. Rare congenital hemorrhagic disorders. In Lilleyman J, Hann I, Blanchette V (eds) Pediatric Hematology. London: Churchill Livingstone, 1999, 611-628.

67 Seligsohn U. Factor XI deficiency. Thromb Haemostasis 1993; 70: 68-71.

68 Green D, Lechner K. A survey of 215 non-hemophilic patients with inhibitors to factor VIII. Thromb Haemostasis 1981; 45:200-203.

69 Nakashima K, Miyahara T, Fujii S et al. Spontaneously acquired factor VIII inhibitor in a 7-year-old girl. Acta Haematol 1982; 68:58-62.

70 Reece EA, Clyne LP, Romero R, Hobbins J.C. Spontaneous factor XI inhibitors: seven additional cases and a review of the literature. Arch Int Med 1984; 144:525-9.

71 Beck DW, Strauss RG, Kisker CT, Henriksen RA. An

intrinsic coagulation pathway inhibitor in a three year old child. dysprothrombinaemia: an inherited structural disorder of human prothrombin. *J Clin Invest* 1969; 48:2251-2259. 73 Miller CH, Lenzi R, Breen C. Prevalence of von Willebrand's disease among US adults. *Blood* 1987; 69:454-459. 74 Werner EJ, Broxson EH, Tucker EL, Manaiac LF, Giroux DS, Abshire TC. Prevalence of von Willebrand disease in children: a multiethnic study. *Blood* 1991; 78:68a. 75 Castaman G, Fredericic AB, Rodeghiero F, Mannucci PM. Von Willebrand's Disease in the year 2003: towards complete identification of gene defects for the correct diagnosis and treatment. *Haematologica* 2003; 88:94-108. 76 Abildgaard CF, Suzuki Z, Harrison J et al. Serial studies in von Willebrand disease: variability versus 'variants'. *Blood* 1980; 56:712-716. 77 Laffan M, Brown SA, Collins PM et al. The diagnosis of von Willebrand disease: a guideline from the UK Haemophilia Centre Doctors' Organisation. *Haemophilia* 2004; 10:199-217. 78 Castaman G, Eikenboom JCJ, Bertina RM, Rodeghiero F. Inconsistency of association between type 1 von Willebrand disease phenotype and genotype in families identified in an epidemiological investigation. *Thromb Haemostasis* 1999; 82:1065-1070. 79 Frederici AB, Mannucci PM. Actual management of von Willebrand disease: first report on 880 cases of the Italian registry of vWD. *Blood* 1997; 90:32a. 80 Frederici AB. Diagnosis of von Willebrand disease. *Semin Thromb Hemostasis* 1998; 24:654-660. 81 Silwer J. Von Willebrand's disease in Sweden. *Acta Paediatrica Scandinavia* 1973; 238:1-159. 82 Gill JC, Endres-Brooks J, Bauer PJ et al. The effects of ABO blood groups on the diagnosis of von Willebrand disease. *Blood* 1987; 69:1691-1695. 83 Ruggeri ZM, Zimmerman TS. Variant von Willebrand's disease. Characterization of two subtypes by analysis of multimeric composition of FVIII/vWF in plasma and platelets. *J Clin Invest* 1980; 65:1318-1325. 84 Miller JL, Castella A. Platelet-type von Willebrand disease: characterization of a new bleeding disorder. *Blood* 1982; 60:790-794. 85 Rinder MR, Richard RE, Rinder HM. Acquired von Willebrand's disease: a concise review. *Am J Hematol* 1997; 54:139-145. 86 Simone JV, Cornet JA, Abildgaard CF. Acquired von Willebrand' syndrome in systemic lupus erythematosus. *Blood* 1964; 31:806-812. 87 Pareti FI, Mannucci PM, D'Angelo A et al. Congenital deficiency of thromboxane and prostacyclin. *Lancet* 1980; 1:898-901. 88 Duckert F, Jung E, Shmerling DH. A hitherto undescribed congenital hemorrhagic diathesis probably due to fibrin stabilizing factor deficiency. *Thromb Diathesis Haemorrhagic* 1960; 5:179-186. 89 Sakata Y, Aoki N. Significance of cross-linking of alpha 2-plasmin inhibitor to fibrin in inhibition of fibrinolysis and in hemostasis.

J Clin Invest 1982; 69:536-542. 90 Duckert F. Documentation of the plasma factor XIII deficiency in man. Ann New York Acad Sci 1972; 202:190-199. 91 Lorand L, Losowsky MS, Miloszewski KJM. Human factor XIII: fibrin stabilizing factor. Progress Hemostasis Thromb 1980; 5:245-290. 92 Saito H. Alpha 2-plasmin inhibitor and its deficiency states. J Lab Clin Med 1988; 112:671-678. 93 Lind B, Thorsen S. A novel missense mutation in the human plasma inhibitor (alpha 2 -antiplasmin) gene associated with a bleeding tendency. Br J Haematol 1999; due to decreased functional activity of type I plasminogen activator inhibitor. J Clin Invest 1989; 83:1747-1752.

95 Dieval J, Nguyen G, Gross S et al. A lifelong bleeding disorder associated with a deficiency of plasminogen activator inhibitor type I. Blood 1991; 77:528-532.

96 Fay WP, Parker AC, Condrey LR, Shapiro AD. Human plasminogen activator inhibitor-1 (PAI-1) deficiency: characterization of a large kindred with a null mutation in the PAI-1 gene. Blood 1997; 90:204-208.

97 Nurden AT, Caen JP. An abnormal platelet glycoprotein pattern in three cases of Glanzmann's thrombasthenia. Br J Haematol 1974; 28:253-260.

98 Phillips DR, Agin PP. Platelet membrane defects in Glanzmann's thrombasthenia. Evidence for decreased amounts of two major glycoproteins. J Clin Invest 1977; 60:535-545.

99 Glanzmann E. Hereditäre hamorrhagische Thrombasthenie. Ein Betrag zur Pathologie der Blutplättchen. Jahrbuch Kinderheilkunde 1918; 18:1-42.

100 Sauslbury FT, Kesler RW. Thrombocytosis in HenochSchönlein purpura. Clinical Pediatr 1983; 22:185-87.

101 Weinstein M, Babyn P, Zlotkin S. An orange a day keeps the doctor away: scurvy in the year 2000. Pediatrics 2001; 108:55.

102 Chatproedprai S, Wananukul S. Scurvy: a case report. J Med Assoc Thailand 2001; 84(Suppl. 1):S106-110.

103 Stewart GM, Rosenberg NM. Conditions mistaken for child abuse: part I. Paediatr Emerg Care 1996; 12:116-121.

104 Aldrich RA, Steinberg AG, Campbell DC. Pedigree demonstrating a sex-linked recessive condition characterized by draining ears, eczematoid dermatitis and

bloody diarrhea. *Pediatrics* 1954; 13:133-139.

105 Clemetson KH, Clemetson JM. Molecular abnormalities in Glanzman's thrombasthenia, Bernard-Soulier syndrome and platelet-type von Willebrand's disease. *Curr Opin Hematol* 1994; 1:388-393.

106 Hermansky F, Pudlak P. Albinism associated with hemorrhagic diathesis and unusual reticulated pigmented cells in the bone marrow: a report of two cases with histochemical studies. *Blood* 1959; 14:162-169.

107 White JG. Structural defects in inherited and giant platelet disorders. *Adv Hum Genet* 1990; 19:133-234.

108 White JG. Inherited abnormalities of the platelet membrane and secretory granules. *Human Pathology* 1987; 18:123-139.

109 Greinacher A, Mueller-Eckhardt C. Hereditary types of thrombocytopenia with giant platelets and inclusion bodies in the leukocytes. *Blut* 1990; 60:53-60.

110 Djaldetti M, Creter D, Bujanover Y, Elian E. Ultrastructural and functional studies of the platelets in patients with May-Hegglin anomaly. *Haematologica* 1982; 67:530-538.

111 Epstein CJ, Sahud MA, Piel CF et al. Hereditary macrothrombocytopenia, nephritis and deafness. *Am J Med* 1972; 52:299-310.

112 Eckstein JD, Filip DJ, Watts JC. Hereditary thrombocytopenia, deafness and renal disease. *Ann Intern Med* 1975; 82:639-645.

113 Lilleyman JS. Intracranial haemorrhage in idiopathic thrombocytopenic purpura. *Arch Dis Child* 1994; 61:251-253.

114 Lilleyman JS. Intracranial haemorrhage in chronic childhood ITP. *Pediatric Hematology and Oncology* 1997; 14:iii-v.

115 Lilleyman JS. Management of childhood idiopathic thrombocytopenic purpura. *Br J Haematol* 1999; 105: 871-875.

116 Bolton-Maggs PHB, Moon I. Assessment of UK practice for management of acute childhood idiopathic thrombocytopenic purpura against published guidelines. *Lancet* 1997; 350:620-623.

117 Wheeler DM, Hobbs CJ. Mistakes in diagnosing nonaccidental injury: 10 years' experience. *Medical Practice perinatal period. Semin Perinatal* 1990; 14: 384-392. 119 Kletzel M, Miller CH, Becton DL et al. Post delivery head bleeding in hemophilic neonates. *Am J Dis Child* 1989; 143:1107-1110. 120 Ljung R, Lindgren AC, Petrini P, Tengborn L. Normal vaginal delivery is to be recommended for haemophilia carrier gravidae. *Acta Paediatrica* 1994; 83:609-611. 121 Kadir RA, Economides DL. Obstetric management of carriers of haemophilia A. *Haemophilia* 1997; 3:81-86. 122 Conway JH, Hilgartner MW. Initial presentations of pediatric hemophiliacs. *Arch Pediatr Adolesc Med* 1994; 148:589-594. 123 Schiver W, Brueschke EE, Dent T. Family practice grand rounds: hemophilia. *J Fam Pract* 1982; 14:661-662, 664, passim. 124 Peyvandi F, Mannucci PM. Rare coagulation disorders. *Thromb Haemostasis* 1999; 82:1207-1214. 125 Bolton-Maggs PH, Perry DJ, Chalmers EA et al. The rare coagulation disorders: review with guidelines from the UK haemophilia Doctors Organisation. *Haemophilia* 2004; 10:593-628. 126 Katz JA, Moake JL, McPherson PD et al. Relationship between human development and disappearance of unusually large von Willebrand factor multimers from plasma. *Blood* 1989; 73:1851-1858. 127 Wetzel RC, Slater AJ, Dover GJ. Fatal intramuscular bleeding misdiagnosed as suspected non-accidental injury. *Pediatrics* 1995; 95 :771-773. 128 Carpentieri U, Gustavson LP, Haggard ME. Misdiagnosis of neglect in a child with bleeding disorder and cystic fibrosis. *South Med J* 1978; 71:854-855. 129 Kaplan SJ, Pelcovitz D, Salzinger S et al. Adolescent physical abuse: risk for adolescent psychiatric disorders. *Am J Psychiatry* 1998; 155: 954-959. 130 Sutor AH, Dagres N, Niederhoff H. Late form of vitamin K bleeding in Germany. *Klinische Padiatrie* 1995; 207:89-97. 131 White ST, Voter K, Perry J. Surreptitious warfarin ingestion. *Child Abuse Neglect* 1985; 9:349-352. 132 Souid AK, Korins K, Keith D et al. Unexplained menorrhagia and hematuria: a case of Munchausen's syndrome by proxy. *Pediatr Hematol Oncol* 1993; 10:245-248. 133 Warkentin TE, Kelton JG. Acquired platelet disorders. In Bloom AL, Forbes CD, Thomas DP et al (eds) *Haemostasis and Thrombosis*. London: Churchill Livingstone, 1994, pp. 767-815. 134 Richardson SG, Fletcher DJ, Jeavons PM, Stuart J. Sodium valproate and platelet function. *BMJ* 1976; 1:221-222. 135 Barr RD, Copeland SA, Stockwell ML et al. Valproic acid and immune thrombocytopenia. *Arch Dis Childh* 1982; 57:681-684. 136 Ko CH, Kong CK, Tse PW. Valproic acid and thrombocytopenia. *Hong Kong Med J* 2001; 7:15-21. 137 Conley EL, Coley KC, Pollock BG et al. Prevalence and risk of thrombocytopenia with valproic acid:

- experience at a psychiatric teaching hospital. *Pharmacotherapy* 2001; 21:1325-1330. 138 De Beradis D, Campanella D, Matera V et al. Thrombocytopenia during valproic acid treatment in young patients with new-onset bipolar disorder. *J Clin Psychopharmacol* 2003; 23:451-458. 139 Ganick DJ, Sunder T, Finley JL. Severe hematologic toxicity of valproic acid: a report of four patients. *Am J Pediatr Hematol Oncol* 1990; 12:80-85. 140 Gesundheit B, Kirby M, Lau W et al. Thrombocytopenia and megakaryocyte dysplasia: an adverse effect of valproic acid treatment. *J Pediatr Hematol Oncol* 2002; 24:589-590. 141 Durongpisitkul K, Fururaj VJ, Park JM, Martin CF. The prevention of coronary artery aneurysm in Kawasaki disease: a meta-analysis on the efficacy of aspirin and acetosalicylic-acid ingestion on maternal and neonatal haemostasis. *N Engl J Med* 1982; 307:909-912.
- 143 Freedman MH, Doyle JJ. Inherited bone marrow failure syndromes. In Lilleyman J, Hann I, Blanchette V (eds) *Pediatric Hematology*. London: Churchill Livingstone, 1999, 23-49.
- 144 Young NS, Alter BP. Clinical features of Fanconi's anaemia. In *Aplastic Anaemia, Acquired and Inherited*. Philadelphia, PA: WB Saunders, 1994, pp: 275-309.
- 145 Eden OB, Lilleyman JS. Guidelines for the management of idiopathic thrombocytopenic purpura. *Arch Dis Child* 1992; 67:1056-1058.
- 146 McClain JL, Clark MM, Sandusky GE. Undiagnosed, untreated acute lymphoblastic leukaemia presenting as suspected child abuse. *J Forensic Sci* 1990; 35:735-739.
- 147 Berrebi A, Malnick SDH, Vorst EJ, Stein D. High incidence of factor XI deficiency in Gaucher's disease. *Am J Hematol* 1992; 40:153-161.
- 148 Humphries JE, Hess CE. Gaucher's disease and acquired coagulopathy. *Am J Hematol* 1994; 45:347-353.
- 149 Kelsey H, Christopoulos C, Gray AA, Machin SI. Acquired pseudo-pseudo Bernard-Soulier syndrome complicating Gaucher's disease. *J Clin Pathol* 1994; 47:162-165. *Pediatric Nephrology* 1992; 6:88-95. 151 Kelly D, Summerfield J. Haemostasis in liver disease. *Semin Liver Dis* 1987; 7:182-191. 152 Miner ME, Kaufman HH, Graham SH, Haar FH, Gildenberg PL. Disseminated intravascular coagulation fibrinolytic syndrome following head injury in children: frequency and prognostic implications. *J Pediatr*

1982; 100:687-691. 153 Hymel KP, Abshire TC, Luckey DW, Jenny C. Coagulopathy in pediatric abusive head trauma. Pediatrics 1997; 99:371-375. 154 Stein SC, Young GS, Talucci RC et al. Delayed brain injury after head trauma: significance of coagulopathy. Neurosurgery 1992; 30:160-165. 155 Kaufman HH, Moake JL, Olson JD et al. Delayed and recurrent intracranial hematomas related to disseminated intravascular clotting and fibrinolysis in head injury. Neurosurgery 1980; 7:445-449. 156 Wedemeyer AL, Edson JR, Krivit W. Coagulation in cyanotic congenital heart disease. Am J Dis Child 1972; 124:656-660. 157 Waldman JD, Czapek EE, Paul MH et al. Shortened platelet survival in cyanotic heart disease. J Pediatr 1975; 87:77-79.

5 Chapter 5. Biochemical Investigations on Post-Mortem Specimens

1 Evans WED. The Chemistry of Death. Springfield, IL: Charles C Thomas Publishers, 1963.

2 Druid H, Holmgren P. A compilation of fatal and control concentrations of drugs in postmortem femoral blood. J Forensic Sci 1997; 42:79-87.

3 Coe JJ. Postmortem chemistry update. Emphasis on forensic application. Am J Forensic Med Pathol 1993; 14:91-117.

4 Reay DT, Insalaco SJ, Eisele JW. Postmortem methemoglobin concentrations and their significance. J Forensic Sci 1984; 29:1160-3.

5 Puschel K, Lockemann U, Bartel J. Postmortem investigation of serum myoglobin levels with special reference to electrical fatalities. Forensic Sci Int 1995; 72:171-7.

6 Zhu BL, Ishida K, Quan L, Tanaguchi M et al. Postmortem urinary myoglobin levels with reference to the causes of death. Forensic Sci Int 2001; 115:183-8.

7 Wyatt DT, Erickson MM, Hillman RE, Hillman LS. Elevated thiamine levels in SIDS, non-SIDS and adults: postmortem artifact. J Pediatr 1984; 104:585-8.

8 Rachut E, Rynbrandt DJ, Doult TW. Postmortem behavior of serum thyroxine, triiodothyronine and parathormone. in victims of sudden infant death syndrome. J Pediatr 1981; 99:758-60. 10 Benjamin DR, Beckwith JB. Elevated values of triiodothyronine in victims of sudden infant death syndrome (Letter). J Pediatr 1982; 100:841. 11 Ross IS, Moffat MA, Reid IW. Thyroid hormones in sudden infant death syndrome. Clin Chim Acta 1983; 129:151-5. 12 Peterson DR, Green WL, van Belle G. Sudden infant death syndrome and hyperthyroidism: comparison of neonatal and postmortem measurements. J Pediatr 1983; 102:202-9. 13 Schwarz EH, Chaslow FI, Erickson MM et al. Elevation of postmortem triiodothyronine in sudden infant death syndrome and in infants who died of other causes: a marker of previous health. J Pediatr 1983; 102:200-5. 14 Edston E, Druid H, Holmgren P, Ostrom M. Postmortem measurements of thyroid hormones in blood and vitreous humor combined with histology. Am J Forensic Med Pathol 2001; 22:78-83. 15 Arroyo A, Valero J, Marron T et al. Pericardial fluid postmortem: Comparative study of natural and violent

deaths. *Am J Forensic Med Pathol* 1998; 19:266-8. 16 Madea B, Kreuser C, Banaschak S. Postmortem biochemical examination of synovial fluid: a preliminary study. *Forensic Sci Int* 2001; 118:29-35. 17 Haider M, Haider SQ. Assessment of protein-calorie malnutrition. *Clin Chem* 1984; 30:1286-99. 18 Tuten MB, Wogt S, Dasse F, Leider Z. Utilization of prealbumin as a nutritional parameter. *J Parenteral Enteral Nutr* 1985; 9:709-11. 19 Benjamin DR. Laboratory tests and nutritional assessment. Protein-energy status. *Pediatr Clin N Am* 1989; 36:139-60. 20 Maeda H, Fukita K, Oritani S et al. Evaluation of postmortem oxymetry with reference to the causes of death. *Forensic Sci Int* 1997; 83:201. 21 Sturmer WQ, Sullivan A, Suzuki K. Lactic acid concentrations in vitreous humor: their use in asphyxial deaths in children. *J Forensic Sci* 1983; 28:222-30. 22 Jetter WW, McLean R. Biochemical changes in body fluids after death. *Am J Clin Path* 1943; 13:178-85. 23 Jaffe FA. Chemical postmortem changes in the intra-ocular fluid. *J Forensic Sci* 1962; 7:231-7. 24 Rognum TO, Saugstad OD. Hypoxanthine levels in the vitreous humor: evidence of hypoxia in most infants who died of sudden infant death syndrome. *Pediatrics* 1991; 87:306-10. 25 Poulsen JP, Rognum TO, Hauge S et al. Postmortem concentrations of hypoxanthine in the vitreous humor - a comparison between babies with severe respiratory failure, congenital abnormalities of the heart, and victims of sudden infant death syndrome. *J Perinat Med* 1993; 21:153-63. 26 Madea B, Kaferstein H, Hermann N, Sticht G. Hypoxanthine in vitreous humor and cerebrospinal fluid: a marker of postmortem interval and prolonged (vital) hypoxia? *Forensic Sci Int* 1994; 65:19-31. 27 Belonje PC, Wilson GR, Siroka SA. High postmortem concentration of hypoxanthine and urate in the vitreous humor of infants are not confined to case of sudden infant death syndrome. *S African Med J* 1996; 86:827-8. 28 Carpenter KH, Bonham JR, Worthy E, Variend S. Vitreous humour and cerebrospinal fluid hypoxanthine concentration as a marker of ante mortem hypoxia in SIDS. *J Clin Pathol* 1993; 46:650-3. 29 Opdal SH, Rogum TO, Vege A, Saugstad OD. Hypoxanthine levels in vitreous humor: a study of influencing factors in sudden infant death syndrome. *Pediatr Res* 1998; hypoxanthine levels in SIDA and infectious death. *Acta Paediatr* 1994; 83:634-9.

31 Jones KL, Krous HF, Nadeau J et al. Vascular endothelial growth factor in the cerebrospinal fluid of infants who die of sudden infant death syndrome: evidence for antecedent hypoxia. *Pediatr* 2003; 111:358-63.

32 Putto A, Ruuskanen O, Meurman O et al. C-reactive protein in the evaluation of a febrile illness. *Arch Dis*

Child 1986; 61:24-9.

33 Peltola H, Homberg D. Rapidity of C-reactive protein in detecting potential septicemia. *Pediatr Inf Dis* 1983; 2:374-6.

34 Benjamin DR, Siebert JR. C-reactive protein and prealbumin in suspected sudden infant death syndrome. *Pediatr Pathol* 1990; 10:503-7.

35 Uhlin-Hansen L. C-reactive protein (CRP), a comparison of preand post-mortem blood levels. *Forensic Sci Int* 2001; 14:32-5.

36 Tsokos M, Reichelt U, Jung R et al. Interleukin-6 and C-reactive protein serum levels in sepsis-related fatalities during the early postmortem period. *Forensic Sci Int* 2001; 119:47-56.

37 Fujita MQ, Zhu BL, Ishida K et al. Serum C-reactive protein levels in postmortem blood-an analysis with special reference to the cause of death and survival time. *Forensic Sci Int* 2002; 130:160-6.

38 Chiesa C, Panero A, Rossi N et al. Reliability of procalcitonin concentrations for the diagnosis of sepsis in critically ill neonates. *Clin Inf Dis* 1998; 26:664-72.

39 Monneret G, Labaune JM, Issac C et al. Procalcitonin and C-reactive protein levels in neonatal infections. *Acta Paediatr* 1997; 86:209-12.

40 Tsokos M, Reichelt U, Nierhaus A, Puschel K. Serum procalcitonin (PCT): a valuable biochemical parameter for the postmortem diagnosis of sepsis. *Int J Legal Med* 2001; 114:237-43.

41 Meisner M, Tschaikowsky K, Schanbel S et al. Procalcitonin influence of temperature, storage, anticoagulation and arterial or venous asservation of blood samples on procalcitonin concentrations. *Eur J Clin Chem Clin Biochem* 1997; 35:597-601.

42 Yunginger JW, Nelson DR, Squillace DL et al. Laboratory investigation of deaths due to anaphylaxis. *J Forensic Sci* 1991; 36:857-60.

43 Anisari MQ, Zamora JL, Lipscomb MF. Postmortem diagnosis of acute anaphylaxis by serum tryptase levels. *Am J Clin Path* 1993; 99:101-3.

- 44 Randall B, Butts J, Halsy JF. Elevated postmortem tryptase levels in the absence of anaphylaxis. *J Forensic Sci* 1995; 40:208-11.
- 45 Edston E, van Hage-Hamsten M. Beta-tryptase measurements postmortem in anaphylactic deaths and controls. *Forensic Sci Int* 1998; 93:135-42.
- 46 Schwartz HJ, Yunginger JW, Schwartz LB. Is unrecognized anaphylaxis a cause of sudden unexpected death? *Clin Exp Allergy* 1995; 25:866-70.
- 47 Holgate ST, Walters C, Walls AF et al. The anaphylaxis hypothesis of sudden infant death syndrome (SIDS): mast cell degranulation in cot death revealed by elevated concentrations of tryptase in serum. *Clin Exp Allergy* 1994; 24:1115-22.
- 48 Edston E, Gidlund E, Wickman M et al. Increased mast cell tryptase in sudden infant death: anaphylaxis, hypoxia or artifact. *Clin Exp Allergy* 1999; 29:1648-54.
- 76 Rognum TO, Hauge S, Oyasaeter S, Saugstad OD. A new biochemical method for the determination of postmortem time. *Forensic Sci Int* 1991; 51:131-46.
- 77 Madea B, Hermann N, Hengbe C. Precision of estimating the time since death by vitreous potassium-comparison of two different equations. *Forensic Sci Int* 1990; 46:277-84.
- 78 James RA, Hoadley PA, Sampson BG. Determination of postmortem interval by sampling vitreous humour. *Am J Forensic Med & Pathol* 1997; 18:158-62.
- 79 Mason JK, Harkness RA, Elton RA, Bartholomew S. Cot deaths in Edinburgh: infant feeding and socioeconomic factors. *J Epidemiol Commun Health* 1980; 34:35-41.
- 80 Coe JI. Postmortem peripheral blood glucose and cardiopulmonary resuscitation. *Forensic Sci Gaz* 1975; 6:1-2.
- 81 Gormsen H, Lund A. diagnostic value of postmortem blood glucose determinations in cases of diabetes mellitus. *Forensic Sci Int* 1985; 28:103-7.
- 82 Peclet C, Picotte P, Jobin F. The use of vitreous humor levels of glucose, lactic acid and blood levels of acetone to establish ante-mortem hyperglycemia in diabetics.

Forensic Sci Int 1994; 65:1-6.

83 Coe JI. Comparative postmortem chemistries of vitreous humor before and after embalming. J Forensic Sci 1976; 21:583-6.

84 Bray M. The eye as a chemical indicator of environmental temperature at the time of death. J Forensic Sci 1984; 29:396-403.

85 Coe JI. Hypothermia: autopsy findings and vitreous glucose. J Forensic Sci 1984; 29:395-8.

86 Chen C, Glagov S, Mako M et al. Postmortem glycosylated hemoglobin (HbA1c): evidence for a history of diabetes mellitus. Ann Clin Lab Sci 1983; 13:407-10.

87 Winecker RE, Hammet-Stabler CA, Chapman JF, Roper-Miller JD. HbA1c as a postmortem tool to identify glycemic control. J Forensic Sci 2002; 47:1373-9.

88 Khuu HM, Robinson CA, Brissie RM, Konrad RJ. Postmortem diagnosis of unsuspected diabetes mellitus established by determination of decedent's hemoglobin A1c level. J Forensic Sci 1999; 44:643-6.

89 Gouille JP, Lacroix C, Bouige D. Glycated hemoglobin: a useful post-mortem reference marker in determining diabetes. J Forensic Sci 2002; 128:44-9.

90 Osuna E, Garcia-Villora A, Perez-Carceles M et al. Vitreous humor fructosamine concentrations in the autopsy diagnosis of diabetes mellitus. Int J Legl Med 1999; 112:275-9.

91 Osuna E, Garcia-Villora A, Perez-Carceles M et al. Glucose and lactate in vitreous humor compared with the determination of fructosamine for the post-mortem diagnosis of diabetes mellitus. Am J Forensic Med Pathol 2001; 22:244-9.

92 DiMaio VJM, Sturmer WQ, Coe JI. Sudden and unexpected deaths after the acute onset of diabetes mellitus . J Forensic Sci 1977; 22:147-51.

93 Sturmer WQ, DiMaio VJM. Sudden and unexpected death following the acute onset of diabetes mellitus (Abstract). Forensic Sci 1975; 5:168.

94 Rozin L, Perper JA, Jaffe R, Drash A. sudden unexpected

death in childhood due to unexpected diabetes mellitus. Am J Forensic Med Pathol 1994; 15:251-6.

95 Russel MA, Opitz JM, Visekul C et al. Sudden infant deaths due to congenital adrenal hypoplasia. Arch Pathol Lab Med 1977; 101:168-9.

96 O'Donohoe NV, Holland PDJ. Familial congenital adrenal hypoplasia. Arch Dis Child 1968; 43:717-23.

97 Jindrich EJ. Adrenal hypofunction and sudden death. hypoplasia: an isolated defect of organogenesis. J Pediatr 1973; 82:444-9. 99 Batch JA, Montalto J, Yong ABW et al. Three cases of congenital adrenal hypoplasia; a cause of salt wasting and mortality in the neonatal period. J Pediatr Child Health 1991; 27:108-12. 100 Molander N. Sudden natural death in later childhood and adolescence. Arch Dis Child 1982; 57:572-6. 101 Favara BE, Franciosi RA, Miles V. Idiopathic adrenal hypoplasia in children. Am J Clin Pathol 1972; 57:287-96. 102 Finlayson NB. Blood cortisol in infants and adults: A postmortem study. J Pediatr 1965; 67:248-52. 103 Sanders FW. The preservation of blood for chemical analysis. J Biol Chem 1923; 58:1-15. 104 Paul JR. Postmortem blood chemical determinations. Bull Ayer Clin Lab Pen Hosp 1925; 9:51-62. 105 Leahy MS, Farber ER. Postmortem chemistry of human vitreous humor. J Forensic Sci 1967; 12:214-22. 106 Levonen E, Raekallio J, Saikkonen J. Postmortem determination of blood creatinine and urea. J Forensic Sci 1963; 10:22-9. 107 Jensen OM. Diagnosis of uremia postmortem. Dan Med Bull 1969; 8(Suppl.):1-97. 108 Coe JJ. Postmortem chemistries on human vitreous humor. Am J Clin Pathol 1969; 51:741-50. 109 Polayes SH, Hershey E, Lederer M. Postmortem blood chemistry in renal disease. Arch Intern Med 1930; 46:283-9. 110 Bennett MR, Rinaldo P, Millington DS, Tanaka K, Yokota I, Coates PM. Medium-chain acyl-CoA dehydrogenase deficiency; postmortem diagnosis in a case of sudden infant death and neonatal diagnosis of an affected sibling. Pediatr Pathol 1991; 11:889-95. 111 Bennet MJ, Allison F, Pollitt RJ, Variend S. Fatty acid oxidation defects as a cause of unexpected death in infancy. Prog Clin Biol Res 1990; 321:349-64. 112 Duran M, Hofkamp M, Rhead WJ et al. Sudden child death and 'healthy' affected family members with medium-chain acyl-coenzyme A dehydrogenase deficiency. Pediatrics 1986; 78:1052-7. 113 Chalmers RA, Stanley CA, English N, Wigglesworth JS. Mitochondrial carnitine-acylcarnitine translocase deficiency presenting as sudden neonatal death. J Pediatr 1997; 131:220-5. 114 Rinaldo P, Stanley CA, Hsu BY et al. Sudden neonatal death in carnitine transporter deficiency. J Pediatr 1997;

131:181-2. 115 Dionisi-Vici C, Seneca S, Zeviani M et al. Fulminant Leigh syndrome and sudden unexpected death in a family with the T9176C mutation of the mitochondrial ATPase 6 gene. *J Inherit Metab Dis* 1998; 21:2-8. 116 Harpey J-P, Charpentier C, Coude M et al. Sudden infant death syndrome and multiple acyl-coenzyme A dehydrogenase deficiency, ethylmalonic-adipic aciduria or systemic carnitine deficiency. *J Pediatr* 1987; 110:881-4. 117 Lundemose JB, Kolvraa S, Gregersen N et al. Fatty acid oxidation disorders as primary cause of sudden and unexpected death in infants and young children: an investigation performed on cultured fibroblasts from 79 children who died aged between 0-4 years. *J Clin Pathol Mol Pathol* 1997; 50:212-17. 118 Emery JL, Variend S, Howat AJ, Vawter GF. Investigation of inborn errors of metabolism in unexpected infant death. *Lancet* 1988; ii:29-31. 119 Hale DE, Bennett MJ. Fatty acid oxidation disorders: a new fatty acyl-coenzyme A dehydrogenase presenting as the sudden infant death. *BMJ* 1984; 288:976.

121 Howat AJ, Bennett MJ, Variend S et al. Defects in the metabolism of fatty acids in the sudden infant death syndrome. *BMJ* 1985; 290:1771-3.

122 Holton JB, Allen JT, Green CA et al. Inherited metabolic disease in sudden infant death syndrome. *Arch Dis Child* 1991; 66:1315-17.

123 Miller ME, Brooks JG, Forbes N, Insel R. Frequency of medium-chain acyl-CoA dehydrogenase G-985 mutation in sudden infant death syndrome. *Pediatr Res* 1992; 31:305-7.

124 Chinsky J, Tolsma T, Cowan T, Blitzer M. MCAD deficiency in SIDS. *Am J Hum Gen* 1991; 49(Suppl.):A183.

125 Arens R, Gozal D, Jain K et al. Prevalence of medium-chain acyl-CoA dehydrogenase deficiency in sudden infant death syndrome. *J Pediatr* 1993; 122:715-18.

126 Lemieux B, Giguere R, Cyr D et al. Screening urine of 3week old newborns: lack of association between sudden infant death syndrome and some metabolic disorders. *Pediatrics* 1993; 85:986-8.

127 Bonham JR, Downing M. Metabolic deficiencies and SIDS. *J Clin Pathol* 1992; 45(Suppl.):33-8.

128 Bennett MJ, Powell S. Metabolic disease and sudden, unexpected death in infancy. *Hum Pathol* 1994; 25:742-6.

129 Roe CR, Millington DS, Maltby KP. Recognition of medium chain acyl CoA dehydrogenase deficiency in asymptomatic siblings of children dying of sudden infant death or Reye-like syndrome. *J Pediatr* 1986; 108:13-18.

130 Rebuffat E, Sottiaux M, Goyens D et al. Sudden infant death syndrome, as first expression of a metabolic disorder. In Schaub J, Van Hoof F, Vis HL (eds) *Inborn Errors of Metabolism*. New York: Vevey/Raven Press, Nestle Nutrition Workshop Series 24, 1991, pp. 71-80.

131 Bennett MJ, Hale DE, Coates PM, Stanley CA. Postmortem recognition of fatty acid oxidation disorders. *Pediatr Pathol* 1991; 11:365-70.

132 Bennet MJ, Allison F, Pollitt RJ, Variend S. Fatty acid oxidation defects as causes of unexpected death in infancy. In Tanaka K, Coates PM (eds) *Fatty Acid Oxidation: Clinical, Biochemical and Molecular Aspects*. New York: Alan R Liss, 1990, pp. 349-64.

133 Blau N, Duran M, Blaskovics ME (eds). *Physician's Guide to the Laboratory Diagnosis of Metabolic Diseases*. London: Chapman and Hall Medical, 1996.

134 Scriver CR, Beaudet AL, Sly WS, Valle D (eds). *The Metabolic and Molecular Bases of Inherited Disease*. New York: McGraw-Hill, 1995.

135 Applegarth DA, Dimmick JE, Hall JG (eds). *Organelle Diseases*. London: Chapman and Hall Medical, 1997.

136 Kemp PM, Little BR, Best RO, Dawson DB. Whole blood levels of dodecanoic acid, a routinely detectable forensic marker for a genetic disease often misdiagnosed as Sudden Infant Death Syndrome (SIDS): MCAD deficiency. *Am J Forensic Med Path* 1996; 17:79-82.

137 Ross KF, Guileyardo JM, Bennet MJ, Barnard JJ. Comment on whole blood levels of dodecanoic acid, a routinely detectable forensic marker for a genetic disease often misdiagnosed as Sudden Infant Death Syndrome (SIDS): MCAD deficiency. (Letter). *Am J Forensic Med Path* 1996; 17:349-50.

138 Blakemore AIF, Singleton H, Politt R et al. The frequency of the G985 MCAD mutation in the general population. *Lancet* 1991; 337:298-9.

139 Coates PM. Historical perspective of medium chain

acyl-CoA dehydrogenase deficiency. A decade of discovery. Prog Clin mutation G1528C in long-chain 3-hydroxyacyl-CoA dehydrogenase deficiency. Characterization and expression of the mutant protein, mutation analysis on genomic DNA and chromosomal localization of the mitochondrial trifunctional protein alpha subunit gene. J Clin Invest 1996; 98:1028-33.

141 Rashed MS, Ozand PT, Bennett MJ et al. Inborn errors of metabolism diagnosed in sudden infant death case by acylcarnitine analysis of postmortem bile. Clin Chem 1995; 41:1109-14.

142 Hale DE, Cornell JE, Bennett MJ. Stability of long-chain and short-chain 3-hydroxyacyl-CoA dehydrogenase activity in the postmortem liver. Clin Chem 1997; 43:273-8.

143 Boles RG, Martin SK, Blitzer MG, Rinaldo P. Biochemical diagnosis of fatty acid oxidation disorders by metabolite analysis of postmortem liver. Hum Pathol 1994; 25:733-4.

144 Gregersen N, Blakemore AIF, Winter V et al. specific diagnosis of medium-chain acyl-CoA dehydrogenase (MCAD) deficiency in dried blood spots by a polymerase chain reaction (PCR) assay detecting a point mutation (G985) in the MCAD gene. Clin Chim Acta 1991; 203:23-4.

145 Matsubara Y, Narisawa K, Tada K. Medium-chain acyl-CoA dehydrogenase deficiency. Molecular aspects. Eur J Pediatr 1992; 151:154-9.

146 Ding J-H, Roe CR, Iafolla AK, Chen Y-T. Medium-chain acyl-CoA dehydrogenase deficiency and sudden infant death (Letter). N Engl J Med 1991; 325:61-2.

147 Kelly DP, Hale DE, Rutledge SL et al. Molecular basis of inherited medium-chain acyl-CoA dehydrogenase deficiency causing sudden child death. J Inherit Metab Dis 1992; 15:171-80.

148 Hallock J, Morrow G, Karp LA, Barness LA. Postmortem diagnosis of metabolic disorders. The findings of maple syrup urine disease in a case of sudden and unexpected death in infancy. Am J Dis Child 1969; 118:649-51.

149 Byard RW, Cohle SD. Sudden Death in Infancy, Childhood and Adolescence. Cambridge: Cambridge University Press, 1994.

150 Clayton PT, Hyland K, Brand M, Leonard JV. Mitochondrial phosphoenolpyruvate carboxykinase deficiency. Eur J Pediatr 1986; 145:46-50.

151 Norman MG, Taylor GP, Clarke LA. Sudden, unexpected, natural death in childhood. Pediatr Pathol 1990; 10:769-84.

152 Burton BK, Roach ES, Wolf B, Weissbecker F. Sudden death associated with biotinidase deficiency. Pediatrics 1987; 79:482-3.

153 Danks DM, Campbell PE, Stevens BJ et al. Menke's kinky hair syndrome. An inherited defect in copper metabolism with widespread effects. Pediatrics 1972; 50:188-201.

154 Forrest AR (ACP Broadsheet no. 137, April 1993). Obtaining samples at postmortem examination for toxicological and biochemical analyses. J Clin Pathol 1993; 46:292-6.

155 Pounder DJ, Carson DO, Johnston K, Orihara Y. Electrolyte concentration differences between the left and right vitreous humor samples. J Forensic Sci 1998;

43:604-7. 156 Bennett MJ, Ragni MC, Hood I, Hale DE. Comparison of postmortem vitreous and urinary organic acids. *Ann Clin Biochem* 1992; 29:541-5. 157 Patrick WJA, Logan RW. Free amino acid content of the vitreous humor in cot deaths. *Arch Dis Child* 1988; 63:660-2. 158 Chong APY, Aw SE. Postmortem endocrine levels in the vitreous humour. *Ann Acad Med (Singapore)* 1986; 15:606-9. 159 Hill E. Significance of dextrose and nondextrose reducing substances in postmortem blood. *Arch Pathol* 1941; sera: a comparison of different sampling sites. *Med Sci Law* 1980; 20:48-53.

161 Zhang DJ, Elswick RK, Miller WG, Bailey JL. Effect of serum-clot contact time on clinical chemistry laboratory results. *Clin Chem* 1998; 44:1325-33.

162 Fowler KJ. Storage of skin biopsies at 70°C for future fibroblast culture. *J Clin Pathol* 1984; 37:1191-3.

163 Bennet MJ, Rinaldo P. The metabolic autopsy comes of age. *Clin Chem* 2001; 47:1145-6.

164 Wilcox RL, Nelson CC, Stengel P, Steiner RD. Postmortem screening for fatty acid oxidation disorders by analysis of Guthrie cards with tandem mass spectrometry in sudden unexpected death in infancy. *J Pediatr* 2002; 141:833-6.

165 Chace DH, DiPerna JC, Mitchell BL et al. Electrospray tandem mass spectrometry for analysis of acylcarnitines in dried postmortem blood specimens collected at autopsy from infants with unexplained cause of death. *Clin Chem* 2001; 47:1166-82.

166 Karkela JT. Critical evaluation of postmortem changes in human autopsy cisternal fluid. Enzymes, electrolytes, acidbase balance, glucose and glycolysis, free amino acids and ammonia. Correlation to total brain ischemia. *J Forensic Sci* 1993; 38:603-16.

Further Reading

Applegarth DA, Dimmick JE, Toone JR. Laboratory detection of metabolic disease. *Pediatr Clin North Am* 1989; 36:49-66.

Applegarth DA, Dimmick JE, Hall JG (eds). *Organelle Diseases*.

London: Chapman and Hall Medical, 1997. pathology tests to the investigation of sudden infant death. In Fleming P,

Blair P, Bacon C et al (eds) Sudden Unexpected Deaths in Infancy. The CESDI SUDI Studies. Norwich: The Stationery Office, 2000, pp. 97-112. Blau N, Duran M, Blaskovics ME (eds). Physician's Guide to the Laboratory Diagnosis of Metabolic Diseases. London: Chapman and Hall Medical, 1996. Brettell TA, Saferstein R. Forensic science. Anal Chem 1995; 67:273R-94R. Byard RW. Sudden Death in Infancy, Childhood and Adolescence, 2nd edn. Cambridge: Cambridge University Press, 2004. Coe JI. Postmortem chemistries on human vitreous humor. Am J Clin Pathol 1969; 51:741-50. Coe JI. Postmortem chemistry of blood, cerebrospinal fluid and vitreous humor. In Tedeschi CG, Eckert WG, Tedeschi LG (eds) Forensic Medicine, vol. 2. New York: WB Saunders, 1977. Coe JI. Post mortem biochemistry of blood and vitreous humour in paediatric practice. In Mason JK (ed.) Paediatric Forensic Medicine and Pathology. London: Chapman and Hall, 1989, pp. 191-203. Coe JI. Postmortem chemistry update. Emphasis on forensic application. Am J Forensic Med Pathol 1993; 14:91-117. Scriver CR, Beaudet AL, Sly WS et al (eds). The Metabolic and Molecular Bases of Inherited Disease. New York: McGraw-Hill, 1995.

6 Chapter 6. Ocular Involvement in Non-Accidental injury

12 Harcourt B, Hopkins D. Ophthalmic manifestations of the battered-baby syndrome. *BMJ* 1971; 3:398.

13 Feldman KW, Schaller RT, Feldman JA. Tap water scald burns in children. *Pediatrics* 1978; 62:1-9.

14 Landers A, Belfer KF, Jenkins AD. Superglue lids: possibly nonaccidental and a medicolegal problem. *Eye* 1996; 10:402-3.

15 Tominack RL, Spyker DA. Capsicum and capsaicin - a review: case report of the use of hot peppers in child abuse. *J Toxicol Clin Toxicol* 1987; 25:591-601.

16 Tseng SS, Keys MP. Battered child syndrome simulating congenital glaucoma. *Arch Ophthalmol* 1976; 94:839-40.

17 Friendly DS. Ocular manifestations of physical child abuse. *Trans Am Acad Ophthalmol Otolaryngol* 1971; 75:318-31.

18 Weidenthal DT, Levin DB. Retinal detachment in a battered infant. *Am J Ophthalmol* 1976; 81:725-7.

19 Gonzales CA. Bilateral rhegmatogenous detachments with unilateral vitreous base avulsion as the presenting signs of child abuse. *Am J Ophthalmol* 1999; 127:475-7.

20 Green MA, Lieberman G, Milroy CM, Parsons MA. Ocular and cerebral trauma in non-accidental injury in infancy: underlying mechanisms and implications for paediatric practice. *Br J Ophthalmol* 1996; 80:282-7.

21 Massicote SJ, Folberg R, Torczynski E et al. Vitreoretinal traction and perimacular retinal folds in the eyes of deliberately traumatized children. *Ophthalmology* 1991; 98:1124-7.

22 Munger CE, Peiffer RL, Bouldin TW et al. Ocular and associated neuropathological observations in suspected whiplash shaken infant syndrome. A retrospective study of 12 cases. *Am J Forensic Med Pathol* 1993; 14:193-200.

23 Giangiacomo J, Barkett KJ. Ophthalmoscopic findings in occult child abuse. *J Pediatr Ophthalmol Strabismus* 1985; 22:234-7.

- 24 Levin AV. Ocular manifestations of child abuse. *Ophthalmol Clin North Am* 1990; 3:249-64.
- 25 Tyagi AK, Willshaw HE, Ainsworth JR. Unilateral retinal haemorrhages in non-accidental injury. *Lancet* 1997; 349:1224.
- 26 Lin KC, Glasgow BJ. Bilateral periopticointrascleral hemorrhages associated with traumatic child abuse. *Am J Ophthalmol* 1999; 127:473-5.
- 27 Ktitzinger EE. Personal communication.
- 28 Kowal L. Ophthalmic manifestations of head injury. *Aust NZ J Ophthalmol* 1992; 20:35-40.
- 29 Frank Y, Zimmerman R, Leeds NM. Neurologic manifestation in abused children who have been shaken. *Dev Med Child Neurol* 1985; 27:312-16.
- 30 Jensen AD, Smith RE, Olson MI. Ocular clues to child abuse. *J Pediatr Ophthalmol Strabismus* 1971; 8:270-3.
- 31 Ballantyne AJ. The nerve fibre pattern of the human retina. *Trans Ophthalmol Soc UK* 1946; 66:179-91.
- 32 Roth M. Uber Netzhautaffectionen beim Wundfeibern. *Deutsch Z Chir* 1872; 1:471-80.
- 33 Falcone PM, Larrison WI. Roth spots seen on ophthalmoscopy: diseases with which they may be associated. *Conn Med* 1995; 59:271-3.
- 34 Kaur B, Taylor D. Fundus haemorrhages in infancy. *Survey Ophthalmol* 1992; 37:1-17.
- 35 Fred HL, Chandler FW. Traumatic asphyxia. *Am J Med* 1960; 29:508-17.
- 36 Hollenhorst RW, Stein HA. Ocular signs and prognosis in subdural and subarachnoid bleeding in young children. *Arch Ophthalmol* 1958; 60:187-92.
- 37 Mushin AS. Ocular damage in the battered baby syndrome. children. *Trans Ophthalmology Soc UK* 1979; 99:432-9. 39 Mathews GP, Das A. Dense vitreous hemorrhages predict poor visual and neurological prognosis in infants with shaken baby syndrome. *J Pediatr Ophthalmol Strabismus* 1996; 33:260-5. 40 von Noorden GK. New clinical aspects of stimulus deprivation amblyopia. *Am J Ophthalmol* 1981;

92:416-21. 41 Ober RR. Hemorrhagic retinopathy in infancy: A clinicopathological report. *J Pediatr Ophthalmol Strabismus* 1980; 17:17-20. 42 Lambert SR, Johnson TE, Hoyt CS. Optic nerve sheath hemorrhages associated with shaken baby syndrome. *Arch Ophthalmol* 1986; 104:1509. 43 Munger CE, Peiffer RL, Bouldin TW et al. Ocular and associated neuropathologic observations in suspected whiplash baby syndrome: a retrospective study of 12 cases. *Am J Forensic Med Pathol* 1993; 14:193-200. 44 Massicote SJ, Folberg R, Torczynski E et al. Vitreoretinal traction and perimacular retinal folds in the eye of deliberately traumatized children. *Ophthalmology* 1991; 98:1124-7. 45 Greenwald MJ, Weiss A, Oesterle CS, Friendly DS. Traumatic retinoschisis in battered babies. *Ophthalmology* 1986; 93:618-25. 46 Riffenburgh RS, Lakshmanan S. Ocular findings at autopsy of child abuse victims. *Ophthalmology* 1991; 98:1519-24. 47 Tomasi LG, Rosman P. Purtscher retinopathy in the battered child syndrome. *Am J Dis Child* 1986; 93:1435-9. 48 Baum JD, Bulpitt CJ. Retinal and conjunctival haemorrhage in the newborn. *Arch Dis Child* 1970; 45:344-9. 49 Sezen F. Retinal haemorrhages in newborn infants. *Br J Ophthalmol* 1970; 55:248-53. 50 Wilkinson MS, Han DP, Rappley MD, Owings CL. Retinal hemorrhage predicts neurologic injury in the shaken baby syndrome. *Arch Ophthalmol* 1989; 107:1472-4. 51 Paton L. V11 diseases of the nervous system: ocular symptoms in subarachnoid haemorrhage. *Trans Ophthalmol Soc UK* 1924; 44:110-26. 52 Schloff S, Mullaney PB, Armstrong DC et al. Retinal findings in children with intracranial haemorrhage. *Ophthalmol* 2002; 109:1472-6. 53 Duhaime A-C, Gennarelli TA, Thibault LE et al. The shaken baby syndrome - a clinical, pathological and biomechanical study. *J Neurosurg* 1987; 66:409-15. 54 Gilliland MG, Folberg R. Shaken babies: some have no impact injuries. *J Forensic Sci* 1996; 41:114-16. 55 David DB, Mears T, Quinlan MP. Ocular complications of bungee jumping. *Br J Ophthalmol* 1994; 78:234-5. 56 Lyle DJ, Stapp JP, Button RR. Ophthalmologic hydrostatic pressure syndrome. *Am J Ophthalmol* 1957; 44:652-7. 57 Christian CW, Taylor AA, Hertle RW, Duhaime A-C. Retinal haemorrhages caused by accidental household trauma. *J Pediatrics* 1999; 135:125-7. 58 Buys YM, Levin AV, Enzenauer RW et al. Retinal findings after head trauma in infants and young children. *Ophthalmology* 1992; 99:1718-23. 59 Billmire ME, Myers PA. Serious head injury in infants: accident or abuse. *Pediatrics* 1985; 75:340-2. 60 Elder JE, Taylor RG, Klug GL. Retinal haemorrhage in accidental head trauma in childhood. *J Pediatr Child Health* 1991; 27:286. 61 The Ophthalmology Child Abuse Working Party. Child abuse and the eye. *Eye* 1999; 13:3-10. 62 Budenz DL, Farber MG, Mirchandani HG et al. Ocular and optic nerve hemorrhages in abused infants with intracranial injuries. *Ophthalmology*

1994; 101:559-64. 63 Riffenburgh RS, Lakshmanan S. Ocular findings at autopsy of abuse working party: Royal College of Ophthalmologists. Eye 2004; 18:795-8.

65 Kramer K. Retinal hemorrhages following cardiopulmonary resuscitation. Clin Pediatr 1993; 13:366-8.

66 Kanter RK. Retinal hemorrhages after cardiopulmonary resuscitation or child abuse. J Pediatr 1986; 108:430-2.

67 Gilliland MG, Luckenbach MW. Are retinal hemorrhages found after resuscitation attempts? A study of the eyes of 169 children. Am J Forensic Med Pathol 1993; 14:187-92.

68 Odom A, Christ E, Kerr N et al. Prevalence of retinal haemorrhages in pediatric patients after in-hospital cardiopulmonary resuscitation: a prospective study. Pediatrics 1997; 99:E3.

69 Fackler JC, Berkowitz ID, Green R. Retinal hemorrhages in newborn piglets following cardiopulmonary resuscitation. Am J Dis Child 1992; 146:1294-6.

70 Tyagi AK, Scotcher S, Kozeis N, Willshaw HE. Can convulsions alone cause retinal haemorrhages in infants? Br J Ophthalmol 1998; 82:659-60.

71 Mei-Zahav M, Uziel Y, Raz J et al. Convulsions and retinal haemorrhage: should we look further. BMJ 2002; 325:334-5.

72 Feyi-Waboso AC, Beck L. Minerva. BMJ 1997; 314:688.

73 Markovitch H. Opening eyes to child abuse. BMJ 1999; 318:950.

74 Guyer DR, Schachat AP, Vitale S et al. Relationship between fundus lesions and haematological parameters at diagnosis. Ophthalmology 1989; 96:860-4.

75 Fraser SG. Retinal haemorrhage in meningitis. Eye 1995; 9:659-60.

76 Levy HL, Brown AE, Williams SE, de Juan E. Vitreous hemorrhage as an ophthalmic complication of galactosemia. J Pediatr 1996; 129:922-5. Dis Child 1998; 78:399. 78 Pulido JS, Lingua RW, Cristol S, Byrne SF. Protein C deficiency associated with vitreous hemorrhage in a neonate. Am J Ophthalmol 1987; 104:546-7. 79 Emerson MV, Pieramici DJ, Stoessi KM et al. Incidence and rate of

disappearance of retinal haemorrhages in newborns. Ophthalmology 2001; 108:36-9. 80 Hughes LA, May K, Talbot JF, Parsons MA. Incidence, distribution and duration of birth-related retinal haemorrhages: a prospective study. J AAPDS 2006; 10:102-6. 81 Von Barsewisch B. Perinatal Retinal Haemorrhages: Morphology, Aetiology and Significance. Berlin: SpringerVerlag, 1979. 82 Gilliland MG, Luckenbach MW, Massicote SJ, Folberg R. The medicolegal implications of detecting hemosiderin in the eyes of children who are suspected of being abused. Arch Ophthalmol 1991; 109:321-2. 83 Schwartz S. Telemedicine and ophthalmology. Jules Stein Eye Inst: Clin Update 1998; 7:3-4. 84 Fishman CD, Dasher WB, Lambert SR. Electroretinographic findings in infants with shaken baby syndrome. J Pediatr Ophthalmol Strabismus 1998; 35:22-6. 85 Conway MD, Peyman GA, Recasens M. Intravitreal tPA and SF6 promote clearing of premacular subhyaloid hemorrhages in shaken and battered baby syndrome. Ophthalmic Surg Lasers 1999; 30:435-41. 86 McCabe CF, Donahue SP. Prognostic indicators for vision and mortality in shaken baby syndrome. Arch Ophthalmol 2000; 118:373-7. 87 Shokunbi T, Agbeja A. Ocular complications of head injury in children. Childs Nerv System 1991; 7:147-9.

7 Chapter 7. The Death Scene following the Sudden Death of a Child

1 Wagner GN. Crime scene investigation in child abuse cases. *Am J Forensic Med Pathol* 1986; 7:94-9.

2 Usher A. The role of the pathologist at the scene of crime. *J Forensic Sci Soc* 1970; 10:213-8.

3 Bass M, Kravath RE, Class I. Death scene investigation in sudden infant death. *N Engl J Med* 1986; 315:100-5.

4 Locard E. The analysis of dust traces, Parts I-III. *Am J Police Sci* 1930; 1:276-298, 405-406, 496-514.

5 Vanezis P, Busuttil A. *Suspicious Death Scene Investigation*. London: Hodder Arnold, 1996.

6 White P. *Crime Scene to Court. The Essentials of Forensic Science*. London: The Royal Society of Chemistry, 1998.

7 Stanton AN. Sudden infant death. Overheating and cot death. *Lancet*. 1984; 2:1199-201.

8 Byard RW, Krous HF. *Sudden Infant Death Syndrome*. London: Arnold, 2001.

9 American Academy of Pediatrics. Distinguishing sudden infant death syndrome from child abuse fatalities. *Pediatrics* 1994; 94(1):124-6.

10 Christoffel KK, Zieserl EJ, Chiaramonte J. Should child abuse and neglect be considered when a child dies unexpectedly? *Am J Dis Child* 1985; 139:876-80.

11 Emery JL. Child abuse, sudden infant death syndrome, and unexpected infant death. *Am J Dis Child* 1993; 147(10):1097-100.

12 Byard RW, Carmichael E, Beal S. How useful is the postmortem examination in sudden infant death syndrome? *Pediatr Pathol* 1994; 14:817-22.

13 Byard RW, Becker LE, Berry J. Formal retrospective case review and sudden infant death. *Acta Paediatr* 1997; 86:1011-12.

14 Newlands J, Emery JS. Child abuse and cot deaths. *Child Abuse Negl* 1991; 15(3):275-8.

15 Beckwith JB. Discussion of terminology and definition of the sudden infant death syndrome. In Bergman AB, Beckwith JB, Ray CD (eds) Sudden Infant Death Syndrome. Proceedings of the Second International Conference on Causes of Sudden Death in Infants. Seattle: University of Washington Press, death syndrome: investigative and autopsy protocols. J Forensic Sci 1976; 21:833-41. 17 Hilton J, Berry JP. Pathology. In Fitzgerald K (ed.) Second SIDS Global Strategy Meeting. Norway: Stavenger, August 5-6, 1994, p. 334. In Rognum TO (ed.) Sudden Infant Death Syndrome. New Trends in the Nineties. Oslo: Scandinavian University Press, 1995. 18 Willinger M, James S, Catz C. Defining the SIDS: deliberations of an expert panel conceived by the National Institute of Child Health and Human Development. Pediatr Pathol 1994; 11:677-84. 19 Center for Disease Control (CDC). Guidelines for death scene investigation of sudden, unexplained infant deaths: recommendations of the Inter Agency Panel on Sudden Infant Death Syndrome. MMWR Recomm Rep 1996; 45:RR-10. 20 Iyasu S, Hanzlick RE, Rowley D, Willinger M. Proceedings of Workshop on Guidelines for Scene Investigation of Sudden Unexplained Infant Deaths. J Forensic Sci 1994; 39: 1126-39. 21 Dragon DA, Landenberg AL. Infant mechanical suffocation deaths in the United States, 1980-1977. Paediatrics. 1999; 103:59. 22 Nakamura AS, Wind M, Danello MD. A review of hazards associated with children placed in adult beds. Arch Pediatr Adolesc Med 1999;153:1018-23. 23 Fact Sheet on the Toxic Gas Hypothesis of Cot Death, www.sids.org.uk/editpics/364-1.pdf 24 Coghlan A. Mattress bugs may link to cot deaths. New Scientist 2002; 10:41. 25 Meadow R. Recurrent cot death and suffocation. Arch Dis Child 1989; 64(1):179-80. 26 Emery JL, Gilbert EF, Zuguipe F. Three crib deaths. A baby minder and probable infanticide. Med Sci Law 1988; 28(3):205-11. 27 Byard R, Petechial hemorrhages and unexpected infant death. Legal Medicine 2003; 1(4):193-7. 28 Betz P, Hausmann R, Eisenmenger W. A contribution to a possible differentiation between SIDS and asphyxiation. Forensic Sci Int 1998; 91:147-52. 29 Shepherd RT. Accidental self-strangulation in a young child. Med Sci Law 1990; 30:119-23. 30 Mendlowicz MV, Jean-Louis G, Gekker M, Rapaport MH. Neonaticide in the city of Rio de Janeiro: forensic and psycholegal perspectives. J Forensic Sci 1999; 44:741-5. 31 Cheung PT. Maternal filicide in Hong Kong, 1971-85. Med Sci Law 1986; 26:185-92. 32 Lee ACW, Li CH, Kwong NS, So KT. Neonaticide, newborn abandonment, and denial of pregnancy - newborn victimisation associated with unwanted motherhood. Hong Kong Med J 2006; 12:61-4. 33 Herman-Giddens ME, Smith JB, Mittal M et al. Newborn killed or left to die by a parent: a population-based study. JAMA 2003; 289:1425-9. 34 Mitchell LB, Davis JH. Spontaneous

births in toilets. J Forensic Sci 1984; 29(2):591-6. 35
Kerley ER. Forensic Anthropology and crime involving
children. J Forensic Sci 1976; 21(2):333-9. 36 Hargrave DR.
A study of child homicide over two decades. Med Sci Law
1992; 32(3):196-245. 37 Kerley ER. The identification of
battered-infant skeletons. J Forensic Sci 1978;
23(1):133-8. 38 Kasim MS, Cheah I, Shafie HM. Childhood
deaths from physical abuse. Child Abuse Negl 1995;
19(7):847-54. 39 Kellet RJ. Infanticide and child
destruction - the historical, legal and pathological
aspects. Forensic Sci Int 1992; impact trauma with
intracranial injuries ascribed to shaking. Am J Dis Child
1990; 144:557-63.

41 Duhaime AC, Christian CW, Rorke LB, Zimmerman RA.
Non-accidental head injury in infants - the 'shaken-baby'
syndrome. N Eng J Med 1998; 338:1822-7.

42 Squires T, Busuttil A. Child fatalities in Scottish
house fires: a case of child neglect? Child Abuse Negl
1995; 19:65-73.

43 Roberts I. Deaths of children in house fires. BMJ 1995;
311:1381-2.

44 Squires T, Busuttil A. Alcohol and house fire fatalities
in Scotland. Med Sci Law 1997; 37:325-40. fires: who dies
and who survive? JAMA 1998; 279: 1633-7. 46 Istre GR, McCoy
BS, Barnard JJ, Bolton A. Deaths and injuries from house
fires. N Eng J Med 2001; 344(25):1911-16. 47 Buteau J,
Thompson B, Sexton D. Homicide followed by suicide: a
Quebec case-series, 1988-90. Can J Psychiatry 1993;
38(8):552-6. 48 Busuttil A. Lockerbie & Dunblane. Disasters
and dilemmas. Med Leg J 1998; 66(4):34-42.

8 Chapter 8. Post-Mortem Examination in Babies and Children

- 1 Vujanic GM, Cartlidge PHT, Stewart JH. Improving the quality of perinatal and infant necropsy examinations: a follow up study. *J Clin Pathol* 1998; 51:850-3.
- 2 Sheehan KM, McDonnell M, Doyle EM et al. The quality and value of sudden infant death necropsy reporting in Ireland. *J Clin Pathol* 2003; 56:753-7.
- 3 Bass M, Kravath RE, Glass L. Death-scene investigation in sudden infant death. *N Engl J Med* 1986; 315:100-5.
- 4 Sturmer WQ. Common errors in forensic pediatric pathology. *Am J Forensic Med Pathol* 1998; 19:317-20.
- 5 Bass M. The fallacy of the simultaneous sudden infant death syndrome in twins. *Am J Forensic Med Pathol* 1989; 10:200-5.
- 6 Saukko P, Knight B. The pathophysiology of death. In *Knight's Forensic Pathology*, 4th edn. London: Arnold, 2004, pp. 52-97.
- 7 Carpenter RF. The prevalence and distribution of bruising in babies. *Arch Dis Child* 1999; 80:363-6.
- 8 Sugar NF, Taylor JA, Feldman KW et al. Bruises in infants and toddlers. *Arch Pediatr Adolesc Med* 1999; 153:399-403.
- 9 Moon RY, Patel KM, Schaefer SJ. Sudden Infant Death Syndrome in child care settings. *Pediatrics* 2000; 106:295-300.
- 10 Maxeiner H. Demonstration and interpretation of bridging vein ruptures in cases of infantile subdural bleedings. *J Forensic Sci* 2001; 46:85-93.
- 11 Erlich E, Maxeiner H, Lange J. Postmortem radiological investigation of torn bridging vein ruptures. *Legal Med (Tokyo)* 2003; 5(Suppl. 1): 225-7.
- 12 Sadler DW. The value of a thorough protocol in the investigation of sudden infant deaths. *J Clin Pathol* 1998; 51:689-94.
- 13 Wigglesworth JS, Keeling JW, Rushton D, Berry PJ. Technical method. Pathological investigations in cases of sudden infant death. *J Clin Pathol* 1987; 40:1481-3.

- 14 Dettmeyer R, Baasner A, Schlamann M et al. Coxsackie B3 myocarditis in 4 cases of suspected sudden infant death syndrome: diagnosis by immunohistochemical and molecularpathologic investigation. *Pathol Res Pract* 2002; 198:689-96.
- 15 Bajanowski T, Rolf B, Jorch G et al. Detection of RNA viruses in sudden infant death (SID). *Int J Legal Med* 2003; 117:237-40.
- 16 Carmichael EM, Goldwater PN, Byard RW. Routine microbiological testing in sudden and unexpected infant death. *J Pediatr Child Health* 1996; 32:412-15.
- 17 Mitchell E, Krous HF, Donald T, Byard RW. An analysis of the usefulness of specific stages in the pathologic investigation of sudden infant death. *Am J Forensic Med Pathol* 2000; 21:395-400.
- 18 Sims MA, Collins KA. Fetal death: a 10-year retrospective study. *Am J Forensic Med Pathol* 2001; 22:261-5.
- 19 British Medical Association. British National Formulary, Paediatric. London: Royal Pharmaceutical Society of Great Britain, 2005, p. 225.
- 20 Berry J, Allibone E, McKeever P et al. The pathology study: The contribution of ancillary pathology tests to the investigation of unexpected infant death. In Fleming P, Bacon C, Blair P et al (eds) *Sudden Unexpected Deaths in Infancy the CESDI SUDI Studies 1993-1996*. London: The Stationery sudden unexplained death in the young. *Am J Forensic Med Pathol* 2001; 22:105-11.
- 22 Wilcox RL, Nelson CC, Stenzel P, Steiner RD. Postmortem screening for fatty acid oxidation disorders by analysis of Guthrie cards with tandem mass spectrometry in sudden unexpected death in infancy. *J Pediatr* 2002; 141:833-6.
- 23 Yudkin PL, Aboualfa M, Eyre JA et al. The influence of elective preterm delivery on birth-weight and head circumference standards. *Arch Dis Child* 1987; 62:24-9.
- 24 Chambers HM, Knowles S, Staples A et al. Anthropometric measurements in the second trimester fetus. *Early Human Dev* 1993; 33:45-59.
- 25 Maroun LL, Graem N. Autopsy standards of body parameters and organ weights in non-macerated and macerated human fetuses. *Pediatr Devel Pathol* 2005; 8:204-17.
- 26 Freeman JV, Cole TJ, Chinn S, Jones PRM, White EM, Preece MA. 1995 Cross-sectional stature and weight reference curves for the UK, 1990. *Arch Dis Child* 73:17-24.
- 27 Singer D, Sung C-R,

Wigglesworth JS. Fetal growth and maturation: with standards for body and organ development. In Wigglesworth JS, Singer D (eds) Textbook of Fetal and Perinatal Pathology, 2nd edn. Malden, MA: Blackwell Science, 1998, pp. 8-40. 28 Hansen K, Sung CJ, Huang C et al. Reference values for second trimester fetal and neonatal organ weights and measurements. *Pediatr Develop Pathol* 2003; 6:160-7. 29 Thompson WS, Cohle SD. Fifteen-year retrospective study of infant organ weights and revision of standard weight tables. *J Forensic Sci* 2004; 49:1-11. 30 Shankle WR, Landing BH, Gregg J. Normal organ weights of infants and children: Graphs of value by age, with confidence intervals. *Pediatric Pathol* 1983; 1:399-408. 31 Haddad S, Restieri C, Krishnan K. Characterization of age-related changes in body weight and organ weights from birth to adolescence in humans. *J Toxicol Environ Health* 2001; 64:453-64. 32 Altman PL, Dittmer DS. Growth: Including Reproduction and Morphological Development. Washington DC: Federation of American Societies for Experimental Biology, 1961. 33 Handy TC, Nichols GR, Buchino JJ. A pediatric forensic medicine program. In Dimnick JW, Singer DB (eds) Forensic Aspects in Pediatric Pathology. Perspectives in Pediatric Pathology. Basel: Karger, 1995, pp. 87-95. 34 Kaplan JA, Fossum RM. Patterns of facial resuscitation injury in infancy. *Am J Forensic Med Pathol* 1994; 15:187-91. 35 Downes AJ, Crossland DS, Mellon AF. Prevalence and distribution of petechiae in well babies. *Arch Dis Child* 2002; 86:291-2. 36 Byard RW, Krous HF. Petechial hemorrhages and unexpected infant death. *Legal Med (Tokyo)* 1999; 1:193-7. 37 Krous HF, Nadeau JM, Byard RW, Blackburn BD. Oronasal blood in sudden infant death. *Am J Forensic Med Pathol* 2001; 23:346-51. 38 Mayes C, Macleod C. When 'NAI' means not actually injured. *BMJ* 1998; 318:1127-8. 39 McCann J, Reay D, Siebert J et al. Postmortem perianal findings in children. *Am J Forensic Med Pathol* 2006; 17:289-98. 40 Valdes-Dapena M, McFeeley PA, Damus KH et al. Histopathology Atlas for the Sudden Infant Death Syndrome: Findings derived from the National Institute of Child Health and Human Development Cooperative Epidemiological Study of Sudden Infant Death Syndrome (SIDS) Risk Factors. Washington: Armed Forces Institute of Pathology, 1993. 41 Krous H. The international standardized autopsy protocol for sudden unexpected infant death. In Rognum TO (ed.) Sudden Infant Death Syndrome. New Trends in the Nineties. Oslo: involution in infancy and childhood: a reliable marker for duration of acute illness. *Hum Pathol* 1988; 19:1155-60.

43 Beckwith JB. Intrathoracic petechial hemorrhages; a clue to the mechanism of death in sudden infant death syndrome?

Ann Acad NY Sci 1988; 533:37-47.

44 Muir R, Niven JSF. The local formation of blood pigments. J Pathol Bacteriol 1935; 41:183-97.

45 Keeling JW. The perinatal necropsy. In Keeling JW, Khong TY (eds) Fetal and Neonatal Pathology, 4th edn. London: Springer, 2007, pp. 20-53.

46 Hardman JM. Cerebrospinal trauma. In Davis RL, Robertson DM (eds) Textbook of Neuropathology, 3rd edn. Baltimore, MD: Williams & Wilkins, 1997.

47 Parsons MA, Smart RD. Necropsy techniques in ophthalmic pathology. Best Practice 164 J Clin Pathol 2001; 54:417-27.

48 Lee WR (ed.). Examination of the globe. Technical aspects. In Ophthalmic Histopathology, 2nd edn. London: SpringerVerlag, 2002, pp. 1-33.

49 Reichard RR, White CL III, Hogan RN et al. Beta-amyloid precursor protein immunohistochemistry in the evaluation of pediatric traumatic optic nerve injury. Ophthalmology 2004; 111:822-7.

50 Wigglesworth JS. Performance of the perinatal autopsy. In Wigglesworth JS (ed.) Perinatal Pathology, 2nd edn. Philadelphia, PA: Saunders, 1986, pp. 23-40.

51 Russell JGB. Radiological assessment of fetal maturity. J Obstet Gynaec Brit Cwlth 1969; 76:208-19.

52 Stempflé N, Hutten Y, Fondacci C et al. Fetal bone age revisited: proposal of a new radiographic score. Pediatr Radiol 1995; 25:551-5.

53 Biankin SA, Arbuckle SM, Graf NS. Autopsy findings in a series of five cases of fetomaternal haemorrhage. Pathology 2003; 35:319-24.

54 Harlow FHD, Spencer JAD. Obstetrics for the neonatologist. In Rennie JM, Robertson NRC (eds) Textbook of Neonatology. London: Churchill Livingstone, 1999, pp. 157-77.

55 Morris JF, Hunt AC. Breaking strength of the umbilical cord. J Forensic Sci 1966; 11:43-9.

56 Wigglesworth JS, Husemeyer RP. Intracranial birth trauma in vaginal breech delivery: the continued importance of

injury to the occipital bone. Br J Obstet Gynecol 1977; 84:684-91.

57 Dorovini-Zis K, Dolman CL. Gestational development of brain. Arch Pathol Lab Med 1977; 101:192-5.

58 Feess-Higgins A, Larroche J-C. Development of the Human Foetal Brain. An Anatomical Atlas. Paris: Inserm CNRS Masson, 1987.

59 Yates PO. Birth trauma to the vertebral arteries. Arch Dis Child 1959; 34:436-41.

60 Marchetti D, Belviso M, Marino M, Gaudio R. Evaluation of the placenta in stillborn fetuses to estimate the time of death. Am J Forensic Med Pathol 2007; 28:38-43.

61 Pinar H, Sung CJ, Oyer CE, Singer DB. Reference values for singleton and twin placental weights. Pediatr Pathol Lab Med 1996; 16:901-7.

62 Naeye RD. Umbilical cord length: clinical significance. J Pediatr 1985; 107:278-81.

63 Genest DR. Estimating the time of death in stillborn fetuses: II. Histologic evaluation of the placenta; a study of 71 stillborns. Obstet Gynecol 1992; 80:585-92.

64 Benirschke K, Kaufmann P, Baergen R. Pathology of the Human Placenta, 5th edn. New York: Springer, 2006.

65 Fox H, Sebire N. Pathology of the Placenta, Major Problems in Pathology, 3rd edn. London: Saunders, 2007.

66 Khong TY. The placenta and umbilical cord. In Keeling JW, Khong TY (eds) Fetal and Neonatal Pathology, 4th edn. Pathol Lab Med 1991; 115:688-95. 68 Macpherson T. Fact and fancy. What can we really tell from the placenta? Arch Path Lab Med 1991; 115:672-81. 69 Wigglesworth JS. Pathology of intrapartum and early neonatal death in the normally formed infant. In Wigglesworth JS, Singer DB (eds) Textbook of Fetal and Perinatal Pathology, 2nd edn. Malden, MA: Blackwell Science, pp. 251-68. 70 Keeling JW. Intrapartum problems. In Keeling JW, Khong TY (eds) Fetal and Neonatal Pathology, 4th edn. London: Springer, 2007, pp. 273-96. 71 Teng FY, Sayre JW. Vacuum extraction: does duration predict scalp injury? Obstet Gynecol 1997; 89:281-5. 72 Amar AP, Aryan HE, Meltzer HS, Levy ML. Neonatal subgaleal hematoma causing brain compression: results of two cases and review of the literature. Neurosurgery 2003; 52:1470-4. 73

Robinson RJ, Rossiter MA. Massive subaponeurotic haemorrhage in babies of African origin. *Arch Dis Child* 1968; 43:684-7. 74 Doward W, Sgouros S. Acute subdural haematomas following Ventouse-assisted delivery. *Pediatr Neurosurg* 2001; 35:336. 75 Towner D, Castro MA, Eby-Wilkens E et al. Effect of mode of delivery in nulliparous women on neonatal intracranial injury. *N Engl J Med* 1999; 341:1709-14. 76 Vachharajani A, Mathur A. Ultrasound-guided needle aspiration of cranial epidural hematoma in a neonate: treating a rare complication of vacuum extraction. *Am J Perinatol* 2002; 19:401-4. 77 Perrin RG, Rutka JT, Drake JM et al. Management and outcomes of posterior fossa subdural hematomas in neonates. *Neurosurgery* 1997; 40:1190-9; discussion 1199-2000. 78 Whitby EH, Griffiths PD, Rutter S et al. Frequency and natural history of subdural haemorrhages in babies and relation to obstetric factors. *Lancet* 2004; 363:846-51. 79 Salman M, Crouchman M. What can cause subdural haemorrhage in a term neonate? *Paediatr Today* 1997; 5:42-5. 80 Davies MJ, Pomerance A, Lamb D. Techniques in examination and anatomy of the heart. In Davies MJ, Pomerance A (eds) *The Pathology of the Heart*. Oxford: Blackwell Scientific Publications, 1975, pp. 26-31. 81 Michaud K, Romain N, Taroni F et al. Evaluation of a simplified method of the conduction system analysis in 100 forensic cases. *Forensic Sci Int* 2002; 130:13-24. 82 Ashworth MA. The cardiovascular system. In Keeling JW, Khong TY (eds) *Fetal and Neonatal Pathology*, 4th edn. London: Springer, 2007, p. 613. 83 Ho SY, Anderson RH. Conduction tissue and SIDS. *Am NY Acad Sci* 1988; 533:176-90. 84 Matturri L, Ottaviani G, Ramos SG, Rossi L. Sudden infant death syndrome (SIDS): A study of cardiac conduction system. *Cardiovasc Pathol* 2000; 9:137-45. 85 Keeling JW, McKenzie KJ, Ironside J et al. Does detailed neuropathological examination of the fixed brain in sudden, unexpected death in infancy contribute to the evaluation of the death? *J Pathol* 2002; 198(Suppl.):24A. 86 Report of a Working Group. *Sudden Unexpected Death in Infancy*. London: Royal College of Pathologists and Royal College of Paediatrics and Child Health, 2004. 87 Fleming PJ, Blair PS, Sidebotham P, Hayler T. Investigating sudden unexpected deaths in infancy and childhood and caring for bereaved families: an integrated multiagency approach. *BMJ* 2004; 328:331-4. 88 Genest DR, Singer DB. Estimating the time of death in stillborn fetuses: III. External fetal examination; a study of

9 Chapter 9. Pathology of Neurological Abnormality in Early Life

1 Rutherford MA, Pennock JM, Cowan FM et al. Does the brain regenerate after perinatal infarction? *Europ J Paediatr Neurol* 1997; 1:13-17.

2 Nelson KB. Can we prevent cerebral palsy? *N Engl J Med* 2003; 349:1765-9.

3 Keeling JW. *Fetal and Neonatal Pathology*, 2nd edn. London: Springer-Verlag, 1993.

4 Squier M, Chamberlain P, Zaiwalla Z et al. Five cases of brain injury following amniocentesis in mid-term pregnancy. *Dev Med Child Neurol* 2000; 42:554-60.

5 Geddes JF. What's new in the diagnosis of head injury? *J Clin Pathol* 1997; 50:271-4.

6 Hortobagyi T, Wise S, Hunt N, Cary N et al. Traumatic axonal damage in the brain can be detected using beta-APP immunohistochemistry within 35 min after head injury to human adults. *Neuropathol Appl Neurobiol* 2007; 33:226-37.

7 Dehmichen M, Meissner C, Schmidt V et al. Axonal injury - a diagnostic tool in forensic neuropathology? A review. *Forensic Sci Int* 1998; 95:67-83.

8 Hannan AJ, Servotte S, Katsnelson A et al. Characterization of nodular neuronal heterotopia in children. *Brain* 1999; 122:219-38.

9 Barkovich AJ, Kuzniecky RI, Jackson GD et al. Classification system for malformations of cortical development: update 2001. *Neurology* 2001; 57:2168-78.

10 Yakovlev PI, Wadsworth RC. Schizencephalies: a study of the congenital clefts in the cerebral mantle. I. Clefts with fused lips. *J Neuropathol Exp Neurol* 1946; 5:116-30.

11 Barkovich AJ, Kjos BO. Schizencephaly: correlation of clinical findings with MR characteristics. *AJNR Am J Neuroradiol* 1992; 13:85-94.

12 Barth PG. Migrational disorders of the brain. *Curr Opin syndromes*. 4. *J Med Genet* 2005; 42:369-78. 14 McQuillen PS, Barkovich AJ, Hamrick SE et al. Temporal and anatomic risk profile of brain injury with neonatal repair of congenital heart defects. *Stroke* 2007; 38(Suppl.):736-41. 15 Kinney

HC, Panigrahy A, Newburger JW et al. Hypoxic-ischemic brain injury in infants with congenital heart disease dying after cardiac surgery. *Acta Neuropathol (Berl)* 2005; 110:563-78.

16 Krageloh-Mann I, Toft P, Lunding J, Andresen J et al. Brain lesions in preterms: origin, consequences and compensation. *Acta Paediatr* 1999; 88:897-908.

17 Krageloh-Mann I, Helber A, Mader I et al. Bilateral lesions of thalamus and basal ganglia: origin and outcome. *Dev Med Child Neurol* 2002; 44:477-84.

18 Peebles DM, Wyatt JS. Synergy between antenatal exposure to infection and intrapartum events in causation of perinatal brain injury at term. *BJOG* 2002; 109:737-9.

19 Redline RW. Severe fetal placental vascular lesions in term infants with neurologic impairment. 1. *Am J Obstet Gynecol* 2005; 192:452-7.

20 Gilles FH, Leviton A, Dooling ED. *The Developing Human Brain: Growth and Epidemiologic Neuropathology*. Boston: John Wright, 1983.

21 de Vries LS, Gunardi H, Barth PG et al. The spectrum of cranial ultrasound and magnetic resonance imaging abnormalities in congenital cytomegalovirus infection. *Neuropediatrics* 2004; 35:113-19.

22 Kurtz J, Anslow P. Infantile herpes simplex encephalitis: diagnostic features and differentiation from non-accidental injury. *J Infect* 2003; 46:12-16.

23 Pasternak JF. Hypoxic-ischemic brain damage in the term infant. Lessons from the laboratory. *Pediatr Clin North Am* 1993; 40:1061-72.

24 Sie LT, van der Knaap MS, Oosting J et al. MR patterns of hypoxic-ischemic brain damage after prenatal, perinatal or postnatal asphyxia. *Neuropediatrics* 2000; 31:128-36.

25 Naeye RL, Lin HM. Determination of the timing of fetal brain damage from hypoxemia-ischemia. *Am J Obstet Gynecol* 2001; 184:217-24.

26 Myers RE. Two patterns of perinatal brain damage and their conditions of occurrence. *Am J Obstet Gynecol* 1972; 112:246-76.

27 Rutherford M. Magnetic resonance imaging of injury to the immature brain. In Squier W (ed.) *Acquired Damage to the Developing Brain: Timing and Causation*. London: Arnold, 2002, pp. 166-92.

28 Towbin A. Central nervous system damage in the human fetus and newborn infant. Mechanical and hypoxic injury incurred in the fetal-neonatal period. *Am J Dis Child* 1970; 119:529-42.

29 Amar AP, Aryan HE, Meltzer HS, Levy ML. Neonatal subgaleal hematoma causing brain compression: report of two cases and review of the literature. *Neurosurgery* 2003; 52:1470-4.

30 Dupuis O, Silveira R, Dupont C et al. Comparison of 'instrument-associated' and 'spontaneous' obstetric depressed skull fractures in a cohort of 68 neonates. *Am J Obstet Gynecol* 2005; 192:165-70.

31 Pollina J, Dias MS, Li V, Kachurek D, Arbesman M. Cranial birth injuries in term newborn infants. *Pediatr Neurosurg* 2001; 35:113-19.

32 Townner D, Castro MA, Eby-Wilkens E, Gilbert WM. Effect of

mode of delivery in nulliparous women on neonatal intracranial injury. *N Engl J Med* 1999; 341:1709-14. 33
Chamnanvanakij S, Rollins N, Perlman JM. Subdural

Figure 9.15 Polymicrogyria. Fixed brain of fetus with

cytomegalovirus. There are areas of polymicrogyria in the middle

regions bilaterally, an appearance which is similar to perisylvian

polymicrogyria of genetic or ischaemic origin. The distribution

can be misleading. singleton fetal and neonatal deaths associated with cranial trauma and cephalic delivery during a national intrapartumrelated confidential enquiry. *BJOG* 2005; 112:619-26.

35 Geddes JF, Tasker RC, Hackshaw AK et al. Dural haemorrhage in non-traumatic infant deaths: does it explain the bleeding in 'shaken baby syndrome'? *Neuropathol Appl Neurobiol* 2003; 29:14-22.

36 Looney CB, Smith JK, Merck LH et al. Intracranial hemorrhage in asymptomatic neonates: prevalence on MR images and relationship to obstetric and neonatal risk factors. *Radiology* 2007; 242:535-41.

37 Whitby EH, Griffiths PD, Rutter S et al. Frequency and natural history of subdural haemorrhages in babies and relation to obstetric factors. *Lancet* 2004; 363:846-51.

38 Tavani F, Zimmerman RA, Clancy RR et al. Incidental intracranial hemorrhage after uncomplicated birth: MRI before and after neonatal heart surgery. *Neuroradiology* 2003; 45:253-8.

39 Volpe JJ. Intracranial haemorrhage. In *Neurology of the Newborn*, 3rd edn. Philadelphia, PA: WB Saunders, 1995, pp. 377-8.

40 Tubbs RS, Louis RG, Acakpo-Satchivi L, Salter EG. Anatomy of the falcine venous plexus. *J Neurosurg* 2007; 107:155-7.

41 Friede RL. Hemorrhages in asphyxiated premature infants. In Friede R (ed.) *Developmental Neuropathology*. Gottingen: Springer-Verlag, 1989, pp. 44-58.

42 Kibayashi K, Shojo H, Sumida T. Dural hemorrhage of the tentorium on postmortem cranial computed tomographic scans in children. *Forensic Sci Int* 2005; 154:206-9.

43 Vinchon M, Noizet O, Defoort-Dhellemmes S et al. Infantile subdural hematomas due to traffic accidents. *Pediatr Neurosurg* 2002; 37:245-53.

44 Steinbok P, Haw CS, Cochrane DD, Kestle JR. Acute subdural hematoma associated with cerebral infarction in the full-term neonate. *Pediatr Neurosurg* 1995; 23:206-15.

45 Durham SR, Duhaime AC. Basic science; maturation-dependent response of the immature brain to experimental subdural hematoma 1. *J Neurotrauma* 2007; 24:5-14.

46 Kemp AM. Investigating subdural haemorrhage in infants. *Arch Dis Child* 2002; 86:98-102.

47 Rogers CB, Itabashi HH, Tomiyasu U, Heuser ET. Subdural neomembranes and sudden infant death syndrome. *J Forensic Sci* 1998; 43:375-6.

48 Markwalder TM. Chronic subdural hematomas: a review. *J Neurosurg* 1981; 54:637-45.

49 Currarino G. Occipital osteodiaschisis: presentation of four cases and review of the literature. *Pediatr Radiol* 2000; 30:823-9.

50 Volpe JJ. Intracerebellar haemorrhage. In *Neurology of the Newborn*, 3rd edn. Philadelphia, PA: WB Saunders, 1995, pp. 384-9. 51 Yates PO. Birth trauma to the vertebral arteries. *Arch Dis Child* 1959; 34:436-41. 52 Rutty GN, Squier WM, Padfield CJ. Epidural haemorrhage of the cervical spinal cord: a post-mortem artefact? *Neuropathol Appl Neurobiol* 2005; 31:247-57. 53 Squier W, Salisbury H, Sisodiya S. Stroke in the developing brain and intractable epilepsy: effect of timing on hippocampal sclerosis. *Dev Med Child Neurol* 2003; 45:580-5. 54 Arias F, Romero R, Joist H, Kraus FT. Thrombophilia: a mechanism of disease in women with adverse pregnancy outcome and thrombotic lesions in the placenta. *J Maternal Fetal Med* 1998; 7:277-86. 55 Mercuri E. Timing and aetiology of neonatal cerebral infarction (Letter). *Paediatrics* 2000; 106:615-16. 56 DeVeber G, Andrew M, Adams C et al. Cerebral sinovenous thrombosis in children. *N Engl J Med* 2001; 345:417-23. 57 Mercuri E, Cowan F, Gupta G et al. Prothrombotic disorders

and abnormal neurodevelopmental outcome in infants with neonatal cerebral infarction. *Pediatrics* 2001; 107:1400-4.

58 Marrett S, Lardennois C, Mercier A et al. Fetal and neonatal cerebral infarcts. *Biol Neonate* 2001; 79:236-40.

59 Evans D, Levene M. MRI Imaging of injury to the immature brain. In Squier W (ed.) *Acquired Damage to the Developing Brain; Timing and Causation*. London: Arnold, 2002. 60

Shevell MI, Silver K, O'Gorman AM et al. Neonatal dural sinus thrombosis. *Pediatr Neurol* 1989; 5:161-5. 61 Rivkin MJ, Anderson ML, Kaye EM. Neonatal idiopathic cerebral venous thrombosis: an unrecognized cause of transient seizures or lethargy. *Ann Neurol* 1992; 32:51-6. 62

Fitzgerald KC, Williams LS, Garg BP et al. Cerebral sinovenous thrombosis in the neonate. *Arch Neurol* 2006; 63:405-9. 63 Traill Z, Squier M, Anslow P. Brain imaging in neonatal hypoglycaemia. *Arch Dis Child Fetal Neonatal Ed* 1998; 79:F145-7. 64 Murakami Y, Yamashita Y, Matsuishi T et al. Cranial MRI of neurologically impaired children suffering from neonatal hypoglycaemia. *Pediatr Radiol* 1999; 29:23-7. 65 Rossiter JP, Anderson LL, Yang F, Cole GM. Caspase-3 activation and caspase-like proteolytic activity in human perinatal hypoxic-ischemic brain injury. *Acta Neuropathol (Berl)* 2002; 103:66-73. 66 Lynch N, Roland EH, Poskitt K et al. Gestational diabetes mellitus: risk of newborn brain injury. *Dev Med Child Neurol* 2007; 49(Suppl. 108):7. 67 Brown GK, Squier MV. Neuropathology and pathogenesis of mitochondrial diseases. *J Inherit Metab Dis* 1996; 19:553-72.

10 Chapter 10. Fetal and Perinatal Death

- 1 Adelson L. Pedicide revisited. *Am J Forensic Med Pathol* 1991; 12:16-26.
- 2 Sims MA, Collins KA. Fetal death. A 10-year retrospective review. *Am J Forensic Med Pathol* 2001; 22:261-65.
- 3 Confidential Enquiry into Maternal and Child Health. Still Birth, Neonatal and Postneonatal Mortality 2000-2002. London: RCOG Press, 2005.
- 4 Schott J, Henley A, Kohner N. Pregnancy and the Death of a Baby: Guidelines for Professionals, 3rd edn. London: SANDS (Stillbirth and Neonatal Death Society), 2007, pp. 171-2.
- 5 Kellett RJ. Infanticide and child destruction - the historical, legal and pathological aspects. *Forensic Sci Inter* 1992; 53:1-28.
- 6 Mason JK. Unnatural death of the fetus and the newborn: abortion, child destruction and infanticide or child murder. In Mason JK (ed.) *Forensic Medicine for Lawyers*. Butterworths: London, 2001, pp. 254-68.
- 7 Di Maio VJ, Di Maio D. *Forensic Pathology*, 2nd edn. Boca Raton: CRC Press, 2001, pp. 336-7.
- 8 Bowen DA. Concealment of birth, child destruction and infanticide. In Mason JK (ed.) *Paediatric Forensic Medicine & Pathology*. London: Chapman and Hall Medical, 1989, pp. 178-90.
- 9 Ophoven JJ. Pediatric forensic pathology. In Gilbert-Barness E (ed.) *Potter's Pathology of the Fetus, Infant and Child*, 2nd edn. Mosby: Elsevier Inc., 2007, pp. 816-20.
- 10 Goldenberg RL, Hale CB, Houde J et al. Neonatal deaths in Alabama. III. Out-of-hospital births, 1940-1980. *Am J Obstet Gynecol* 1983; 147:687-93.
- 11 Ong BB, Green M. Infanticide in Malaysia: two case reports and a review of literature. *Am J Forensic Med Pathol* 2003; 24:64-9.
- 12 Hamilton A, English S. Baby bones uncover an island murder mystery. *The Times*, January 18, 2002; p. 3.

13 English S. Woman charged after children's bodies found. The Times, April 18, 2001; p. 1.

14 Nurse hid her dead babies in Attic. The Herald, August 27 2005, p. 6.

15 Boyes R. Mother tells of her dead babies' secret. The Times, Am J Forensic Med Pathol 1988; 9:9-11. 17 Yamauchi M, Usami S, Ikeda R et al. Medico-legal studies on infanticide: statistics and a case of repeated neonaticide. Forensic Sci Inter 2000; 113:205-8. 18 Shiono H, Maya A, Tabata N et al. Medicolegal aspects of infanticide in Hokkaido District, Japan. Am J Forensic Med Pathol 1986; 7:104-6. 19 Funayama M, Ikeda T, Tabata N et al. Case report: repeated neonaticides in Hokkaido. Forensic Sci Int 1994; 64:147-50. 20 Davies RJ. The midwife's role in the management of normal labour. In Chamberlain G (ed.) Turnbull's Obstetrics . Edinburgh: Churchill Livingstone, 1995, pp. 581-90. 21 Northern Region Perinatal Mortality Survey Coordinating Group. Collaborative survey of perinatal loss in planned and unplanned home births. Br Med J 1996; 313:1306-19. 22 Mitchell EK, Davis JH. Spontaneous births into toilets. J Forensic Sci 1984; 29:591-6. 23 Genest DR, Singer DB. Estimating the time of death in still born fetuses: III. External fetal examination; a study of 86 still borns. Obstet Gynecol 1992; 80:593-600. 24 Harries JT. Meconium in health and disease. Br Med Bull 1978; 34:75-8. 25 Robertson NRC. Care of the normal term newborn baby. In Rennie JM, Robertson NRC (eds) Textbook of Neonatology. London: Churchill Livingstone, 1999, pp. 373-87. 26 Adlerberth I, Carlsson B, Man de P et al. Intestinal colonization with enterobacteriaceae in Pakistan and Swedish hospital-delivered infants. Acta Paediatr Scand 1991; 80:602-10. 27 Balmer SE, Wharton BA. Diet and faecal flora in the newborn: breast milk and infant formula. Arch Dis Child 1989; 64:1672-77. 28 Tabata N, Morita M, Azumi J. A frozen newborn infant: froth in the air-passage after thawing. Forensic Sci Int 2000; 108:67-74. 29 Knight B (ed.). Infanticide and still birth. In Forensic Pathology. London: Edward Arnold, 1991, pp. 402-13. 30 Wigglesworth JS. Pathology of Intrapartum and early neonatal death in the normally formed infant. In Wigglesworth JS, Singer DB (eds) Textbook of Fetal and Perinatal Pathology, 2nd edn. Malden, MA: Blackwell Science, 1998, pp. 251-68. 31 Moar JJ. The hydrostatic test - a valid method of determining live birth? Am J Forensic Med Pathol 1997; 18:109-10. 32 Attwood HD. The histological diagnosis of amniotic fluid embolism. J Pathol Bacteriol 1958; 76:211-15. 33 Konstanidou AE, Agapitos E, Korkolopoulou P, Davaris P. Tracheoesophageal malformation: pathogenetic evidence

provided by two cases. *Teratology* 2001; 63:11-14. 34
Lavezzi WA, Keough KM, Der'Ohannesian PJD et al. The use of
pulmonary interstitial emphysema as an indicator of live
birth. *Am J Forensic Med and Pathol* 2003; 24:87-91. 35
Still birth (Definition) Act 1992. Eliz II, 1992, c29. 36
Evans DJ, Levene MI. Evidence of selection bias in preterm
survival studies: a systematic review. *Arch Dis Child Fetal*
2001; 84:F79-84. 37 Huxley AK, Froede RC, Birkby WH.
Strangulation of pregnant woman leads to one first-degree
murder indictment for the death of the mother: A
medicolegal reconsideration of maternal/fetal/homicide. *Am*
J Forensic Med Pathol 2001; 22:51-4. 38 Singer DB, Sung
C-R, Wigglesworth JS. Fetal growth and maturation; with
standards for body and organ development. 1998, pp. 8-40.

39 Keeling JW. The perinatal necropsy. In Keeling JW, Khong
TY (eds) *Fetal and Neonatal Pathology*, 4th edn. London:
Springer, 2007, pp. 20-53.

40 Huxley AK, Kosa F. Estimation of lunar age from
diaphyseal length from the fetal materials in the fetal
collections at Albert Szent-Györgyi Medical University,
Hungary (abst). *Proc Am Acad Forensic Sci* 1999; 5:222-3.

41 Dorovini-Zis K, Dolman CL. Gestational development of
brain. *Arch Pathol Lab Med* 1977; 101:192-5.

42 Feess-Higgins A, Larroche J-C. Development of the Human
Fetal Brain: An Anatomical Atlas. Paris: INSERM CNRS,
Masson, 1987.

43 Foote GA, Wilson AJ, Stewart JH. Perinatal post-mortem
radiography - experience with 2500 cases. *Br J Radiol* 1978;
51:351-6.

44 Russell JGB. Radiological assessment of age, retardation
and death. In Barson AJ (ed.) *Laboratory Investigation of*
Fetal Disease. Bristol: Wright, 1981, pp. 3-16.

45 Gould SJ. The respiratory system. In Keeling JW, Khong
TY (eds) *Fetal and Neonatal Pathology*, 4th edn. London:
Springer, 2007, pp. 531-70.

46 Baak JPA, Oort J. A Manual of Morphometry in Diagnostic
Pathology. Berlin: Springer-Verlag; Heidelberg, 1983, pp.
131-6.

47 Hilder L, Costeloe K, Thilaganathan B. Prolonged
pregnancy: evaluating gestation-specific risks of fetal and
infant mortality. *Br J Obstet Gynaecol* 1998; 105:169-73.

- 48 Keeling JW. Intrapartum problems. In Keeling JW, Khong TY (eds) *Fetal and Neonatal Pathology*, 4th edn. London: Springer, 2007, pp. 273-96.
- 49 Saunders E. Neonaticides following 'secret' pregnancies: seven case reports. *Public Health Rep* 1989; 104:368-72.
- 50 Mendlowicz MV, Jean-Louis G, Gekker M, Rapaport MH. Neonaticide in the city of Rio de Janeiro: forensic and psycholegal perspective. *J Forensic Sci* 1999; 44:741-5.
- 51 de Vries LS, Rennie JM. Preterm brain injury. In Rennie JM, Robertson NRC (eds) *Textbook of Neonatology*, 3rd edn. London: Churchill Livingstone, 1999, pp. 1252-71.
- 52 Connolly AM, Katz VL, Bash KL et al. Trauma and pregnancy. *Am J Perinatol* 1997; 14:331-6.
- 53 Fort AT, Harlin RS. Pregnancy outcome after noncatastrophic maternal trauma during pregnancy. *Obstet Gynecol* 1970; 35:912-15.
- 54 Rothenberger D, Quattlebaum FW, Perry JF et al. Blunt maternal trauma: a review of 103 cases. *J Trauma* 1978; 18:173-8.
- 55 Shah KH, Simons RK, Holbrook T et al. Trauma in pregnancy: maternal and fetal outcomes. *J Trauma* 1998; 45:83-6.
- 56 Curet MJ, Schermer CR, Demarest GB et al. Predictors of outcome in trauma during pregnancy: identification of patients who can be monitored for less than 6 hours. *J Trauma* 2000; 49:18-24.
- 57 Theodorou DA, Velmahos GC, Souter I et al. Fetal death after trauma in pregnancy. *Am Surg* 2000; 66:809-12.
- 58 Goodwin TM, Breen MT. Pregnancy outcome and fetomaternal haemorrhage after non catastrophic trauma. *Am J Obstet Gynecol* 1990; 162:665-71.
- 59 Siebenga J, van der Schoot JT, Keeman JN. Trauma during pregnancy. *Ned Tijdschr Geneesk* 1999; 143:1144-8.
- 60 Runnebaum IB, Holcberg G, Katz M. Pregnancy outcome after repeated blunt abdominal trauma. *Eur J Obstet Gynecol Reprod Biol* 1998; 80:85-6.

61 Pearlman MD, Fintinalli JE, Lorenz RP. Blunt trauma during Rhodes RS (1996) Trauma in pregnancy: the role of interpersonal violence. *Am J Obstet Gynecol* 174:1873-7. 63 Weiss HB, Songer TJ, Fabio A. Fetal deaths related to maternal injury. *JAMA* 2001; 286:1863-8. 64 Sugrue M, Kolkman KA. Trauma during pregnancy. *Aust J Rural Health* 1999; 7:82-4. 65 Rubovits FE. Traumatic rupture of the pregnant uterus from 'seat belt' injury. *Am J Obstet Gynecol* 1964; 90:828-9. 66 Raney EH. Fetal death secondary to nonpenetrating trauma to the gravid uterus. *Am J Obstet Gynecol* 1970; 106:313-14. 67 Crosby WM, Costiloe JP. Safety of lap-belt restraint for pregnant victims of automobile collisions. *N Engl J Med* 1971; 284:632-6. 68 Pearce M. Seatbelts in pregnancy: above and below the bump, not over it. *BMJ* 1992; 304:586-7. 69 Pearlman MD, Klinich KD, Schneider LW et al. A comprehensive program to improve safety for pregnant women and fetuses in motor vehicle crashes: a preliminary report. *Am J Obstet Gynecol* 2000; 182:1554-64. 70 Williams JK, McClain L, Rosemurgy AS, Colorado NM. Evaluation of blunt abdominal trauma in the third trimester of pregnancy: maternal and fetal considerations. *Obstet Gynecol* 1990; 75:33-7. 71 Matthews CD. Incorrectly used seatbelt associated with uterine rupture following vehicular collision. *Am J Obstet Gynecol* 1975; 121:1115-16. 72 Judich A, Kuriansky J, Engelberg I et al. Amniotic fluid embolism following blunt abdominal trauma in pregnancy. *Injury* 1998; 29:475-7. 73 Covington DL, Diehl SJ, Wright BD, Piner M. Assessing for violence during pregnancy using a systematic approach. *Matern Child Health J* 1997; 1:129-33. 74 Cokkinides VE, Coker AL, Sanderson M et al. Physical violence during pregnancy: maternal complications and birth outcomes. *Obstet Gynecol* 1999; 93:661-6. 75 Rachana C, Suralya K, Hisham AS et al. Prevalence and complications of physical violence during pregnancy. *Eur J Obstet Gynecol Reprod Biol* 2002; 103:26-9. 76 Department of Health. Confidential enquiries of maternal deaths in the UK. London: Department of Health, 2001 (<http://www.doh.gov.uk/cmo/mdeaths.htm>). 77 Drife J. Why mothers die. *J Roy Coll Physicians Edin* 2005; 35:332-6. 78 Lipsky S, Holt VL, Easterling TR, Critchlow CW. Impact of police-reported intimate partner violence during pregnancy on birth outcome. *Obstet Gynecol* 2003; 102:557-64. 79 Boy A, Salihu HM. Intimate partner violence and birth outcomes: a systematic review. *Int J Fertil Womens Med* 2004; 49:159-64. 80 Sokal MM, Katz M, Lell ME, Fox A. Neonatal survival after traumatic fetal subdural hematoma. *J Reprod Med* 1980; 24:131-3. 81 Stephens RP, Richardson AC, Lewin JS. Bilateral subdural hematomas in a newborn infant. *Pediatrics* 1997; 99:619-21. 82 Pak LL, Reece EA, Chan L. Is adverse pregnancy outcome predictable after blunt abdominal

trauma? Am J Obstet Gynecol 1998; 179:1140-4. 83 Becroft DM, Gunn TR. Prenatal cranial haemorrhages in 47 Pacific Islander infants: is traditional massage the cause? NZ Med J 1989; 102:207-10. 84 Lieberman JR, Mazor M, Molcho J et al. Electrical accidents during pregnancy. Obstet Gynecol 1986; 67:861-3. 85 Mazor M, Lieberman JR. Abortion caused by electric current. Arch Gynecol Obstet 1987; 241:71-2. 86 Jaffe R, Fejgin M, Ben Aderet N. Fetal death in early pregnancy due to electric current. Acta Obstet Gynecol Scand Acta Obstet Gynecol Scand 1992; 71:118-23.

88 Yoong AF. Electrical shock sustained in pregnancy followed by placenta abruption. Postgrad Med J 1990; 66:563-4.

89 Fatovich DM. Electric shock in pregnancy. J Emerg Med 1993; 11:175-7.

90 Einarson A, Bailey B, Inocencion G et al. Accidental electric shock in pregnancy: a prospective cohort study. Am J Obstet Gynecol 1997; 176:678-81.

91 Rees WD. Pregnant woman struck by lightning. BMJ 1965; 1:103-4.

92 Chan Y-F, Sivasamboo R. Lightning accidents in pregnancy. J Obstet Gynaecol Br Commonw 1972; 79:761-2.

93 Guha-Ray DK. Fetal death at term due to lightning. Am J Obstet Gynecol 1979; 134:103-5.

94 Flannery DB, Wiles H. Follow-up of a survivor of intra-uterine lightning exposure. Am J Obstet Gynecol 1982; 142:238-9.

95 Pierce MR, Henderson RA, Mitchell JM. Cardiopulmonary arrest secondary to lightning injury in a pregnant woman. Ann Emerg Med 1986; 15:597-9.

96 Awwad JT, Azar GB, Seoud MA et al. High-velocity penetrating wounds of the gravid uterus: review of 16 years of civil war. Obstet Gynecol 1994; 83:259-64.

97 O'Shaughnessy MJ. Conservative obstetric management of a gunshot wound to the second-trimester gravid uterus: a case report. J Reprod Med 1997; 42:606-8.

98 Pierson R, Mihalovits H, Thomas L, Beatty R. Penetrating abdominal wounds in pregnancy. Ann Emerg Med 1986; 15:1232-4.

99 Grubb DK. Nonsurgical management of penetrating uterine trauma in pregnancy: a case report. *Am J Obstet Gynecol* 1992; 166:583-4.

100 Franger AL, Buchsbaum HJ, Peaceman AM. Abdominal gunshot wounds in pregnancy. *Am J Obstet Gynecol* 1989; 160:1124-8.

101 Lavin JP, Polsky SS. Abdominal trauma during pregnancy. *Clin Perinatol* 1983; 10:423-38.

102 Buchsbaum HJ, Staples PJ. Self-inflicted gunshot wound to the pregnancy uterus: report of two cases. *Obstet Gynecol* 1985; 65:32S.

103 Sakala EP, Kort DD. Management of stab wounds to the pregnant uterus: a case report and a review of the literature. *Obstet Gynecol Surv* 1988; 43:319-24.

104 Rose PG, Strohn PL, Zuspan FP. Fetomaternal haemorrhage following trauma. *Am J Obstet Gynecol* 1985; 153 :844-7.

105 Reis PM, Sander CM, Pearlman MD. Abruptio placentae after auto accidents. A case-control study. *J Reprod Med* 2000; 45:6-10. study of factors associated with fetal death in injured pregnant patients. *Arch Surg* 1999; 134:1274-7. 107 Drost TF, Rosemurgy AS, Sherman HF et al. Major trauma in pregnant women: maternal/fetal outcome. *J Trauma* 1990; 30:574-8. 108 Fries MH, Hankins GDV. Motor vehicle accident associated with minimal maternal trauma but subsequent fetal demise. *Ann Em Med* 1989; 18:301-4. 109 Evrard JR, Sturmer WQ, Murray FJ. Fetal skull fracture from an automobile accident. *Am J Forensic Med Pathol* 1989; 10:232-4. 110 Härtl R, Ko K. In utero skull fracture: a case report. *J Trauma* 1996; 41:549-52. 111 Gunn TR, Mora JD, Becroft DM. Congenital hydrocephalus secondary to prenatal intracranial haemorrhage. *Aust NZ J Obstet Gynaecol* 1988; 28:197-200. 112 Robinson MJ, Cameron MD, Smith MF, Ayres AB. Fetal subdural haemorrhages presenting as hydrocephalus. *Br Med J* 1980; 281:35. 113 De Sousa CD, Clark T, Bradshaw A. Antenatally diagnosed subdural hemorrhage in congenital factor-X deficiency. *Arch Dis Child* 1988; 63:1168-70. 114 Sherer DM, Anyaegbunam A, Onyeije C. Antepartum fetal intracranial hemorrhage, predisposing factors and prenatal sonography: a review. *Am J Perinatol* 1998; 15:431-41. 115 Weinberg L, Wyatt P, Busuttil A. Traumatic intrauterine fetal spinal fracture following seatbelt use: a case report. *J Trauma* 2001; 51:1195-16. 116 Fakhoury GW, Gibson JRM. Seatbelt hazards

in pregnancy: a case report. Br J Obstet Gynaecol 1986; 93:395-6. 117 Siddall-Allum JN, Hughes JH, Kaler S, Reginald PW. Splenic rupture in utero following a road traffic accident. A case report. Br J Obstet Gynaecol 1991; 98:318-19. 118 Litmanovitz I, Dolphin T, Arnon S et al. Fetal intrathoracic injuries following mild maternal motor vehicle accident. J Perinat Med 2000; 28:158-60. 119 Griffiths M, Hillman G, Usherwood MM. Seat belt injury in pregnancy resulting in fetal death. A need for education? Case reports. Br J Obstet Gynaecol 1991; 98:320-4. 120 Yates PO. Birth trauma to the vertebral arteries. Arch Dis Child 1959; 34:436-41. 121 Ito Y, Tsuda R, Kimura H. Diagnostic value of the placenta in medico-legal practice. Forensic Sci Int 1989; 40:79-84.

11 Chapter 11. Sudden Unexpected Death in Infancy: Sudden Infant Death Syndrome or Something Else?

1 Carpenter RG, Shaddick CW. Role of infection, suffocation and bottle feeding in cot death. *Br J Prev Med* 1965; 19:1.

2 Beckwith JB. Introduction: discussion of terminology. In Bergman AB, Beckwith JB, Ray CG (eds) *Sudden Infant Death Syndrome*. Washington DC: University of Washington Press, 1970, p. 18.

3 Bass M, Kravath RE, Glass L. Death-scene investigation in sudden infant death. *N Engl J Med* 1986; 315:100-5.

4 Berry J, Allibone E, McKeever P et al. The pathology study: the contribution of ancillary pathology tests to the investigation of unexpected infant death. In Fleming P, Bacon C, Blair P, Berry PJ (eds) *Sudden Unexpected Deaths in Infancy the CESDI SUDI Studies 1993-1996*. London: The Stationery Office, 2000, pp. 97-112.

5 Willinger M, James LS, Catz C. Defining the sudden infant death syndrome (SIDS): deliberations of an expert panel convened by the National Institute of Child Health and Human Development. *Pediatr Pathol* 1991; 11:677-84.

6 Fleming P, Blair P, Ward-Platt M et al. The case-control study: results and discussion. In Fleming P, Blair P, Bacon C, Berry J (eds) *Sudden Unexpected Deaths in Infancy: The CESDI SUDI Studies*. London: The Stationery Office, 2000, pp. 13-96.

7 Bajanowski T, Vennemann M, Rauch E et al. Unnatural causes of sudden unexpected deaths initially thought to be sudden infant death syndrome. *Int J Legal Med* 2005; 119:213-16.

8 Gilbert-Barness EF, Barness LA. Sudden infant death syndrome. Is it a cause of death? *Arch Pathol Lab Med* 1993; 117:1246-8.

9 Green MA. Time to put 'cot death' to bed? *BMJ* 1999; 1999; 80:7-14. 11 Limerick S. Not time to put cot death to bed. *BMJ* 1999; 319:698-700. 12 Bacon CJ. Cot death after CESDI. *Arch Dis Child* 1997; 76:171-3. 13 Limerick SR, Bacon CJ. Terminology used by pathologists in reporting on sudden infant deaths. *J Clin Pathol* 2004; 57:309-11. 14 Flemming PJ, Blair PS, Sidebottom P, Hayler T. Investigating sudden unexpected deaths in infancy and childhood and caring for

bereaved families: an integrated multiagency approach. *Br Med J* 2004; 328:331-4. 15 Krous HF, Beckwith JB, Byard RW et al. Sudden infant death syndrome and unclassified sudden infant deaths: a definitional and diagnostic approach. *Pediatrics* 2004; 114:234-8. 16 Knowelden J, Keeling J, Nicholl JP et al. A Multicentre Study of Post-neonatal Mortality. London: HMSO, 1984. 17 Gibson AAM. Current epidemiology of SIDS. *J Clin Pathol* 1992; 45(Suppl.):7-10. 18 Gilbert RE, Fleming PJ, Azaz Y, Rudd PT. Signs of illness preceding sudden unexpected death in infants. *BMJ* 1990; 300:1237-9. 19 Wigglesworth JS, Keeling JW, Rushton DI, Berry PJ. Technical method. Pathological investigations in causes of sudden infant death. *J Clin Pathol* 1987; 40:1481-3. 20 Royal College of Pathologists. Guidelines for Post-mortem Reports. London: Royal College of Pathologists, 1993, pp. 8-10. 21 Valdés-Dapena M, McFeeley PA, Hoffman HJ et al. Histopathology Atlas for the Sudden Infant Death Syndrome. Washington DC: Armed Forces Instit Pathol, 1993. 22 Krous HF. An international standardized autopsy protocol for sudden unexpected infant death. In Rognum TO (ed.) *Sudden Infant Death Syndrome. New Trends in the Nineties*. Oslo: University of Scandinavia Press, 1995, pp. 75-89. 23 Howatson AG. The autopsy for sudden unexpected death in infancy. *Current Diagnostic Pathology* 2006; 12:173-83. 24 Report of a Working Group: Sudden Unexpected Death in Infancy. London: Royal College of Pathologists and Royal College of Paediatrics and Child Health, 2004. 25 Landi K, Gutierrez C, Sampson B et al. Investigation of the sudden death of infants: a multicenter analysis. *Pediatr Dev Pathol* 2005; 8:630-8. 26 Sadler DW. The value of a thorough protocol in the investigation of sudden infant deaths. *J Clin Pathol* 1998; 51:689-94. 27 Mitchell E, Krous HF, Donald T, Byard RW. An analysis of the usefulness of specific stages in the pathologic investigation of sudden infant death. *Am J Forensic Med Pathol* 2000; 21:395-400. 28 Langlois NE, Ellis PS, Little D, Hulewicz B. Toxicologic analysis in cases of possible sudden infant death syndrome: a worthwhile exercise? *Am J Forensic Med Pathol* 2002; 23:162-6. 29 Arnestad M, Vege A, Rognum TO. Evaluation of diagnostic tools applied in the examination of sudden unexpected deaths in infancy and early childhood. *Forensic Sci Internat* 2002; 125:262-8. 30 Keeling JW, Knowles SAS. Sudden death in childhood and adolescence. *J Pathol* 1989; 159:221-4. 31 Arneil GC, Gibson AA, McIntosh H et al. National postperinatal infant mortality and cot death study, Scotland 1981-82. *Lancet* 1985; 1:740-3. 32 Byard RW, Krous HF. Minor inflammatory lesions and sudden infant death: cause, coincidence, or epiphenomena? Blair P, Bacon C, Berry J (eds) *Sudden Unexpected Death In Infancy. The CESDI SUDI Studies*. London: The Stationery Office, 2000,

pp. 7-12.

34 Irgens LM. Risk factors for SIDS: Do they exist? In Rognum TO (ed.) Sudden Infant Death Syndrome. Oslo: Scandinavian University Press, 1995, pp. 99-105.

35 Blair PS, Fleming PJ, Bensley D et al. Smoking and the sudden infant death syndrome: results of 1993-5 casecontrol study for confidential inquiry into still births and deaths in infancy. *BMJ* 1996; 313:195-8.

36 Alm B, Milerad J, Wennergren G et al. A case-control study of smoking and sudden infant death syndrome in the Scandinavian countries, 1992 to 1995. *Arch Dis Child* 1998; 78:329-34.

37 Blair PA, Sidebotham P, Berry PJ et al. Major epidemiological changes in sudden infant death syndrome: a 20-year population-based study. *Lancet* 2006; 367: 314-19.

38 Daltveit AK, Øyen N, Skjaerven R, Irgens LM. The epidemic of SIDS in Norway 1967-93: changing effects of risk factors. *Arch Dis Child* 1997; 77:23-7.

39 Smith GC, Wood AM, Pell JP, Dobbie R. Sudden infant death syndrome and complications in other pregnancies. *Lancet* 2005; 366:2107-11.

40 Malloy MH. Sudden infant death syndrome among extremely pre-term infants: United States 1997-1999. *J Perinatol* 2004; 24:101-7.

41 Leach CE, Blair PS, Flemming PJ et al. Epidemiology of SIDS and explained sudden infant deaths: CESDI SUDI research group. *Pediatrics* 1999; 104:e43.

42 Golding J, Peters TJ. What else do SIDS risk prediction scores predict? *Early Hum Develop* 1985; 12:247-60.

43 Smith GC, Wood AM, Pell JP et al. Second-trimester maternal serum alpha-fetoprotein levels and the subsequent risk of sudden infant death syndrome. *N Engl J Med* 2004; 351:978-86.

44 Bass M. The fallacy of the simultaneous sudden infant death syndrome in twins. *Am J Forensic Med Pathol* 1989; 10:200-5.

45 Carpenter RG, Gardner A, McWeeny PM, Emery JL. Multistage scoring system for identifying infants at risk

of unexpected death. Arch Dis Child 1977; 52:606-12.

46 Golding J, Limerick S, Macfarlane JA. Sudden Infant Death: Patterns, Puzzles and Problems. London: Open Books, 1985, pp. 94-5, 190-5.

47 Ward-Platt M, Blair PS, Fleming PJ et al. A clinical comparison of SIDS and explained sudden infant deaths: how healthy and how normal? Arch Dis Child 2000; 82:98-106.

48 Overpeck MD, Brenner RA, Trumble AC et al. Risk factors for infant homicide in the United States. N Engl J Med 1998; 339:1211-16.

49 Stanton AN, Downham MAPS, Oakley JR et al. Terminal symptoms in children dying suddenly and unexpectedly at home. Preliminary report of the DHSS multicentre study of postneonatal mortality. BMJ 1978; 2:1249-51.

50 Stanton AN, Oakley JR. Pattern of illnesses before cot deaths. Arch Dis Child 1983; 58:878-81.

51 Ford RPK, Mitchell EA, Stewart AW et al. SIDS, illness, and acute medical care. Arch Dis Child 1997; 77:54-5.

52 L'Hoir MP, Engelberts AC, van Well GThJ et al. Sudden unexpected death in infancy: epidemiologically determined risk factors related to pathological classification. Acta Paediatr 1998; 87:1279-87.

53 British Paediatric Association. Report of a Working Party. 1994. 54 Rosen CL, Frost JD, Glaze DG. Child abuse and recurrent infant apnea. J Pediatr 1986; 109:1065-7. 55 Southall DP, Plunkett MCB, Banks MW et al. Covert video recordings of life-threatening child abuse: lessons for child protection. Pediatrics 1997; 100:735-6. 56 Berger D. Child abuse simulating 'near-miss' sudden infant death syndrome. J Pediatr 1979; 95:554-6. 57 Ariagno RL, Guillemineault C, Korobkin R et al. 'Near-miss' for sudden infant death syndrome infants: a clinical problem. Pediatrics 1983; 71:726-30. 58 Byard RW, Krous HF. Sudden infant death syndrome: overview and update. Pediatr Develop Pathol 2003; 6:1 12-27. 59 Truman TL, Ayoub CC. Considering suffocatory abuse and Munchausen by proxy in the evaluation of children experiencing apparent life-threatening events and sudden infant death syndrome. Child Maltreat 2002; 7:138-48. 60 Galvin HK, Newton AW, Vandevan AM. Update on Munchausen by proxy. Curr Opin Pediatr 2005; 17:252-7. 61 Becroft DM, Thompson JMD, Mitchell EA. Nasal and intrapulmonary haemorrhage in sudden infant death syndrome.

Arch Dis Child 2001; 85:116-20. 62 Barber MA, Davis PM. Fits, faints, or fatal fantasy? Fabricated seizures and child abuse. Arch Dis Child 2002; 86:230-3. 63 Proudfoot A. Is the cause toxicological? Medicine 1999; 27(4):4. 64 Emery JL, Thornton JA. Effects of obstruction to respiration in infants, with particular reference to mattresses, pillows, and their coverings. BMJ 1968; 3:209-13. 65 Foundation for the Study of Infant Deaths. Reduce the risks of cot death - an easy guide (Leaflet). FSID, 1996. 66 Foundation for the Study of Infant Deaths. Reduce the risks of cot death (Leaflet). FSID, 1991. 67 UNICEF UK. Sharing a bed with your baby. London: UNICEF UK, 2003. 68 Scragg KR, Mitchell EA, Stewart AW et al. Infant roomsharing and prone sleep position in sudden infant death syndrome. Lancet 1996; 347:7-12. 69 Stanton AN. Sudden infant death. Overheating and cot death. Lancet 1984; 2:1199-201. 70 Fleming PJ, Gilbert R, Azaz Y et al. Interaction between bedding and sleeping position in the sudden infant death syndrome: a population based case-control study. BMJ 1990; 30:85-9. 71 Wigfield RE, Fleming PJ, Azaz YEZ et al. How much wrapping do babies need at night? Arch Dis Child 1993; 69:181-6. 72 Beal SM, Finch CF. An overview of retrospective casecontrol studies investigating the relationship between prone sleeping position and SIDS. J Paediatr Child Health 1991; 27:334-9. 73 Beal SM. Sleeping position and sudden infant death syndrome. Med J Aust 1988; 149:562. 74 de Jonge GA, Engelberts AC, Koomen-Liefting AJM, Kostense PJ. Cot death and prone sleeping position in The Netherlands. BMJ 1989; 298:722. 75 Mitchell EA, Scragg R, Stewart AW et al. Results from the first year of the New Zealand cot death study. N Z Med J 1991; 104:71-6. 76 Brooke H, Gibson A, Tappin D, Brown H. Case-control study of sudden infant death syndrome in Scotland, 1992-5. BMJ 1997; 314:1516-20. 77 Mitchell EA, Hutchison L, Stewart AW. The continuing decline in SIDS mortality. Arch Dis Child 2007; 92: between use of quilt and sudden infant death syndrome: case-control study. BMJ 1998; 316:195-6.

79 Waters KA, Gonzalez A, Jean C et al. Face-straight-down and face-near-straight-down positions in healthy, prone-sleeping infants. J Pediatr 1996; 128:616-25.

80 Fleming PJ, Blair PS, Bacon C et al. Environment of infants during sleep and risk of the sudden infant death syndrome: results of 1993-5 case-control study for confidential inquiry into still births and deaths in infancy. BMJ 1996; 313:191-5.

81 Ramanathan R, Chandra S, Gilbert-Barnes E, Franciosi R.

Sudden infant death syndrome and water beds (Letter to the editor). N Engl J Med 1988; 318:1700.

82 Bass M. More on sudden infant death syndrome and water beds (Letter). N Engl J Med 1988; 319:1415.

83 Gilbert-Barness E, Hegstrand L, Chandra S et al. Hazards of mattresses, beds and bedding in deaths of infants. Am J Forensic Med Pathol 1991; 12:27-32.

84 Kemp JS, Thach BT. Sudden death in infants sleeping on polystyrene-filled cushions. N Engl J Med 1991; 324:1858-64.

85 Gilbert-Barness E, Emery JL. Deaths of infants on polystyrene-filled beanbags. Am J Forensic Med Pathol 1996; 17:202-6.

86 Byard RW, Beal SM. V-shaped pillows and unsafe infant sleeping. J Paediatr Child Health 1997; 33:171-3.

87 Moore L, Bourne AJ, Beal S et al. Unexpected infant death in association with suspended rocking cradles. Am J Forensic Med Pathol 1995; 16:177-80.

88 Bass M. Asphyxial crib death. N Engl J Med 1977; 296: 555-6.

89 Smialek JE, Smialek PZ, Spitz WU. Accidental bed deaths in infants due to unsafe sleeping situations. Clin Pediatr 1977; 11:1031-6.

90 Byard RW, Beal S, Bourne AJ. Potentially dangerous sleeping environments and accidental asphyxia in infancy and early childhood. Arch Dis Child 1994; 17:497-500.

91 Variend S, Usher A. Broken cots and infant fatality. Med Sci Law 1984; 24:111-12.

92 Byard RW, Bourne AJ, Beal SM. Mesh-sided cots: yet another potentially dangerous infant sleeping environment. Forensic Sci Int 1996; 83:105-9.

93 Cassidy SP. Analysis of crib-related deaths for the years 1989 through 1991 (memorandum). Bethesda, MD: US Consumer Product Safety Commission, 1994.

94 Foundation for the Study of Infant Deaths. Newsletter FSID 1999; 59:12.

- 95 Nakamura S, Wind M, Danello MA. Review of hazards associated with children placed in adult beds. *Arch Pediatr Adolesc Med* 1999; 153:1019-23.
- 96 Moore L, Byard RW. Pathological findings in hanging and wedging deaths in infants and young children. *Am J Forensic Med Pathol* 1993; 14:296-302.
- 97 Byard RW, Beal SM, Simpson A et al. Accidental infant death and stroller-prams. *Med J Aust* 1996; 165:140-1.
- 98 Collins KA. Death by overlaying and wedging. A 15-year retrospective study. *Am J Forensic Med Pathol* 2001; 22:155-9.
- 99 Byard RW. Is breast feeding in bed always a safe practice? *J Paediatr Child Health* 1998; 34:418-19.
- 100 Scragg KR, Mitchell EA. Side sleeping position and bed sharing in the sudden infant death syndrome. *Ann Med* 1998; 30:345-9.
- 101 Luke JL. Sleeping arrangements of sudden infant death syndrome victims in the District of Columbia: a preliminary infant death syndrome in Finland in 1969-1980. *J Forensic Sci Intern* 1986; 30:219-33. 103 Norvenius SG. Sudden infant death syndrome in Sweden in 1973-1977 and 1979. *Acta Paediatr Scand Suppl* 1987; 333:1-138. 104 Rushton DI. Co-sleeping and sudden infant death syndrome. *Lancet* 1997; 349:56-7. 105 Blair PS, Fleming PJ, Smith IJ et al. Babies sleeping with parents: case-control study of factors influencing the risk of the sudden infant death syndrome. *BMJ* 1999; 319:1457-62. 106 Tappin D, Ecob R, Brooke H. Bedsharing, roomsharing and sudden infant death syndrome in Scotland: a case control study. *J Pediatr* 2005; 147:32-7. 107 Czegledy-Nagy E, Cutz E, Becker LE. Sudden death in infants under one year of age. *Pediatr Pathol* 1993; 13:671-84. 108 Byard RW, Carmichael E, Beal S. How useful is post-mortem examination in sudden infant death syndrome? *Pediatr Pathol* 1994; 14:817-22. 109 Parham DM, Savell VH, Kokes CP et al. Incidence of autopsy findings in unexpected deaths of children and adolescents. *Pediatr Dev Pathol* 2003; 6:142-55. 110 Mitchell E, Krous HF, Donald T, Byard RW. Changing trends in the diagnosis of sudden infant death. *Am J Forensic Med Pathol* 2000; 21:311-14. 111 Berry PJ, Keeling JW. The investigation of sudden unexpected death in infancy. In Anthony PP, MacSween RNM (eds) *Recent Advances in Histopathology* 14. London: Churchill Livingstone, 1989, pp. 151-279. 112 Byard RW, Cohle SD. *Sudden Death in Infancy, Childhood and Adolescence*.

Cambridge: Cambridge University Press, 1994. 113 Dancea A, Co[^]té A, Roblicek C et al. Cardiac pathology in sudden unexpected infant death. *J Pediatr* 2002; 141:336-42. 114 Cohle SD, Balraj E, Bell M. Sudden death due to ventricular septal defect. *Pediatr Develop Pathol* 1999; 2:327-32. 115 Smith NM, Ho SY. Heart block and sudden death associated with fibrosis of the conduction system at the margin of a ventricular septal defect. *Pediatr Cardiol* 1994; 15:139-42. 116 Bajanowski T, Ortmann C, Teige K et al. Pathological changes of the heart in sudden infant death. *Int J Legal Med* 2003; 117:193-203. 117 Levin M, Tizard EJ, Dillon MJ. Kawasaki disease: recent advances. *Arch Dis Child* 1991; 66:1369-74. 118 Lipsett J, Cohle SD, Berry PJ, Byard RW. Anomalous coronary arteries: a multicenter pediatric autopsy study. *Pediatr Pathol* 1994; 14:287-300. 119 Berry CL. Myocardial infarction in a neonate. *Br Heart J* 1970; 32:412-15. 120 Tillett A, Hartley B, Simpson J. Paradoxical embolism causing fatal myocardial infarction in a newborn infant. *Arch Dis Child* 2001; 85:F137-8. 121 Byard RW. Vascular conditions. In Byard RW, Cohle SD (eds) *Sudden Death in Infancy, Childhood and Adolescence*. Cambridge: Cambridge University Press, 1994, pp. 175-261. 122 Gilbert-Barness E, Barness LA. Nonmalformative cardiovascular pathology in infants and children. *Pediatr Develop Pathol* 1999; 2:499-530. 123 Fried K, Beer S, Vure E et al. Autosomal recessive sudden unexpected death in children probably caused by a cardiomyopathy associated with myopathy. *J Med Genet* 1979; 16:341-6. 124 Edwards WD. Cardiomyopathies. *Hum Pathol* 1987; history of sudden death needs investigation. *BMJ* 1997; 314:843.

126 Suarez V, Fuggle WJ, Cameron AH et al. Foamy myocardial transformation of infancy: an inherited disease. *J Clin Pathol* 1987; 40:329-34.

127 Shehata BM, Patterson K, Thomas JE et al. Histiocytoid cardiomyopathy: three new cases and a review of the literature. *Pediatr Devel Pathol* 1998; 1:56-69.

128 Adgey J, Johnston PW, Mathew TP. Sudden cardiac death - a predictable, avoidable and treatable event? *Proc R Coll Physicians Edinb* 1998; 28:350-6.

129 Towbin JA. Molecular genetic basis of sudden cardiac death. *Pediatr Clin N Am* 2004; 51:1229-55.

130 Schwartz PJ, Stramba-Badiale M, Segantini A et al. Prolongation of the QT interval and the sudden infant death syndrome. *New Engl J Med* 1998; 338:1709-14.

- 131 Arnestad M, Crotti L, Rognum TO et al. Prevalence of long-QT syndrome gene variants in sudden infant death syndrome. *Circulation* 2007; 115:361-7.
- 132 Ackerman MJ, Tester DJ, Driscoll DJ. Molecular autopsy of sudden unexplained death in the young. *Am J Forensic Med Pathol* 2001; 22:105-11.
- 133 Hanzlick RL. Case report: lingual thyroglossal duct cyst causing death in a four-week-old infant. *J Forensic Sci* 1984; 29:345-8.
- 134 Kanawaku Y, Funayama M, Nata M, Kanetake J. Sudden infant death: thyroglossal duct cyst versus environmental factors. *Forensic Sci Int* 2006; 156:158-60.
- 135 McNamarra VM, Crabbe DC. Tracheomalacia. *Paediatr Respir Rev* 2004; 5:147-54.
- 136 Wong SW, Gardner V. Sudden death in children due to mesenteric defect and mesenteric cyst. *Am J Forensic Med Pathol* 1992; 13:214-16.
- 137 Byard RW. Sudden infant death, large intestinal volvulus and a duplication cyst of the terminal ileum. *Am J Forensic Med Pathol* 2000; 21:62-4.
- 138 Byard RW, Simpson A. Sudden death and intussusception in infancy and childhood-autopsy considerations. *Med Sci Law* 2001; 41:41-5.
- 139 Ng'walali PM, Yonemitsu K, Tsuenari S. Fatal intussusception in infancy: an experience in forensic autopsy. *Leg Med (Tokyo)* 2003; 5:181-4.
- 140 Smith NM, Bourne J, Clapton WK, Byard RW. The spectrum of presentation at autopsy of myocarditis in infancy and childhood. *Pathology* 1992; 24:129-31.
- 141 Shatz A, Hiss J, Arensburg B. Myocarditis misdiagnosed as sudden infant death syndrome (SIDS). *Med Sci Law* 1997; 37:16-18.
- 142 de Sa DJ. Isolated myocarditis in the first year. *Arch Dis Child* 1985; 60:484-5.
- 143 Krous HF, Haas E, Chadwick AE, Wagner GN. Sudden death in a neonate with idiopathic eosinophilic endomyocarditis. *Pediatr Devel Pathol* 2005; 8:587-92.

- 144 Dettmeyer RB, Padosch SA, Madea B. Lethal enterovirus-induced myocarditis and pancreatitis in a 4-month-old boy. *Forensic Sci Int* 2006; 156:51-4.
- 145 Losty HC, Lee P, Alfaham M et al. Fatty infiltration in the liver of medium chain acyl CoA dehydrogenase deficiency. *Arch Dis Child* 1991; 66:727-8.
- 146 Matsubaru Y, Narisawa K, Tada K et al. Prevalence of K329E mutation in medium-chain acyl-CoA dehydrogenase gene determined from Guthrie cards. *Lancet* 1991; 338: 552-3.
- 147 Dunder M, Lanyon WG, Connor JM. Scottish frequency of the common G985 mutation in the medium-chain Acyl-CoA J Inherit Metab Dis 1993; 16:991-3.
- 148 Fitzpatrick D. Inborn errors of metabolism in the newborn: clinical presentation and investigation. *J R Coll Physicians Edinb* 2006; 36:147-51.
- 149 Emery JL, Variend S, Howat AJ, Vawter GF. Investigation of inborn errors of metabolism in unexpected infant death. *Lancet* 1988; 2:29-31.
- 150 Lundemoose JB, Kolvraa S, Gregersen N et al. Fatty acid oxidation disorders as primary cause of sudden and unexpected death in infants and young children: an investigation performed on cultured fibroblasts from 79 children who died aged between 0-4 years. *J Clin Pathol: Mol Pathol* 1997; 50:212-17.
- 151 Boles RG, Buck EA, Blitzer MG et al. Retrospective biochemical screening of fatty acid oxidation disorders in post-mortem livers of 418 cases of sudden death in the first year of life. *J Pediatr* 1998; 132:924-33.
- 152 James CL, Keeling JW, Smith JW, Byard RW. Total anomalous pulmonary venous drainage associated with fatal outcome in infancy and early childhood - an autopsy study of 52 cases. *Pediatr Pathol* 1994; 14:665-78.
- 153 Keeling JW. The perinatal necropsy. In Keeling JW, Khong TY (eds) *Fetal and Neonatal Pathology*, 4th edn. London: Springer-Verlag, 2007, pp. 20-53.
- 154 Byard RW. Idiopathic arterial calcification and unexpected infant death. *Ped Pathol Lab Med* 1996; 16:985-94.
- 155 Champ C, Byard RW. Pulmonary thromboembolism and unexpected death in infancy. *J Paediatr Child Health* 1994; 30:550-1.
- 156 Berry PJ, Nagington J. Fatal infection with echovirus 11. *Arch Dis Child* 1982; 57:22-9.
- 157 Modlin JF. Perinatal echovirus infection: insights from a literature review of 61 cases of serious infection and 16 outbreaks in nurseries. *Rev Infect Dis* 1986; 8:918-26.
- 158 Wang J, Atchison RW, Walpusk J, Jaffe R. Echovirus hepatic failure in infancy: report of four cases with speculation on the pathogenesis. *Pediatr Devel Pathol* 2001; 4:454-60.
- 159 Kaplan MH, Klein SW, McPhee J, Harper RG. Group B coxsackievirus infections in infants younger than three months of age: a serious

childhood illness. *Rev Infect Dis* 1983; 5:1019-32. 160
 Wilcken B, Carpenter KH, Hammond J. Neonatal symptoms in
 medium chain acyl coenzyme A dehydrogenase deficiency. *Arch*
Dis Child 1993; 69:292-4. 161 Kirk JM, Laing IA, Smith N,
 Uttley WS. Neonatal presentation of medium-chain acyl-CoA
 dehydrogenase deficiency in two families. *J Inherit Metab*
Dis 1996; 19:370-1. 162 Vawter GF, Kozakewich HPW. Aspects
 of morphologic variation among SIDS-victims. In Tildon JT,
 Roeder LM, Steinschneider A (eds) *Sudden Infant Death*
Syndrome. New York: Academic Press, 1983, pp. 133-44. 163
 Molz G, Hartmann H. Dysmorphism, dysplasia, and anomaly in
 sudden infant death. *N Engl J Med* 1984; 311:259. 164 Molz
 G, Brodzinski A, Bär W, Vonlanthen B. Morphologic
 variations in 180 cases of sudden infant death and 180
 controls. *Am J Forensic Med Pathol* 1992; 13:186-90. 165
 Blair PA, Nadin P, Cole TJ et al. Weight gain and sudden
 infant death syndrome: changes in weight z scores may
 identify infants at increased risk. *Arch Dis Child* 2000;
 82:462-9. 166 van Baarlen J, Schuurman H-J, Huber J. Acute
 thymus involution in infancy and childhood: a reliable
 marker for duration of illness. *Hum Pathol* 1988; 19: the
 mechanism of death in sudden infant death syndrome? *Ann Am*
Acad Sci 1988; 553:37-47.

168 Kleeman WJ, Wiechern V, Schuck M, Tröger HD.
 Intrathoracic and subconjunctival petechiae in sudden
 infant death syndrome (SIDS). *Forensic Sci Int* 1995;
 72:49-54.

169 Isakasen CV, Helweg-Larsen K. The impact of attempted
 resuscitation in SIDS: post-mortem findings. In Rognum TO
 (ed.) *Sudden Infant Death Syndrome*. Oslo: Scandinavian
 University Press, 1995, pp. 70-80.

170 Werthammer J, Brown ER, Neff RK, Taeusch HW Jr. Sudden
 infant death syndrome in infants with bronchopulmonary
 dysplasia. *Pediatrics* 1982; 69:301-3.

171 Berry PJ. Pathological findings in SIDS. *J Clin Pathol*
 1992; 45(Suppl.):11-16.

172 Valdes-Dapena M. The pathologist and the sudden infant
 death syndrome. *Am J Pathol* 1982; 106:118-31.

173 Emery JL, Dinsdale F. Increased incidence of
 lymphoreticular aggregates in lungs of children found
 unexpectedly dead. *Arch Dis Child* 1974; 49:107-11.

174 Krous HF, Nadeau JM, Silva PD, Blackburne BD. A
 comparison of respiratory symptoms and inflammation in

sudden infant death syndrome and in accidental or inflicted infant death. *Am J Forensic Med Pathol* 2003; 24:1-8.

175 Gregersen M, Rajs J, Laursen H et al. Pathologic criteria for the Nordic study of SIDS. In Rognum TO (ed.) *Sudden Infant Death Syndrome*. Oslo: Scandinavian University Press, 1995, pp. 50-8.

176 Shatz A, Hiss J, Arensburg B. Basement-membrane thickening of the vocal cords in sudden infant death syndrome. *Laryngoscope* 1991; 101:484-6.

177 Krous FH, Hauck FR, Herman SM et al. Laryngeal basement membrane thickening is not a reliable post-mortem marker for SIDS. Results from the Chicago Infant Mortality study. *Am J Forensic Med Pathol* 1999; 20:221-7.

178 Adelson L, Kinney ER. Sudden and unexpected death in infancy and childhood. *Pediatrics* 1956; 17:663.

179 Valdés-Dapena M, Hoffman HJ, Froelich C, Requeira O. Glomerulosclerosis in the sudden infant death syndrome. *Pediatr Pathol* 1990; 10:273-9.

180 Naeye RL. Hypoxemia and the sudden infant death syndrome. *Science* 1974; 186:837-8.

181 Gilbert-Barness EF, Kenison K, Giulian G, Chandra S. Extramedullary hematopoiesis in the liver in sudden infant death syndrome. *Arch Pathol Lab Med* 1991; 115:226-9.

182 Smith NM, Telfer SM, Byard RW. A comparison of the incidence of cytomegalovirus inclusion bodies in submandibular and tracheobronchial glands in SIDS and non-SIDS autopsies. *Pediatr Pathol* 1992; 12:185-90.

183 Variend S. Infant mortality, microglial nodules and parotid CMV-type inclusions. *Early Hum Devel* 1990; 21:31-40.

184 Takashima S, Armstrong D, Becker LE, Huber J. Cerebral white matter lesions in sudden infant death syndrome. *Pediatrics* 1978; 62:155-9.

185 Takashima S, Armstrong D, Becker L, Bryan C. Cerebral hypoperfusion in the sudden infant death syndrome? Brainstem gliosis and vasculature. *Ann Neurol* 1978; 4:257-62.

186 Kinney H, Burger P, Harrell F, Hudson RP. 'Reactive

gliosis' in the medulla oblongata of victims of the Sudden Infant Death Syndrome. *Pediatrics* 1983; 72:181-7.

187 Kinney HC, Filiano JJ. Brain research in SIDS. In Byard RW, Krous HF (eds) *Sudden Infant Death Syndrome. Problems, Progress and Possibilities*. London: Arnold, 2001, pp. 118-37.

188 Kinney HC. Abnormalities of the brainstem serotonergic system in the sudden infant death syndrome: a review. *pathology of the adrenal glands in sudden infant death syndrome (SIDS)*. *Int J Legal Med* 1994; 106:244-8. 190 Becker AE, Becker MJ. Fat distribution in the adrenal cortex as an indication of the mode of intra-uterine death. *Human Pathol* 1976; 7:495-504. 191 Sinclair-Smith C, Dinsdale F, Emery J. Evidence of duration and type of illness in children found unexpectedly dead. *Arch Dis Child* 1976; 51:424-9. 192 Kaplan JA, Fossum RM. Patterns of facial resuscitation injury in infancy. *Am J Forensic Med Pathol* 1994; 15:187-91. 193 Bush CM, Jones JS, Cohle SD, Johnson H. Pediatric injuries from cardiopulmonary resuscitation. *Ann Emerg Med* 1996; 28:40-4. 194 Feldman KW, Brewster DK. Child abuse, cardiopulmonary resuscitation, and rib fractures. *Pediatrics* 1984; 73:339-42. 195 Spevak MR, Kleinman PK, Belanger PL et al. Cardiopulmonary resuscitation and rib fractures in infants: a post-mortem radiologic-pathologic study. *JAMA* 1994; 272:617-18. 196 Price EA, Rush LR, Perper JA, Bell MD. Cardiopulmonary resuscitation-related injuries and homicidal blunt abdominal trauma in children. *Am J Forensic Med Pathol* 2000; 21:307-10. 197 Downes AJ, Crossland DS, Mellon AF. Prevalence and distribution of petechiae in well babies. *Arch Dis Child* 2002; 86:291-2. 198 Perrot LJ. Masque ecchymotique. Specific or nonspecific indicator for abuse. *Am J Forensic Med Pathol* 1989; 10:95-7. 199 Byard RW, Krous HF. Petechial hemorrhages and unexpected infant death. *Leg Med (Tokyo)* 1999; 1:193-7. 200 Oehmichen M, Gerling I, Meißner C. Petechiae of the baby's skin as differentiation symptom of infanticide versus SIDS. *J Forensic Sci* 2000; 45:602-7. 201 Betz P, Hausmann R, Eisenmenger W. A contribution to a possible differentiation between SIDS and asphyxiation. *Forensic Sci Int* 1998; 91:147-52. 202 Rao VJ, Wetli CV. The forensic significance of conjunctival petechiae. *Am J Forensic Med Pathol* 1988; 9:32-4. 203 Hood I, Ryan D, Spitz WU. Resuscitation and petechiae. *Am J Forensic Med Pathol* 1988; 9:35-7. 204 McIntosh N, Mok JYQ, Margerison A. Epidemiology of oronasal hemorrhage in the first two years of life: implications for child protection. *Pediatrics* 2007; 120:1074-8. 205 Krous HF, Nadeau JM, Byard RW, Blackbourne BD. Oronasal blood in Sudden Infant Death.

Am J Forensic Med Pathol 2001; 23:346-51. 206 Sugar NF, Taylor JA, Feldman KW, Puget Sound Pediatric Research Network. Bruises in infants and toddlers. Those who don't bruise rarely bruise. Arch Pediatr Adolesc Med 1999; 153:399-403. 207 Amir J, Katz K, Grunebaum M et al. Fractures in premature infants. J Pediatr Orthop 1998; 8:41-4. 208 Koo WW, Sherman R, Succop P et al. Fracture and rickets in very low birth weight infants: conservative management and outcome. J Pediatr Orthop 1989; 9:326-30. 209 Dabezies EJ, Warren PD. Fractures in very low birth weight infants with rickets. Clin Orthop Relat Res 1997; 335:233-9. 210 Barry PW, Hocking MD. Infant rib fracture - birth trauma or non-accidental injury? Arch Dis Child 1993; 68:250. 211 Bullock B, Schubert CJ, Brophy PD et al. Cause and clinical characteristics of rib fractures in infants. Pediatrics 2000; Emerg Med 2006; 47:210, 215.

213 Campbell CJ, Read DJC. Lung petechiae - their pathophysiology and diagnostic significance in cot death. Aust Physiol Pharmacol Soc 1978; 9:143.

214 Berry PJ. Intra-alveolar haemorrhage in sudden infant death syndrome: a cause for concern? J Clin Pathol 1999; 52:553-4.

215 Hanzlick R. Pulmonary hemorrhage in deceased infants: baseline data for further study of infant mortality. Am J Forensic Med Pathol 2001; 22:188-92.

216 Coffin CM, Schechtman K, Cole FS, Dehner LP. Neonatal and infantile pulmonary hemorrhage: an autopsy study with clinical correlation. Pediatr Pathol 1993; 13:583-9.

217 Golde DW, Drew WL, Klein HZ et al. Occult pulmonary haemorrhage in leukaemia. BMJ 1975; 2:166-8.

218 Keeling JW, Maxwell RS, Busuttil A. Haemosiderin in infant lungs. J Pathol 1998; 184:29A.

219 Yukawa N, Carter N, Rutty G, Green MA. Intra-alveolar haemorrhage in sudden infant death syndrome: a cause for concern? J Clin Pathol 1999; 52:581-7.

220 Berry PJ, Lee J. Alveolar siderophages and the sudden infant death syndrome. J Pathol 1998; 184:27A.

221 Stewart S, Fawcett J. Interstitial haemosiderin in the lungs of sudden infant death syndrome: a histological hallmark of 'near-miss' episodes? J Pathol 1985; 145:53-8.

222 Byard RW, Stewart WA, Telfer S, Beal SM. Assessment of pulmonary and intrathymic hemosiderin deposition in sudden infant death syndrome. *Pediatr Pathol Lab Med* 1997; 17:275-82.

223 Becroft DM, Thompson JMD, Mitchell EA. Pulmonary interstitial haemosiderin in infancy: a common consequence of normal labour. *Pediatr Devel Pathol* 2005; 8:448-52.

224 Becroft DM, Lockett BK. Intra-alveolar pulmonary siderophages in sudden infant death: a marker for previous imposed suffocation. *Pathology* 1997; 29:60-3.

225 Milroy CM. Munchausen syndrome by proxy and intraalveolar haemosiderin. *Int J Legal Med* 1999; 111:2:309-12.

226 Dorandeu A, Perie G, Jouan H et al. Histological demonstration of haemosiderin deposits in lungs and liver from victims of chronic physical child abuse. *Int J Legal Med* 1999; 112:280-6.

227 Fagan DG. Haemosiderin in pulmonary macrophages from SUD, SIDS and deaths in an MVA. *J Pathol* 1997; 182:49A. infants: baseline data for further study of infant mortality. *Am J Forensic Med Pathol* 2000; 21:319-22. 229 Schluckebier DA, Cool CD, Henry TE et al. Pulmonary siderophages and unexpected infant death. *Am J Forensic Med Pathol* 2002; 23:360-3. 230 Krous HF, Wixom C, Chadwick AE et al. Pulmonary intraalveolar siderophages in SIDS and suffocation: a San Diego SIDS/SUDC project report. *Pediatr Devel Pathol* 2006; 9:103-14. 231 Montaña E, Etzel RA, Allan T et al. Environmental risk factors associated with pediatric idiopathic pulmonary hemorrhage and hemosiderosis in a Cleveland community. *Pediatrics* 1997; 99:31-8. 232 Pappas MD, Sarnaik AP, Meert KL et al. Idiopathic pulmonary hemorrhage in infancy. Clinical features and management with high frequency ventilation. *Chest* 1996; 110:553-5. 233 Cutz E, Perrin DG, Vujanic GM, Ackerly C. Idiopathic pulmonary haemosiderosis (IPH) presenting as sudden unexpected death SUD in infancy (Abstract). *Anales Espanoles de Pediatria* 1999; 92(Suppl.):52. 234 Muir R, Niven JSF. The local formation of blood pigments. *J Pathol Bacteriol* 1935; 41:183-97. 235 Sherman JM, Winnie G, Thomassen MJ et al. Time course of hemosiderin production and clearance by human pulmonary macrophages. *Chest* 1984; 86:409-11. 236 Esterley JR, Oppenheimer EH. Massive pulmonary haemorrhage in the newborn. Pathologic considerations. *J Pediatr* 1966; 69:3-11. 237 Rushton DI. Liver and gallbladder. In Keeling JW (ed.) *Fetal And*

Neonatal Pathology, 3rd edn. London: Springer-Verlag, 2001, pp. 409-39. 238 McCann J, Reay D, Siebert J et al. Postmortem perianal findings in children. *Am J Forensic Med Pathol* 1996; 17:289-98. 239 Case ME, Graham MA, Handy TC et al. The National Association of Medical Examiners Ad Hoc Committee on Shaken Baby Syndrome. Position paper on fatal abusive head injuries in infants and young children. *Am J Forensic Med Pathol* 2001; 22:112-22. 240 Bodian M, Heslop B. Sudden infant death syndrome. In Siim J-C (ed.) *Proceedings of the Eighth International Congress of Paediatrics*, Basel, 1956. Copenhagen: Williams & Wilkins, 1960, p. 91.

12 Chapter 12. Sudden Natural Death in Infants and Children

- 1 Lambert EC, Menon VA, Wagner HR, Vlad P. Sudden unexpected death from cardiovascular disease in children. A cooperative international study. *Am J Cardiol* 1974; 34:89-96.
- 2 Abu-Harb M, Hey E, Wren C. Death in infancy from unrecognised congenital heart disease. *Arch Dis Child* 1994; 71:3-7.
- 3 Basso C, Frescura C, Corrado D et al. Congenital heart disease and sudden death in the young. *Hum Pathol* 1995; 26(10):1065-72.
- 4 Stahl J, Santos LD, Byard RW. Coronary artery thromboembolism and unexpected death in childhood and adolescence. *J Forensic Sci* 1995; 40:599-601.
- 5 Klitzner TS. Sudden cardiac death in children. *Circulation* 1990; 82:629-32.
- 6 Steinberger J, Lucas RV, Edwards JE, Titus JL. Causes of sudden unexpected cardiac death in the first two decades of life. *Am J Cardiol* 1996; 77:992-5.
- 7 Glew RH, Varghese PJ, Krovetz LJ et al. Sudden death in congenital aortic stenosis. *Am Heart J* 1969; 78:615-25.
- 8 McManus BM, Babul S. Pathology of sudden death in the 9 Byard RW, Bourne AJ, Adams PS. Subarterial ventricular septal defect in an infant with sudden unexpected death: Cause or coincidence? *Am J Cardiovasc Pathol* 1990; 3:333-6.
- 10 Byard RW. Vascular conditions. In Byard W, Cohle SD (eds) *Sudden Death in Infancy, Childhood and Adolescence*. Cambridge: Cambridge University Press, 1994, pp. 175-261.
- 11 Bird LM, Billman GF, Lacro RV et al. Sudden death in Williams syndrome: report of ten cases. *J Pediatr* 1996; 129:926-31.
- 12 DeSa DJ. Isolated myocarditis in the first year. *Arch Dis Child* 1985; 60:484-5.
- 13 Molander N. Sudden natural death in later childhood and adolescence. *Arch Dis Child* 1982; 57:572-6.
- 14 Siboni A, Simonsen J. Sudden unexpected natural death in young persons. *Forensic Sci Int* 1986; 31:159-66.
- 15 Keeling JW, Knowles SAS. Sudden death in childhood and adolescence. *J Pathol* 1989; 159:221-4.
- 16 Davies MJ. The cardiomyopathies: a review of terminology, pathology and pathogenesis. *Histopathology* 1984; 8:363-93.
- 17 Noren GR, Staley NA, Bandt CH, Kaplan EL. Occurrence of myocarditis in sudden death in children. *J Forensic Sci*

1977; 22:188-96. 18 Davies MJ, Popple A. Sudden unexpected cardiac death: a practical approach to the forensic problem. *Histopathology* 1979; 3:255-77. 19 Lim C-H, Toh CCS, Chia B-L, Low L-P et al. Stokes-Adams attacks due to acute nonspecific myocarditis. *Am Heart J* 1975; 90:172-8. 20 Neuspiel DR, Kuller LH. Sudden and unexpected natural death in childhood and adolescence. *J Am Med Assoc* 1985; 254:1321-5. 21 Woodruff JF. Viral myocarditis. *Am J Pathol* 1980; 101:427-42. 22 Leslie K, Blay R, Haisch C et al. Clinical and experimental aspects of viral myocarditis. *Clin Microbiol Rev* 1989; 2:191-203. 23 Hilton DA, Variend S, Pringle JH. Demonstration of coxsackie virus RNA in formalin-fixed tissue sections from childhood myocarditis cases by in situ hybridization and the polymerase chain reaction. *J Pathol* 1993; 170:45-51. 24 Lozinski GM, Davis GG, Krous HF et al. Adenovirus myocarditis: retrospective diagnosis by gene amplification from formalin-fixed, paraffin-embedded tissues. *Hum Pathol* 1994; 25:831-4. 25 Shimizu C, Rambaud C, Cheron G et al. Molecular identification of viruses in sudden infant death associated with myocarditis and pericarditis. *Pediatr Infect Dis J* 1995; 14:584-8. 26 Samuels MA. Neurogenic heart disease: A unifying hypothesis. *Am J Cardiol* 1987; 60:15-19. 27 Frustaci A, Loperfido F, Gentiloni N et al. Catecholamine-induced cardiomyopathy in multiple endocrine neoplasia: A histologic, ultrastructural and biochemical study. *Chest* 1991; 99:382-5. 28 Olsen EGJ. Myocarditis. In Olsen EGJ (ed.) *The Pathology of the Heart*. London: The MacMillan Press Ltd, 1980; 178-99. 29 Patterson K, Donnelly WH, Dehner LP et al. The cardiovascular system. In Stocker JT, Dehner LP (eds) *Pediatric Pathology Vol. 1*. Philadelphia: Lippincott Company, 1992; 575-651. 30 Haupt HM, Hutchins GM. The heart and cardiac conduction system in polymyositis-dermatomyositis: A clinicopathologic study of 16 autopsied patients. *Am J Cardiol* 1982; 50:998-1006. 31 Bissenden JG, Hall S. Kawasaki syndrome: lessons for

Figure 12.24 Microscopy of a microglial nodule in the

brainstem of an infant with cytomegaloviral parotitis who died

suddenly at home. *introduction to pathology and pathogenesis. Br Heart J* 1994; 72(Suppl.):24.

33 Kelly DP, Strauss AW. Inherited cardiomyopathies. *N Engl J Med* 1994; 330:913-19.

34 Lawson JWR. Southwestern Internal Medicine Conference: hypertrophic cardiomyopathy: current views on etiology,

pathophysiology and management. Am J Med Sci 1987; 294:191-210.

35 Burch M. Hypertrophic cardiomyopathy. Arch Dis Child 1994; 71:488-9.

36 McKenna WJ, Stewart JT, Nihoyannopoulos P et al. Hypertrophic cardiomyopathy without hypertrophy: two families with myocardial disarray in the absence of increased myocardial mass. Br Heart J 1990; 63:287-90.

37 Gow RM. Sudden cardiac death in the young. Can J Cardiol 1996; 12:1157-60.

38 Burch M, Mann JM, Sharland M et al. Myocardial disarray in Noonan syndrome. Br Heart J 1992; 68:586-8.

39 Halliday HL. Hypertrophic cardiomyopathy in infants of poorly-controlled diabetic mothers. Arch Dis Child 1981; 56:258-63.

40 Burch M, Runciman M. Dilated cardiomyopathy. Arch Dis Child 1996; 74:479-81.

41 Maron BJ, Shirani J, Poliac LC et al. Sudden death in young competitive athletes: clinical, demographic, and pathological profiles. J Am Med Assoc 1996; 276:199-204.

42 Huber S. Viral myocarditis - a tale of two diseases. Lab Invest 1992; 66:1-3.

43 Bennett MJ, Hale DE, Pollitt RJ et al. Endocardial fibroelastosis and primary carnitine deficiency due to a defect in the plasma membrane carnitine transporter. Clin Cardiol 1996; 19:243-6.

44 Virmani R, Robinowitz M, Clark MA, McAllister HA. Sudden death and partial absence of the right ventricular myocardium. Arch Pathol Lab Med 1982; 106:163-7.

45 Thiene G, Nava A, Corrado D et al. Right ventricular cardiomyopathy and sudden death in young people. N Engl J Med 1988; 318:129-33.

46 McKenna WJ, Thiene G, Nava A et al. Diagnosis of arrhythmogenic right ventricular dysplasia/cardiomyopathy. Br Heart J 1994; 71:215-18.

47 Fontaine G. Arrhythmogenic right ventricular dysplasia. Curr Opin Cardiol 1995; 10:16-20.

48 Ahmad F, Li D, Karibe A et al. Localisation of a gene responsible for arrhythmogenic right ventricular dysplasia to chromosome 3p23. *Circulation* 1998; 98:2791-5.

49 Gerlis LM, Schmidt-Ott SC, Ho SY, Anderson RH. Dysplastic conditions of the right ventricular myocardium: Uhl's anomaly versus arrhythmogenic right ventricular dysplasia. *Br Heart J* 1993; 69:142-50.

50 Tansey DK, Aly Z, Sheppard MN. Fat in the right ventricle of the normal heart. *Histopathology* 2005; 46:98-104.

51 Krous HF, Chadwick AE, Isaacs H. Tumors associated with sudden infant and childhood death. *Pediatr Dev Pathol* 2005; 8:20-5.

52 Shehata BM, Patterson K, Thomas JE et al. Histiocytoid cardiomyopathy: Three new cases and a review of the literature. *Pediatr Dev Pathol* 1998; 1:56-69.

53 Suarez V, Fuggle WJ, Cameron AH et al. Foamy myocardial transformation of infancy: an inherited disease. *J Clin Pathol* 1987; 40:329-34.

54 Koponen MA, Siegel RJ. Histiocytoid cardiomyopathy and sudden death. *Hum Pathol* 1996; 27:420-3.

55 Ness MJ, McManus BM. Anomalous right coronary artery origin in otherwise unexplained infant death. Arch Pathol arteries arising from the aorta associated with sudden death in infancy and early childhood. *Arch Pathol Lab Med* 1991; 115:770-3. 57 Corrado D, Thiene G, Cocco P, Frescura C. Nonatherosclerotic coronary artery disease and sudden death in the young. *Br Heart J* 1992; 68:601-7. 58 Garfia A, Rodriguez M, Chavarria H, Garrido M. Sudden cardiac death during exercise due to an isolated multiple anomaly of the left coronary artery in a 12-year-old girl: Clinicopathologic findings. *J Forensic Sci* 1997; 42:330-4. 59 Scully RE, Mark EJ, McNeely WF, McNeely BU. Case records of the Massachusetts General Hospital, Case 22-1989. *N Engl J Med* 1989; 320:1475-83. 60 Thiene G, Pennelli N, Rossi L. Cardiac conduction system abnormalities as a possible cause of sudden death in young athletes. *Hum Pathol* 1983; 14:704-9. 61 Angelini P. Normal and anomalous coronary arteries: definitions and classification. *Am Heart J* 1989; 117:418-34. 62 Price J. Kawasaki syndrome. *Br Med J* 1984; 288:262-3. 63 Curtis N. Kawasaki disease. *Br Med J* 1997; 315:322-3. 64 Tizard EJ, Suzuki A, Levin M, Dillon MJ.

Clinical aspects of 100 patients with Kawasaki disease. Arch Dis Child 1991; 66:185-8. 65 Nakamura Y, Yanagawa H, Ojima T et al. Cardiac sequelae of Kawasaki disease among recurrent cases. Arch Dis Child 1998; 78:163-5. 66 Hoare S, Abinun M, Cant AJ. Overlap between Kawasaki disease and Group A streptococcal infection (Letter). Pediatr Infect Dis J 1997; 16:633-4. 67 Byard RW. Cardiac conditions. In Byard RW (ed.) Sudden Death in Infancy Childhood and Adolescence, 2nd edn. Cambridge: Cambridge University Press, 2004, pp. 202-48. 68 Bharati S, Bauernfiend R, Scheinman M et al. Congenital abnormalities of the conduction system in two patients with tachyarrhythmias. Circulation 1979; 59:593-606. 69 Splawski I, Shen J, Timothy KW et al. Spectrum of mutations in long Q-T syndrome genes KVLQT1, HERG, SCN5A, KCNE1 and KNCE2. Circulation 2000; 102:1178-85. 70 Towbin JA. Molecular basis of sudden cardiac death. Pediatr Clin N Am 2004; 51:1229-55. 71 Moran JJ. Idiopathic arterial calcification of infancy: a clinicopathologic study. Pathol Ann 1975; 10:393-417. 72 Rutsch F, Vaingankar S, Johnson K et al. PC-1 nucleoside triphosphate pyrophosphohydrolase deficiency in idiopathic infantile arterial calcification. Am J Pathol 2001; 158:543-54. 73 Rutsch F, Ruf N, Vaingankar S et al. Mutations in ENPP1 are associated with 'idiopathic' infantile arterial calcification. Nat Genet 2003; 34:379-81. 74 Juul S, Ledbetter D, Wight TN, Woodrum D. New insights into idiopathic infantile arterial calcinosis. Three patient reports. Am J Dis Child 1990; 144:229-33. 75 Byard RW. Idiopathic arterial calcification and unexpected infant death. Pediatr Pathol Lab Med 1996; 16:985-94. 76 Joshi VV, Pawel B, Connor E et al. Arteriopathy in children with acquired immune deficiency syndrome. Pediatr Pathol 1987; 7:261-75. 77 Siegel RJ, Dunton SF. Systemic occlusive arteriopathy with sudden death in a 10-year-old boy. Hum Pathol 1991; 22:197-200. 78 Imamura M, Yokoyama S, Kikuchi K. Coronary fibromuscular dysplasia presenting as sudden infant death. Arch Pathol Lab Med 1997; 121:159-61. 79 Rosenberg HG. Systemic arterial disease and chronic with tuberous sclerosis. Pediatr Pathol 1985; 3:359-73.

81 Mudd SH, Levy HL, Skovby F. Disorders of transsulfuration. In Scriver CR, Beaudet AL, Sly WS, Valle D (eds) The Metabolic and Molecular Bases of Inherited Disease. New York: McGraw-Hill Inc., 1995; 1279-327.

82 Fortuin NJ, Morrow AG, Roberts WC. Late vascular manifestations of the Rubella syndrome. Am J Med 1971; 51:134-40.

83 Hamilton SJ, Allard MF, Friedman JM. Cardiac Findings in an individual with neurofibromatosis 1 and sudden death. *Am J Med Genet* 2001; 110:95-9.

84 Uno H, Arya S, Laxova R, Gilbert EF. Menkes' syndrome with vascular and adrenergic nerve abnormalities. *Arch Pathol Lab Med* 1983; 107:286-9.

85 Fleisher GR, Buck BE, Cornfeld D. Primary intimal fibroplasia in a child with Down's syndrome. *Am J Dis Child* 1978; 132:700-3.

86 Cina SJ, Smialek, JE, Burke AP et al. Primary cardiac tumors causing sudden death: a review of the literature. *Am J Forensic Med Pathol* 1996; 17:271-81.

87 Siegal GP. Primary tumors of muscle. In Stocker JT, Askin FB (eds) *Pathology of Solid Tumors in Children*. London: Chapman and Hall Medical, 1998, pp. 161-81.

88 Parker KM, Embry JH. Sudden death due to tricuspid valve myxoma with massive pulmonary embolism in a 15-month old male. *J Forensic Sci* 1997; 42:524-6.

89 Krous HF, Chapman AJ, Altshuler G. Cardiac hemangioma: a rare (or possible) cause of sudden death in children. *J Forensic Sci* 1978; 23:375-8.

90 Swalwell CI. Benign intracardiac teratoma - a case of sudden death. *Arch Pathol Lab Med* 1993; 117:739-42.

91 Byard RW, Cutz E. Sudden and unexpected death in infancy and childhood due to pulmonary thromboembolism. *Arch Pathol Lab Med* 1990; 114:142-4.

92 Champ C, Byard RW. Pulmonary thromboembolism and unexpected death in infancy. *J Pediatr Child Health* 1994; 30:550-1.

93 Patton DJ, Galliani CA, Johnson WH, Hedlund GL. Sudden death in Marfan syndrome. *Am Journal of Roentgenology* 1995; 165:160.

94 Masse J-F, Pêrusse R. Ectodermal dysplasia. *Arch Dis Child* 1994; 71:1-2.

95 Clarke A, Phillips DIM, Brown R, Harper PS. Clinical aspects of X-linked hypohidrotic ectodermal dysplasia. *Arch Dis Child* 1987; 62:989-96.

- 96 Waters KA, Everett F, Sillence D et al. Breathing abnormalities in sleep in achondroplasia. *Arch Dis Child* 1993; 69:191-6.
- 97 Bland JD, Emery JL. Unexpected death of children with achondroplasia after the perinatal period. *Dev Med Child Neurol* 1982; 24:489-92.
- 98 Webb DW, Osborne JP. Tuberous sclerosis. *Arch Dis Child* 1995; 72:471-4.
- 99 Nir A, Tajik J, Freeman WK et al. Tuberous sclerosis and cardiac rhabdomyosarcoma. *Am J Cardiol* 1995; 76:419-21.
- 100 O'Callaghan FJK, Clarke AC, Joffe H et al. Tuberous sclerosis complex and Wolff-Parkinson-White syndrome. *Arch Dis Child* 1998; 78:159-62.
- 101 Livingston JH, Brown JK. Intracerebral haemorrhage after the neonatal period. *Arch Dis Child* 1986; 61:538-44.
- 102 Gieteling EW, Rinkel GJE. Characteristics of intracranial aneurysms and subarachnoid haemorrhage in patients with polycystic kidney disease. *J Neurol* 2003; 250:418-23.
- 103 Lilova MI, Petkov DL. Intracranial aneurysms in a child with autosomal recessive polycystic kidney disease. *Pediatr death due to hemorrhage from occult central nervous system lesions. Pediatr Neurosurg* 1991-92; 17:88-94.
- 105 Lilleyman JS. Intracranial haemorrhage in idiopathic thrombocytopenic purpura. *Arch Dis Child* 1994; 71:251-3.
- 106 Abu Al Ragheb SY, Koussous KJ, Amr SS. Intracranial neoplasms associated with sudden death: a report of seven cases and a review of the literature. *Med Sci Law* 1986; 26:270-2.
- 107 DiMaio SM, DiMaio VJM, Kirkpatrick JB. Sudden, unexpected deaths due to primary intracranial neoplasms. *Am J Forensic Med Pathol* 1980; 1:29-45.
- 108 Byard RW, Moore L. Sudden and unexpected death in childhood due to a colloid cyst of the third ventricle. *J Forensic Sci* 1993; 38:210-13.
- 109 Buzzi S, Verdura C, Arlati S, Colecchia M. Sudden death in a child due to rare endocranial neoformation. *Med Sci Law* 1998; 38:176-8.
- 110 Leestma JE, Walczak T, Hughes JR et al. A prospective study on sudden unexpected death in epilepsy. *Ann Neurol* 1989; 26:195-203.
- 111 Byard RW, Keeley FW, Smith CR. Type IV Ehlers-Danlos syndrome presenting as sudden infant death. *Am J Clin Pathol* 1990; 98:579-82.
- 112 Elterman RD, Bodensteiner JB, Barnard JJ. Sudden unexpected death in patients with Dandy-Walker malformation. *J Child Neurol* 1995; 10:382-4.
- 113 Vaishnav A, MacKinnon AE.

Progressive hydrocephalus in teenage spina bifida patients. *Z Kinderchirurg* 1986; 41(Suppl. 1):36-7. 114 Stellman GR, Bannister CM, Hillier V. The incidence of seizure disorder in children with acquired and congenital hydrocephalus. *Z Kinderchirurg* 1986; 41(Suppl. 1):38-9. 115 Friede RL. Meningoencephalitic processes in the perinatal period. *Developmental Neuropathology*. New York: SpringerVerlag, 1975; 178-87. 116 Howat AJ, Smith CML, Variend S. Sudden infant death and encephalitis in two siblings. *Dev Med Child Neurol* 1987; 29:539-40. 117 Shields LBE, Handy TC, Parker JC, Burns C. Postmortem diagnosis of leukodystrophies. *J Forensic Sci* 1998; 43:1068-71. 118 Kerenyi N. Congenital adrenal hypoplasia. *Arch Pathol* 1961; 71:336-3. 119 Irvine WJ, Toft AD. Diagnosing adrenocortical insufficiency. *Practitioner* 1977; 218:539-45. 120 Al Sabri AM, Smith N, Busuttil A. Sudden death due to autoimmune Addison's disease in a 12-year-old girl. *Int J Legal Med* 1997; 110:278-80. 121 Favara BE, Franciosi RA, Miles V. Idiopathic adrenal hypoplasia in children. *Am J Clin Pathol* 1972; 57:287-96. 122 Brown W, Singer DB. Pregnancy-induced hypertension and congenital adrenal hypoplasia. *Obstet Gynaecol* 1988; 72:190-4. 123 Bacon CJ, Hall SM. Haemorrhagic shock encephalopathy syndrome in the British Isles. *Arch Dis Child* 1992; 67:985-93. 124 Little D, Wilkins B. Haemorrhagic shock and encephalopathy syndrome: an unusual cause of sudden death in children. *Am J Forensic Med Pathol* 1997; 18:79-83. 125 PHLS Communicable Disease Surveillance Centre. Joint British Paediatric Association and Communicable Disease Surveillance Scheme for haemorrhagic shock encephalopathy syndrome surveillance report for 1982-4. *Br Med J* 1985; 290:1578-9. 126 Glasgow JFT, Moore R. Reye's syndrome 30 years on. *Br associations and inborn errors of metabolism. Lancet* 1987; ii:429-31.

128 Bonnel HJ, Beckwith JB. Fatty liver in sudden childhood death. *Am J Dis Child* 1986; 140:30-3.

129 Forsyth BW, Shapiro ED, Horwitz RI et al. Misdiagnosis of Reye's-like illness (Letter). *Am J Dis Child* 1991; 145:964-6.

130 Green A, Hall SM. Investigation of metabolic disorders resembling Reye's syndrome. *Arch Dis Child* 1992; 67:1313-17.

131 Hardie RM, Newton LH, Bruce JC et al. The changing clinical pattern of Reye's syndrome 1982-1990. *Arch Dis Child* 1996; 74:400-5.

132 Rowe PC, Valle D, Brusilow SW. Inborn errors of

metabolism in children referred with Reye's syndrome. J Am Assoc 1988; 260:3167-70.

133 Byard RW, Bohn DJ, Wilson G et al. Unsuspected diaphragmatic hernia: a potential cause of sudden and unexpected death in infancy and early childhood. J Pediatr Surg 1990; 25:1166-8.

134 Pfalzgraf RR, Zumwalt RE, Kenny MR. Mesodiverticular band and sudden death in children. Arch Pathol Lab Med 1988; 112:182-4.

135 Pumphrey RSH, Stanworth SJ. The clinical spectrum of anaphylaxis in north-west England. Clin Exp Allergy 1996; 26:1364-70.

136 Pumphrey RS, Robert IS. Postmortem findings after fatal anaphylactic reactions. J Clin Pathol 2000; 53:273-6.

137 Delage C, Irely NS. Anaphylactic deaths: a clinicopathologic study of 43 cases. J Forensic Sci 1972; 17:525-39.

138 Sampson HA, Mendelson MD, Rosen JP. Fatal and near-fatal anaphylactic reactions to food in children and adolescents. N Engl J Med 1992; 327:380-4.

139 Riches KJ, Gillis D, James RA. An autopsy approach to bee sting-related deaths. Pathology 2002; 34:257-62.

140 Byard RW. Miscellaneous conditions. In Byard RW (ed.) Sudden Death in Infancy, Childhood and Adolescence, 2nd edn. Cambridge: Cambridge University Press, 2004, pp. 469-88.

141 Assem ESK, Gelder CM, Spiro SG et al. Anaphylaxis induced by peanuts. Br Med J 1990; 300:1377-8.

142 Patel L, Radivan FS, David TJ. Management of anaphylactic reactions to food. Arch Dis Child 1994; 71:370-5.

143 Powars D, Chan LS, Schroeder WA. The variable expression of sickle cell disease is genetically determined. Semin Hematol 1990; 27 :360-76.

144 Jenkins ME, Scott RB, Bairs RL. Studies in sickle cell anaemia. J Pediatr 1960; 56:30-9.

145 Leikin SL, Gallagher D, Kinney TR et al. Mortality in

children and adolescents with sickle cell disease.
Pediatrics 1989; 84:500-8.

146 Clinicopathologic Conference. Sudden death in a young woman with sickle cell anaemia. Am J Med 1992; 92:556-60.

147 Cutz E. Idiopathic pulmonary hemosiderosis and related disorders in infancy and childhood. In Rosenberg HS, Bernstein J (eds) Respiratory and Alimentary Tract Diseases. Basel: Boehm-Hutter Press, 1987, pp. 47-81.

148 Stocker JT. The respiratory tract. In Stocker JT, Dehner LP (eds) Pediatric Pathology Vol. 1. Philadelphia: Lippincott Company, 1992; 505-73.

149 Schwartz MZ, Filler RM. Tracheal compression as a cause of apnea following repair of tracheo-oesophageal fistula: treatment by aortopexy. J Pediatr Surg 1980; 15:842-8.

150 Trollfors B, Nylén O, Strangert K. Acute epiglottitis in children and adults in Sweden 1981-3. Arch Dis Child 1990; 65:491-4.

151 Claesson B, Trollfors B, Ekström-Jodal B et al. Incidence and prognosis of acute epiglottitis in children in a Swedish Child 1991; 66:1227-30. 153 Barrat GE, Koopmann CF Jr, Coulthard SW. Retropharyngeal abscess - a ten-year experience. Laryngoscope 1984; 94:455-63. 154 Brook I. Microbiology of retropharyngeal abscesses in children. Am J Dis Child 1987; 141:202-4. 155 Donnelly BW, McMillan JA, Weiner LB. Bacterial tracheitis: Report of eight new cases and review. Rev Infect Dis 1990; 12:729-35. 156 Britto J, Habibi P, Walters S et al. Systemic complications associated with bacterial tracheitis. Arch Dis Child 1996; 74:249-50. 157 McKenzie M, Norman MG, Anderson JD, Thiessen PN. Upper respiratory tract infection in a 3 year old girl. J Pediatr 1984; 105:129-33. 158 Cant AJ, Gibson PJ, West RJ. Bacterial tracheitis in Down's syndrome. Arch Dis Child 1987; 62:962-3. 159 Panitch HB, Callahan CW, Schidlow DV. Bronchiolitis in children. Clin Chest Med 1993 14:715-31. 160 Price JF. Acute and long-term effects of viral bronchiolitis in infancy; Lung 1990; 168(Suppl.):414-21. 161 Meert K, Heidemann S, Abella B, Sarnaik A. Does prematurity alter the course of respiratory syncytial virus infection? Crit Care Med 1990; 18:1357-9. 162 MacDonald NE, Breese Hall C, Suffin SC et al. Respiratory syncytial viral infection in infants with congenital heart disease. N Engl J Med 1982; 307:307-400. 163 Groothuis JR, Gutierrez KM, Lauer BA. Respiratory syncytial virus infection in children with bronchopulmonary

dysplasia. *Pediatrics* 1988; 82:199-203. 164 Hall CB, Powell KR, MacDonald NE et al. Respiratory syncytial viral infection in children with compromised immune function. *N Engl J Med* 1986; 315:77-81. 165 Hastleton PA, Ironside JW, Whittaker JS et al. Pulmonary veno-occlusive disease. A report of four cases. *Histopathology* 1986; 10:933-44. 166 Cagle P, Langston C. Pulmonary veno-occlusive disease as a cause of sudden infant death. *Arch Pathol Lab Med* 1984; 108:338-40. 167 Jay GW, Leestma JE. Sudden death and epilepsy. *Acta Neurologica Scandinavica* 1981; 63(Suppl. 82):11-16. 168 McGugan EA. Sudden unexpected deaths in epileptics - a literature review. *Scot Med J* 1999; 44:137-9. 169 Shields WD. Status epilepticus. *Pediatr Clin North Am* 1989; 36:383-93. 170 Leestma JE. Forensic aspects of complex neural dysfunctions. In Leestma JE (ed.) *Forensic Neuropathology*. New York: Raven Press, 1988, pp. 396-428. 171 Coyle HP, Baker-Brian N, Brown SW. Coroners' autopsy reporting of sudden unexplained death in epilepsy (SUDEP) in the UK. *Seizure* 1994; 3:247-54. 172 Nashef L, Walker F, Allen P et al. Apnoea and bradycardia during epileptic seizures: relation to sudden death in epilepsy. *J Neurol Neurosurg Psychiatry* 1996; 60:297-300. 173 Lip GYH, Brodie MJ. Sudden death in epilepsy: an avoidable outcome? *J Royal Soc Med* 1992; 85:609-11. 174 Brown SW, Mawer GE, Lawler W et al. Sudden death and epilepsy (Letter). *Lancet* 1990; 335:606-7. 175 Timmings PL. Sudden unexpected death in epilepsy: is carbamazepine implicated? *Seizure* 1998; 7:289-91. 176 Garson A Jr. Medicolegal problems in the management of cardiac arrhythmias in children. *Pediatrics* 1987; 79(1):84-8. 177 Brown DC, Godman MJ. Life-threatening 'epilepsy'. *Arch Dis Forensic Sci Int* 1994; 66:117-27.

179 Zach MS, Karner U. Sudden death in asthma. *Arch Dis Child* 1989; 64:1446-51.

180 Carswell F. Thirty deaths from asthma. *Arch Dis Child* 1985; 60:25-8.

181 Kravis LP, Kolski GB. Unexpected death in childhood asthma. *Am J Dis Child* 1985; 139:558-63.

182 Benatar SR. Fatal asthma. *N Engl J Med* 1986; 314:423-9.

183 Larsen GL. Asthma in children. *N Engl J Med* 1992; 326:1540-5.

184 Molfino NA, Nannini LJ, Martelli AN, Slutsky AS. Respiratory arrest in near-fatal asthma. *N Engl J Med* 1991; 324:285-8.

185 Haalboom JRE, Deenstra M, Struyvenberg A. Hypokalaemia induced by inhalation of fenoterol. *Lancet* 18 May 1985; 2:1125-7.

186 Pearce N, Crane J, Burgess C et al. Beta agonists and asthma mortality: déjà vu. *Clin Exp Allergy* 1991; 21:401-10.

187 Warner DP, McKinney PA, Law GR, Bodansky HJ. Mortality and diabetes from a population-based register in Yorkshire 1978-93. *Arch Dis Child* 1998; 78:435-8.

188 Dahlquist G, Kallen B. Mortality in childhood-onset type 1 diabetes: a population-based study. *Diabetes Care* 2005; 28:2381-7.

189 Edge JA, Ford-Adams ME, Dunger DB. Causes of death in children with insulin-dependent diabetes 1990-96. *Arch Dis Child* 1999; 81:318-23.

190 DiMaio VJM, Sturmer WQ, Coe JI. Sudden and unexpected deaths after the acute onset of diabetes mellitus. *J Forensic Sci* 1977; 22:147-51.

191 Rosenbloom AL, Kohrman A, Sperling M. Classification and diagnosis of diabetes mellitus in children and adolescents. *Journal of Pediatrics* 1981; 99:320-3.

192 Coe JI. Post-mortem biochemistry of blood and vitreous humour in paediatric practice. In Mason JK (ed.) *Paediatric Forensic Medicine and Pathology*. London: Cambridge University Press, 1989, pp. 191-203.

193 Olpin SE. The metabolic investigation of sudden infant death. *Annals of Clinical Biochemistry* 2004; 41: 282-93.

194 John WG, Scott KWM, Hawcroft DM. Glycated haemoglobin and glycated protein and glucose concentrations in necropsy blood samples. *J Clin Pathol* 1988; 41:415-18.

195 Rozin L, Perper JA, Jaffe R, Drash A. Sudden unexpected death in childhood due to unsuspected diabetes mellitus. *Am J Forensic Med Pathol* 1994; 15:251-6.

196 Tattersall RB, Gill GV. Unexplained deaths of type 1 diabetic patients. *Diabetic Medicine* 1991; 8:49-58.

197 Thordarson H, Sovik O. Dead in bed syndrome in young diabetic patients in Norway. *Diabetic Medicine* 1995;

- 198 Matyka K, Ford-Adams M, Dunger DB. Hypoglycaemia and counterregulation during childhood. *Horm Res* 2002; 57(Suppl. 1):85-90.
- 199 Emery JL, Howat AJ, Variend S, Vawter GF. Investigation of inborn errors of metabolism in unexpected infant deaths. *Lancet* 1988; ii:29-31.
- 200 Pollitt RJ. Disorders of mitochondrial long-chain fatty acid oxidation. *J Inherited Metab Dis* 1995; 18:473-90.
- 201 Pollitt RJ. Inherited disorders of straight chain fatty acid oxidation. *Arch Dis Child* 1987; 62:6-7.
- 202 Anon. Sudden infant death and inherited disorders of fat oxidation. *Lancet* 8 November 1986; ii:1073-5.
- 203 Bennett MJ, Hale DE, Coates PM, Stanley CA. Postmortem recognition of fatty acid oxidation disorders. *Pediatr Pathol Mitochondrial very long chain acyl-CoA dehydrogenase deficiency - a new disorder of fatty acid oxidation. Arch Dis Child* 1995; 73:F103-5. 205 Olpin SE, Allen J, Bonham JR et al. Features of Carnitine Palmitoyltransferase Type I Disease. *J Inherit Metab Dis* 2001; 24:35-42. 206 Chace DH, DiPerna JC, Mitchell BL et al. Electrospray tandem mass spectrometry for analysis of acylcarnitines in dried postmortem blood specimens collected at autopsy from infants with unexplained cause of death. *Clin Chem* 2001; 47:1166-82. 207 Touma EH, Charpentier C. Medium chain acyl-CoA dehydrogenase deficiency. *Arch Dis Child* 1992; 67:142-5. 208 Roe CR, Millington DS, Maltby DA, Kinnebrew P. Recognition of medium-chain acyl-CoA dehydrogenase deficiency in asymptomatic siblings of children dying of sudden infant death or Reye-like syndromes. *J Pediatr* 1986; 108:13-18. 209 Anon. Medium chain acyl CoA dehydrogenase deficiency. *Lancet* 1991; 338:544-5. 210 Shortland G, Besley G, Bonham J et al. Newborn screening for medium chain acyl CoA dehydrogenase deficiency (MCADD): Findings from a multicentre prospective UK collaborative study. *J Inherit Metab Dis* 2006; 29(Suppl. 1):19. 211 Losty HC, Lee P, Alfaham M et al. Fatty infiltration in the liver in medium chain acyl CoA dehydrogenase deficiency. *Arch Dis Child* 1991; 66:727-8. 212 Bove KE. Letter to the Editor. *Pediatr Pathol* 1992; 12:621-5. 213 Guenthard J, Wyler F, Fowler B, Baumgartner R. Cardiomyopathy in respiratory chain disorders. *Arch Dis Child* 1995; 72:223-6. 214 Smeitink JAM, Fischer JC, Ruitenbeek W et al. Sudden infant death associated with defective oxidative phosphorylation. *Lancet*

1993; 341:1601. 215 Konstantopoulou V, Sperl W, Wohlgenannt J et al. Near missed sudden unexpected infant death (SUID) as the first sign of a respiratory chain complex I deficiency. *J Inherit Metab Dis* 2001; 24(Suppl. 1):78. 216 Tripp ME, Katcher ML, Peters HA et al. Systemic carnitine deficiency presenting as familial endocardial fibroelastosis. *N Engl J Med* 1981; 305:385-90. 217 Steihm ER, Damrosch DS. Factors in the prognosis of meningococcal infection. *J Pediatr* 1966; 68:457-67. 218 Marzouk O, Thomson APJ, Sills JA et al. Features and outcome in meningococcal disease presenting with maculopapular rash. *Arch Dis Child* 1991; 66:485-7. 219 Morley SL, Levin M. Bacterial meningitis. *Prescr J* 1998; 38:129-41. 220 Sharief N, Khan K, Conlan P. Overwhelming sepsis presenting as sudden unexpected death. *Arch Dis Child* 1993; 69:381-3. 221 Dyke MP, Martin RP, Berry PJ. Septicaemia and adrenal haemorrhage in congenital asplenia. *Arch Dis Child* 1991; 66:636-7. 222 Larkin SM, Williams DN, Osterholm MT et al. Toxic shock syndrome: clinical, laboratory, and pathologic findings in nine fatal cases. *Annals of Internal Medicine* 1982; 96:858-64. 223 Cone LA, Woodard DR, Schlievert PM, Tomory GS. Clinical and bacteriologic observations of a toxic shock-like syndrome due to *Streptococcus pyogenes*. *N Engl J Med* 1987; 317:146-9. 224 Stevens DL, Tanner MH, Winship J et al. Severe group A streptococcal infections associated with a toxic shock-like syndrome and scarlet fever toxin A. *N Engl J Med* 1989; 321:1-7. 225 Stamenkovic I, Lew PD. Early recognition of potentially fatal fasciitis due to group A streptococci in western Norway: incidence and clinical features. *Lancet* 1994; 344:1111-15.

227 Tyrrell GJ, Lovgren M, Kress B, Grimsrud K. Varicella-associated invasive group A streptococcal disease in Alberta, Canada - 2000-2002. *Clin Infect Dis* 2005; 40:1055-7.

228 Vugia DJ, Peterson CL, Meyers HB et al. Invasive group A streptococcal infections in children with varicella in Southern California. *Pediatr Infect Dis J* 1995; 15:146-50.

229 Sawin RS, Schaller RT, Tapper D et al. Early recognition of neonatal abdominal wall necrotizing fasciitis. *Am J Surg* 1994; 167:481-4.

230 Stocker JT. Pathologic features of long-standing 'healed' bronchopulmonary dysplasia. *Hum Pathol* 1986; 17:943-61.

231 Miller RW, Woo P, Kellman RK. Tracheobronchial abnormalities in infants with bronchopulmonary dysplasia.

J Paediatr 1987; 111:779-82.

232 Greenholz SK, Hall RJ, Lilly JR, Shikes RH. Surgical implications of bronchopulmonary dysplasia. J Pediatr Surg 1987; 22:1132-6.

233 Doull IJ, Mok Q, Tasker RC. Tracheobronchomalacia in preterm infants with chronic lung disease. Arch Dis Child 1997; 76:F203-5.

234 Tammela OKT, Koivisto ME. A 1-year follow-up of low birth weight infants with and without bronchopulmonary dysplasia: health, growth, clinical lung disease, cardiovascular and neurological sequelae. Early Hum Dev 1992; 30:109-20. of congenital myotonic dystrophy: mortality and long term clinical aspects. Arch Dis Child 1993; 68:177-81. 236 Thomas PK, Calne DB, Elliott CF. X-linked scapulothoracic syndrome. J Neurol Neurosurg Psychiatry 1972; 35:208-15. 237 Primhak RA, Spicer RD, Variend S. Sudden death after minor abdominal trauma: an unusual presentation of pheochromocytoma. Br Med J 1986; 292:95-6. 238 O'Neill D, O'Grady J, Variend S. Child fatality associated with pathological features of histiocytic necrotizing lymphadenitis (Kikuchi-Fujimoto Disease). Pediatr Pathol Lab Med 1998; 18:79-88. 239 Morens DM, Hammar SL, Heicher DA. Idiopathic acute pancreatitis in Children. Am J Dis Child 1974; 128:401-4. 240 Wilcken B, Hammond J, Silink M. Morbidity and mortality in medium chain acyl coenzyme A dehydrogenase deficiency. Arch Dis Child 1994; 70:410-12. 241 Traisman ES, Young S, Lifschultz BD et al. Sudden death in a neonatal as a result of Herpes simplex infection. J Forensic Sci 1988; 33:267-71. 242 Mercuri E, Cowan F, Rutherford M et al. Ischaemic and haemorrhagic brain lesions in newborns with seizures and normal apgar scores. Arch Dis Child 1995; 73:F67-74. 243 Norman MG, Taylor GP, Clarke LA. Sudden, unexpected, natural death in childhood. Pediatr Pathol 1990; 10:769-84. 244 Variend S. Infant mortality, microglial nodules and parotid CMV-type inclusions. Early Hum Dev 1990; 21:31-40. 245 Variend S, O'Neill D, Arnold P. The possible significance of cytomegaloviral parotitis in infant and early childhood deaths. Arch Pathol Lab Med 1997; 121:1272-6.

13 Chapter 13. Recent Advances in Paediatric Toxicology

1 Goepp J. Pediatric poisonings. Clin Chem 1996; 42:1356-60.

2 Ellenhorn MJ, Barceloux DG. Medical toxicology. In Diagnosis and Treatment of Human Poisoning. New York: Elsevier, 1988.

3 Fine J, Goldfrank L. Update in medical toxicology. Pediatr Clin North Am 1992; 39:1031-51.

4 Burda A, Burda N. Controversies in toxicology. The nation's first poison control center taking a stand against accidental childhood poisoning in Chicago. Vet Hum Toxicol 1997; 39:115-19.

5 Hanzlick R. National association of medical examiner's Pediatric Toxicology (PedTox) registry. Toxicology 1996; 107:153-8.

6 Liebelt EL, Shannon MW. Small doses, big problems. A selected review of highly toxic common medications. Pediatr Emerg Care 1993; 9:292-7.

7 Berlin CM. Advances in pediatric pharmacology and toxicology. Adv Pediatr 1993; 40:545-74.

8 Berlin CM. Advances in pediatric pharmacology and toxicology. Adv Pediatr 1995; 42:593-629.

9 Berlin CM. Advances in pediatric pharmacology and toxicology. Adv Pediatr 1997; 44:545-74.

10 Criddle LM. An overview of pediatric poisonings. AACN Adv Crit Care 2007; 18:109-18.

11 Eldridge DL, Van Eyk J, Kornegay C. Pediatric toxicology. Emerg Med Clin North Am 2007; 25:283-308; abstract vii-viii.

12 Chasnoff IJ, Burns WJ, Schnoll SH, Burns KA. Cocaine use in pregnancy. N Engl J Med 1985; 313:666-9.

13 Rubin JD, Ferencz C, Loffredo C. Use of prescription and non-prescription drugs in pregnancy. J Clin Epidemiol 1993; 46:581-9.

14 Chasnoff IJ, Lewis DE, Griffith DR, Willey SD. Cocaine and pregnancy. Clinical and toxicological implications for

the bingeing. Effect on pregnancy. *Am J Obstet Gynecol* 1994; 171:372-9. 16 Das G. Cocaine abuse and reproduction. *Int J Clin Pharmacol Ther* 1994; 32:7-11. 17 Sweet AY. Narcotic withdrawal syndrome in the newborn. *Pediatr Rev* 1982; 3; 285-91. 18 Bergman A, Weisner L. Relation of passive cigarette smoking to sudden infant death syndrome. *J Pediatr* 1976; 58:665-8. 19 Ward SLD, Bautista D, Chan L, et al. Sudden infant death syndrome in infants of substance-abusing mothers. *J Pediatr* 1990; 117:876-81. 20 Meyer MB, Jonas BS, Tomascia JA. Perinatal events associated with maternal smoking during pregnancy. *Am J Epidemiol* 1976; 103:464-9. 21 Bar-Oz B, Bulkowstein M, Benyamini L, et al. Use of antibiotic and analgesic drugs during lactation. *Drug Saf* 2003; 26:925-35. 22 Koren G, Cairns J, Chitayat D, et al. Pharmacogenetics of morphine poisoning in a breastfed neonate of a codeineprescribed mother. *Lancet* 2006; 368:704. 23 Johnson TN. The development of drug metabolizing enzymes and their influence on the susceptibility to adverse drug reactions in children. *Toxicology* 2003; 192:37-48. 24 Ito S. Drug therapy for breast-feeding women. *N Engl J Med* 2000; 343:118-26. 25 Lopez-Munoz F, Alamo C, Quintero-Gutierrez FJ, GarciaGarcia P. A bibliometric study of international scientific productivity in attention-deficit hyperactivity disorder covering the period 1980-2005. *Eur Child Adolesc Psychiatry*, 2008 [epub ahead of print]. 26 Klein-Schwartz W. Abuse and toxicity of methylphenidate. *Curr Opin Pediatr* 2002; 14:219-23. 27 Bailey B, Letarte A, Abran MC. Methylphenidate unintentional ingestion in preschool children. *Ther Drug Monit* 2005; 27:284-6. 28 Korkia P, Stimson GV. Anabolic steroid use. *Lancet* 1993; 341:1407. 29 DuRant RH, Escobedo LG, Heath GW. Anabolic steroid use, strength training and multiple drug use among adolescents in the United States. *Pediatrics* 1995; 96:23-8. 30 Yesalis C, Kennedy N, Kopstein A. Anabolic-androgenic steroid use in the United States. *JAMA* 1993; 270:1217-21. 31 Madea B, Grellner W, Musshoff F, Dettmeyer R. Medico-legal aspects of doping. *J Clin Forensic Med* 1998; 5:1-7. 32 Buckley WE, Yesalis CE, Friedl KE, et al. Estimated prevalence of anabolic steroid use among male high school seniors. *JAMA* 1988; 260:3441-5. 33 Terney R, McLain LG. The use of anabolic steroids in high school students. *Am J Dis Child* 1990; 144:99-103. 34 Hoffman RJ, Nelson L. Rational use of toxicology testing in children. *Curr Opin Pediatr* 2001; 13:183-8. 35 Madden MA. Pediatric poisonings: recognition, assessment, and management. *Crit Care Nurs Clin North Am* 2005; 17:395-404, xi. 36 Belson MG, Simon HK, Sullivan K, Geller RJ. The utility of toxicologic analysis in children with suspected ingestions. *Pediatr Emerg Care* 1999; 15:383-7. 37 Kind T. Carbon monoxide. *Pediatr Rev* 2005;

26:150-1. 38 White ML, Liebelt EL. Update on antidotes for pediatric poisoning. *Pediatr Emerg Care* 2006; 22:740-6; quiz 7-9. 39 Heimann G. Enteral absorption and bioavailability in children in relation to age. *Eur J Clin Pharmacol* 1980; 18:43-50. 40 Richardson T. Pitfalls in forensic toxicology. *Ann Clin in man. Eur J Clin Pharmacol* 1980; 18:9-15.

42 Hines RN. The ontogeny of drug metabolism enzymes and implications for adverse drug events. *Pharmacol Ther* 2008; 118:250-67.

43 Soldin SJ, Steele BW. Mini-review: therapeutic drug monitoring in pediatrics. *Clin Biochem* 2000; 33:333-5.

44 Soldin OP, Soldin SJ. Review: therapeutic drug monitoring in pediatrics. *Ther Drug Monit* 2002; 24:1-8.

45 Alcorn J, McNamara PJ. Pharmacokinetics in the newborn. *Adv Drug Deliv Rev* 2003; 55:667-86.

46 Allegaert K, Verbesselt R, Naulaers G, et al. Developmental pharmacology: neonates are not just small adults. *Acta Clin Belg* 2008; 63:16-24.

47 Ward RM, Benitz WE, Benjamin DK, Jr., et al. Criteria supporting the study of drugs in the newborn. *Clin Ther* 2006; 28:1385-98.

48 Johnson TN, Rostami-Hodjegan A, Goddard JM, et al. Contribution of midazolam and its 1-hydroxy metabolite to preoperative sedation in children: a pharmacokinetic/pharmacodynamic analysis. *Br J Anaesth* 2002; 89:428-37.

49 Cuzzolin L, Atzei A, Fanos V. Off-label and unlicensed prescribing for newborns and children in different settings: a review of the literature and a consideration about drug safety. *Expert Opin Drug Safety* 2006; 5:703-18.

50 Shamoo AE, Tauer CA. Ethically questionable research with children: the fenfluramine study. *Account Res* 2002; 9:143-66.

51 Sharav VH. Children in clinical research: a conflict of moral values. *Am J Bioeth* 2003; 3:W12-W59.

52 Woolf AD, Shannon MW. Clinical toxicology for the pediatrician. *Pediatr Clin North Am* 1995; 42:317-33.

- 53 George S. Position of immunological techniques in screening in clinical toxicology. Clin Chem Lab Med 2004; 42:1288-309.
- 54 Miyaishi S. Immunoassays: theory and instrumentation, techniques, applications. In Townshend A (ed.) Encyclopedia Analytical Sciences. Volume 5. London: Academic Press, 1995, pp. 2049-108.
- 55 Montagne M, Pugh CB, Fink. JL. Testing for drug use, part 1: analytical methods. Am J Hosp Pharm 1988; 45:1297-305.
- 56 Baselt RC. Urine drug screening by immunoassay: interpretation of results. In Baselt RC (ed.) Advances in Analytical Toxicology. Foster City, CA: Biomedical Publications, 1984, pp. 81-123.
- 57 Kolbrich EA, Kim I, Barnes AJ, et al. Cozart RapiScan Oral Fluid Drug Testing System: an evaluation of sensitivity, specificity, and efficiency for cocaine detection compared with ELISA and GC-MS following controlled cocaine administration. J Anal Toxicol 2003; 27:407-11.
- 58 Gjerde H, Christophersen AS, Skuterud B, et al. Screening for drugs in forensic blood samples using EMIT urine assays. Forensic Sci Int 1990; 44:179-185.
- 59 Pichon V. Selective sample treatment using molecularly imprinted polymers. J Chromatogr A 2007; 1152:41-53.
- 60 Souverain S, Rudaz S, Veuthey JL. Restricted access materials and large particle supports for on-line sample preparation: an attractive approach for biological fluids analysis. J Chromatogr B Anal Technol Biomed Life Sci 2004; 801:141-56.
- 61 Wille SM, Lambert WE. Recent developments in extraction procedures relevant to analytical toxicology. Anal Bioanal Chem 2007; 388:1381-91.
- 62 Chen Y, Guo Z, Wang X, Qiu C. Sample preparation. J Chromatogr A 2008; 1184:191-219.
- 63 Herzler M, Herre S, Pragst F. Selectivity of substance 2003; 27:233-42. 64 Pragst F, Herzler M, Erxleben BT. Systematic toxicological analysis by high-performance liquid chromatography with diode array detection (HPLC-DAD). Clin Chem Lab Med 2004; 42:1325-40. 65 Grobosch

T, Lemm-Ahlers U. Immunoassay screening of lysergic acid diethylamide (LSD) and its confirmation by HPLC and fluorescence detection following LSD ImmunElute extraction. *J Anal Toxicol* 2002; 26:181-6. 66 Moore CM. Drug testing in the 90s. In Leikin SB, Paloucek FP (eds) *Poisoning and Toxicology Handbook*, 2nd edn. Chicago, IL:Lexi-Comp Inc; Hudson (Cleveland) and American Pharmaceutical Association, 1996, pp. 1162-75. 67 Giroud C, Michaud K, Sporkert F, et al. A fatal overdose of cocaine associated with coingestion of marijuana, buprenorphine, and fluoxetine. Body fluid and tissue distribution of cocaine and its metabolites determined by hydrophilic interaction chromatography-mass spectrometry (HILIC-MS). *J Anal Toxicol* 2004; 28:464-74. 68 Dienes-Nagy A, Rivier L, Giroud C, et al. Method for quantification of morphine and its 3- and 6- glucuronides, codeine, codeine glucuronide and 6-monoacetylmorphine in human blood by liquid chromatography-electrospray mass spectrometry for routine analysis in forensic toxicology. *J Chromatogr A* 1999; 854:109-18. 69 Swartz ME. UPLC: An introduction and review. *Journal of Liquid Chromatography & Related Technologies* 2005; 28:1253-63. 70 Churchwell MI, Twaddle NC, Meeker LR, Doerge DR. Improving LC-MS sensitivity through increases in chromatographic performance: comparisons of UPLCES/MS/MS to HPLC-ES/MS/MS. *J Chromatogr B Anal Technol Biomed Life Sci* 2005; 825:134-43. 71 Bugey A, Staub C. Application of monolithic supports to online extraction and LC-MS analysis of benzodiazepines in whole blood samples. *J Sep Sci* 2007; 30:2967-78. 72 Segura J, Ventura R, Jurado C. Derivatization procedures for gas chromatographic-mass spectrometric determination of xenobiotics in biological samples, with special attention to drugs of abuse and doping agents. *J Chromatogr B BioMed Sci Applications* 1998; 713:61-90. 73 Gunnar T, Ariniemi K, Lillsunde P. Validated toxicological determination of 30 drugs of abuse as optimized derivatives in oral fluid by long column fast gas chromatography/ electron impact mass spectrometry. *J Mass Spectrom* 2005; 40:739-53. 74 Gunnar T, Ariniemi K, Lillsunde P. Fast gas chromatography-negative-ion chemical ionization mass spectrometry with microscale volume sample preparation for the determination of benzodiazepines and alpha-hydroxy metabolites, zaleplon and zopiclone in whole blood. *J Mass Spectrom* 2006; 41:741-54. 75 Thomas A, Widmer C, Hopfgartner G, Staub C. Fast gas chromatography and negative-ion chemical ionization tandem mass spectrometry for forensic analysis of cannabinoids in whole blood. *J Pharm Biomed Anal* 2007; 45:495-503. 76 Thormann W, Thormann W. Progress of capillary electrophoresis in therapeutic drug monitoring and clinical and forensic toxicology. *Ther Drug Monit* 2002; 24:222-31. 77 Thormann W,

Zhang C, Schmutz A. Capillary electrophoresis for drug analysis in body fluids. *Ther Drug Monit* 1996; 18:506-520.
78 Von Heeren F, Thormann W. Capillary electrophoresis in clinical and forensic analysis. *Electrophoresis* 1997; 18:2415-26.
79 Lloyd DK. Capillary electrophoresis analysis of biofluids with a focus on less commonly analyzed matrices. *J Chromatogr methods in forensic toxicology. J Anal Toxicol* 2007; 31:237-53, 8A-9A.

81 Maurer HH, Peters FT. Toward high-throughput drug screening using mass spectrometry. *Ther Drug Monit* 2005; 27:686-8.

82 Maurer HH. Hyphenated mass spectrometric techniques - indispensable tools in clinical and forensic toxicology and in doping control. *J Mass Spectrom* 2006; 41:1399-413.

83 Pavlic M, Libiseller K, Oberacher H. Combined use of ESI-QqTOF-MS and ESI-QqTOF-MS/MS with mass-spectral library search for qualitative analysis of drugs. *Anal Bioanal Chem* 2006; 386:69-82.

84 Ojanpera S, Pelander A, Pelzing M, et al. Isotopic pattern and accurate mass determination in urine drug screening by liquid chromatography/time-of-flight mass spectrometry. *Rapid Commun Mass Spectrom* 2006; 20:1161-7.

85 Hartmann C, Smeyers-Verbeke J, Massart DL, McDowall RD. Validation of bioanalytical chromatographic methods. *J Pharm Biomed Anal* 1998; 17:193-218.

86 Peters FT, Drummer OH, Musshoff F. Validation of new methods. *Forensic Sci Int* 2007; 165:216-24.

87 Pichini S, Ventura M, Pujadas M, et al. HAIRVEQ: an external quality control scheme for drugs of abuse analysis in hair. *Forensic Sci Int* 2004; 145:109-15.

88 Wille SM, Lambert WE. Volatile substance abuse - postmortem diagnosis. *Forensic Sci Int* 2004; 142:135-56.

89 Gallardo E, Queiroz JA. The role of alternative specimens in toxicological analysis. *Biomed Chromatogr* 2008; 22: 795-821.

90 Warner A. Interference of common household chemicals in immunoassay methods for drugs of abuse. *Clin Chem* 1989; 35:648-51.

91 Jaffee WB, Trucco E, Levy S, Weiss RD. Is this urine

really negative? A systematic review of tampering methods in urine drug screening and testing. *J Subst Abuse Treat* 2007; 33:33-42.

92 Fraser AD, Worth D. Urinary excretion profiles of 11-nor-9carboxy-delta9-tetrahydrocannabinol. Study III. A delta9THC-COOH to creatinine ratio study. *Forensic Sci Int* 2003; 137:196-202.

93 Gottshalk LA, Cravey RH. Toxicological and Pathological Studies on Psychoactive Drug-involved Deaths. Davis, CA: Biomedical Publications, 1980.

94 Druid H, Holmgren P. Compilations of therapeutic, toxic, and fatal concentrations of drugs. *J Toxicol Clin Toxicol* 1998; 36:133-4; author reply 5-6.

95 Schulz M, Schmoldt A. Therapeutic and toxic blood concentrations of more than 800 drugs and other xenobiotics. *Pharmazie* 2003; 58:447-74.

96 Blake MJ, Castro L, Leeder JS, Kearns GL. Ontogeny of drug metabolizing enzymes in the neonate. *Semin Fetal Neonatal Med* 2005; 10:123-38.

97 Blake MJ, Gaedigk A, Pearce RE, et al. Ontogeny of dextromethorphan O- and N-demethylation in the first year of life. *Clin Pharmacol Ther* 2007; 81:510-6.

98 Johnson TN. Modelling approaches to dose estimation in children. *Br J Clin Pharmacol* 2005; 59:663-9.

99 Johnson TN. The problems in scaling adult drug doses to children. *Arch Dis Child* 2008; 93:207-11.

100 Walson PD. Therapeutic drug monitoring in special populations. *Clin Chem* 1998; 44:415-9.

101 Moeller ME, Fey P, Sachs H. Hair analysis as evidence in forensic cases. *Forensic Sci Int* 1993; 63:43-53.

102 Kintz P, Tracqui A, Mangin P. Detection of drugs in human hair for clinical and forensic applications. *Int J Legal Med* (ed.) *Drug Testing in Hair*. Boca Raton, FL: CRC Press. 1996; 211-222. 104 Kintz P, Villain M, Cirimele V. Determination of trimeprazine-facilitated sedation in children by hair analysis. *J Anal Toxicol* 2006; 30:400-2. 105 Springfield AC, Cartmell LW, Aufderheide AC, et al. Cocaine and metabolites in the hair of ancient coca leaf chewers. *Forensic Sci Int* 1993; 63:269-275. 106 Nakahara Y,

Kikura R. Hair analysis for drugs of abuse. VII. The incorporation rates of cocaine, benzoylecgonine and ecgonine methyl ester into rat hair and hydrolysis of cocaine in rat hair. *Archives Toxicol* 1994; 68:54-59. 107

Rollins DE, Wilkins DG, Gygi SP, et al. Testing for drugs of abuse in hair. Experimental observations and indications for future research. *Forensic Sci Rev* 1997; 9:23-36. 108

Pragst F, Balikova MA. State of the art in hair analysis for detection of drug and alcohol abuse. *Clin Chim Acta* 2006; 370:17-49. 109

Gygi SP, Joseph RE, Cone EJ, et al. Incorporation of codeine and metabolites into hair: role of pigmentation. *Drug Metab Dispos* 1996; 24:495-501. 110

Wilkins DG, Haughey HM, Krueger GG, Rollins DE. Disposition of codeine in female human hair after multiple dose administration. *J Anal Toxicol* 1995; 19:492-8. 111

Mieczkowski T. Assessing the potential of a 'color effect' for hair analysis of 11-nor-9-carboxy-delta(9)-tetrahydrocannabinol: analysis of a large sample of hair specimens. *Life Sci* 2003; 74:463-9. 112

Mieczkowski T, Kruger M. Interpreting the color effect of melanin on cocaine and benzoylecgonine assays for hair analysis: brown and black samples compared. *J Forensic Leg Med* 2007; 14:7-15. 113

Cone EJ, Joseph RE. The potential for bias in hair testing for drugs of abuse. In Kintz P (ed.) *Drug Testing in Hair*. Boca Raton, FL: CRC Press, 1996, pp. 69-93. 114

Goldberger BA, Caplan YH, Maguire T, Cone EJ. Testing human hair for drugs of abuse. IV. Identification of heroin and 6-monoacetylmorphine as indicators of heroine use. *J Anal Toxicol* 1991; 15:226-31. 115

Harkey MR, Henderson GL, Zhou C. Simultaneous quantitation of cocaine and its major metabolites in human hair by gas chromatography/chemical ionization mass spectrometry. *J Anal Toxicol* 1991; 15:260-65. 116

Kintz P, Cirimele V, Mangin P. Testing human hair for cannabis. II. Identification of THC-COOH by GC-MS-NCI as a unique proof. *J Forensic Sci* 1995; 40:619-22. 117

Henderson GL. Mechanisms of drug incorporation into hair. *Forensic Sci Int* 1993; 63:19-29. 118

Henderson GL, Harkey MR, Zhou C, et al. Incorporation of isotopically-labeled cocaine and metabolites into human hair. 1. Dose-response relationships. *J Analytical Toxicol* 1996; 20:1-12. 119

Nakahara Y, Kikura R, Takahashi F. Hair analysis for drugs of abuse. X. Effect of physicochemical properties on incorporation rates into hair. *Biol Pharm Bull* 1995; 18:1223-7. 120

Nakahara Y, Kikura R. Hair analysis for drugs of abuse. XIII. Effect of structural factors on incorporation of drugs into hair: the incorporation rates of amphetamine analogs. *Arch Toxicol* 1996; 70:841-9. 121

Blank DL, Kidwell DA. External contamination of hair by cocaine: an issue in forensic interpretation. *Forensic Sci*

- Int 1993; 63:145-56. 122 Cirimele V, Kintz P, Mangin. P. Drug concentrations in human hair after bleaching. J Anal Toxicol 1995; 19:331-2. 123 Joseph R, Su TP, Cone EJ. In vitro binding studies of drugs 20:338-44.
- 124 Höld KM, Wilkins DG, Crouch DJ, et al. Detection of stanozolol in hair by negative ion chemical ionization mass spectrometry. J Anal Toxicol 1996; 20:345-49.
- 125 Chiarotti M, Strano-Rossi S. Preparation of hair samples for drug analysis. Forensic Sci Rev 1996; 8:111-28.
- 126 Irving RC, Dickson SJ. The detection of sedatives in hair and nail samples using tandem LC-MS-MS. Forensic Sci Int 2007; 166:58-67.
- 127 Mangin P, Kintz P. Variability of opiates concentrations in human hair according to their anatomical origin: head, axillary and pubic regions. Forensic Sci Int 1993; 63:77-83.
- 128 Offidani C, Strano-Rossi S, Chiarotti M. Drug distribution in the head, axillary and pubic hair of chronic addicts. Forensic Sci Int 1993; 63:1105-8.
- 129 Mangin P. Drug analysis in nonhead hair. In Kintz P (ed.) Drug testing in hair. Boca Raton, FL: CRC Press, 1996, pp. 279-87.
- 130 Moeller MR, Eser HP. The analytical tools for hair testing. In Kintz P (ed.) Drug testing in hair. Boca Raton, FL: CRC Press, 1996, pp. 95-120.
- 131 Hegstad S, Khiabani HZ, Kristoffersen L, et al. Drug screening of hair by liquid chromatography-tandem mass spectrometry. J Anal Toxicol 2008; 32:364-72.
- 132 Tracqui A. Unusual drugs in hair. In Kintz P (ed.) Drug Testing in Hair. Boca Raton, FL: CRC Press, 1996, pp. 191-210.
- 133 Idowu OR, Caddy B. A review of the use of saliva in the forensic detection of drugs and other chemicals. J Forensic Soc 1982; 22:123-235.
- 134 Caddy B. Saliva as a specimen for drug analysis. In Baselt RC (ed.) Adv in Analytical Toxicology. Vol 1. Foster City, CA: Biomedical Publications, 1984, pp. 198-254.
- 135 Schramm W, Smith RH, Craig PA, Kidwell DA. Drugs of

abuse in saliva: a review. *J Anal Toxicol* 1992; 16:1-9.

136 Dyer KR, Wilkinson C. The detection of illicit drugs in oral fluid: another potential strategy to reduce illicit drug-related harm. *Drug Alcohol Rev* 2008; 27:99-107.

137 Dams R, Choo RE, Lambert WE, et al. Oral fluid as an alternative matrix to monitor opiate and cocaine use in substance-abuse treatment patients. *Drug Alcohol Depend* 2007; 87:258-67.

138 Samyn N, Laloup M, De Boeck G. Bioanalytical procedures for determination of drugs of abuse in oral fluid. *Anal Bioanal Chem* 2007; 388:1437-53.

139 Cone EJ. Saliva testing for drugs of abuse. *Ann NY Acad Sci* 1993; 694:91-127.

140 Kintz P, Cirimele V, Ludes B. Codeine testing in sweat and saliva with the drugwipe. *Int J Legal Med* 1998; 111:82-4.

141 Dams R, Huestis MA, Lambert WE, et al. Matrix effect in bio-analysis of illicit drugs with LC-MS/MS: influence of ionization type, sample preparation, and biofluid. *J Am Soc Mass Spectrom* 2003; 14:1290-4.

142 Kintz P, Tracqui A, Jamey C, Mangin P. Detection of codeine and phenobarbital in sweat collected with a sweat patch. *J Anal Toxicol* 1996; 20:197-201.

143 Cone EJ, Hillsgrove MJ, Jenkins AJ, et al. Sweat testing for heroin, cocaine and metabolites. *J Anal Toxicol* 1994; 18:298-305.

144 Tracqui A, Kintz P, Ludes B, et al. The detection of opiate drugs in non traditional specimens (clothing): a report of ten cases. *J Forensic Sci* 1995; 40:263-5.

145 Dolan K, Rouen D, Kimber J. An overview of the use of urine, hair, sweat and saliva to detect drug use. *Drug Alcohol Rev* 2004; 23:213-7.

146 Fogerson R, Schoendorfer D, Fay J, Spiehler V. Qualitative an experiment with cocaine. *J Anal Toxicol* 1995; 19:41-8. 148 Kintz P, Brenneisen R, Bundeli P, Mangin P. Sweat testing for heroin and metabolites in a heroin maintenance program. *Clin Chem* 1997; 43:736-9. 149 Moriya F, Chan KM, Noguchi TT, Wu PYK. Testing for drugs of abuse in meconium of newborn infants. *J Anal Toxicol* 1994;

18:41-5. 150 Lewis DE, Moore CM, Leikin JB, Koller A. Meconium analysis for cocaine: a validation study and comparison with paired urine analysis. *J Anal Toxicol* 1995; 19:148-50. 151 Oyler J, Darwin WD, Preston KL, et al. Cocaine disposition in meconium from newborns of cocaine-abusing mothers and urine of adult drug users. *J Anal Toxicol* 1996; 20:453-62. 152 Moore C, Negrusz A, Lewis D. Determination of drugs of abuse in meconium. *J Chromatogr B Biomed Sci Appl* 1998; 713:137-46. 153 Gareri J, Klein J, Koren G. Drugs of abuse testing in meconium. *Clin Chim Acta* 2006; 366:101-11. 154 Koren G, Hutson J, Gareri J. Novel methods for the detection of drug and alcohol exposure during pregnancy: implications for maternal and child health. *Clin Pharmacol Ther* 2008; 38(4): 631-4. 155 Browne S, Moore C, Negrusz A, et al. Detection of cocaine, norcocaine and cocaethylene in the meconium of premature neonates. *J Forensic Sci* 1994; 39:1515-19. 156 Moore C, Lewis D, Becker J, Leikin J. The determination of 11-nor- Δ^9 -tetrahydrocannabinol-9-carboxylic acid (THCCOOH) in meconium. *J Anal Toxicol* 1996; 20:50-1. 157 Moore CM, Lewis DE, Leikin JB. The determination of phencyclidine in meconium using ion trap mass spectrometry. *J Forensic Sci* 1996; 41:1057-9. 158 Clark GD, Rosenzweig TB, Raisys VA, et al. The analysis of cocaine and benzoylecgonine in meconium. *J Anal Toxicol* 1992; 16:261-3. 159 Stolk LM, Coenradie SM, Smit BJ. Analysis of methadone and its primary metabolite in meconium. *J Anal Toxicol* 1997; 21:154-9. 160 Dempsey D, Moore C, Deitermann D, et al. The detection of cotinine in hydrolyzed meconium samples. *Forensic Sci Int* 1999; 102:167-71. 161 Le NL, Reiter A, Tomlinson K, et al. The detection of oxycodone in meconium specimens. *J Anal Toxicol* 2005; 29:54-7. 162 Williamson S, Jackson L, Skeoch C, et al. Determination of the prevalence of drug misuse by meconium analysis. *Arch Dis Child Fetal Neonatal Ed* 2006; 91:F291-2. 163 Xia Y, Wang P, Bartlett MG, et al. An LC-MS-MS method for the comprehensive analysis of cocaine and cocaine metabolites in meconium. *Anal Chem* 2000; 72:764-71. 164 Kelly T, Gray TR, Huestis MA. Development and validation of a liquid chromatography-atmospheric pressure chemical ionization-tandem mass spectrometry method for simultaneous analysis of 10 amphetamine-, methamphetamine- and 3,4-methylenedioxymethamphetamine-related (MDMA) analytes in human meconium. *J Chromatogr B Anal Technol Biomed Life Sci* 2008; 867:194-204. 165 Moore CM, Lewis D. Fatty acid ethyl esters in meconium: biomarkers for the detection of alcohol exposure in neonates. *Clin Chim Acta* 2001; 312:235-7. 166 Moore C, Jones J, Lewis D, Buchi K. Prevalence of fatty acid ethyl esters in meconium specimens. *Clin Chem* 2003; 49:133-6. 167 Ripple M,

Goldberger BA, Caplan YH, et al. Detection of cocaine and its metabolites in human amniotic fluid. *J Anal Toxicol* 1992; 16:328-31. *Forensic Sci Int* 1992; 56:177-81.

169 Winecker RE, Goldberger BA, Tebbett I, et al. Detection of cocaine and its metabolites in amniotic fluid and umbilical cord tissue. *J Anal Toxicol* 1997; 21:97-104.

170 Gray T, Huestis M. Bioanalytical procedures for monitoring in utero drug exposure. *Anal Bioanal Chem* 2007; 388:1455-65.

171 Kugelberg FC, Jones AW. Interpreting results of ethanol analysis in postmortem specimens: a review of the literature. *Forensic Sci Int* 2007; 165:10-29.

172 Musshoff F, Madea B. Analytical pitfalls in hair testing. *Anal Bioanal Chem* 2007; 388:1475-94.

173 Liu RH. Comparison of common immunoassay kits for effective application in workplace drug analysis. *Forensic Sci Rev* 1994; 6:20-57.

174 Green K, Isenschmid DS. Medical review officer interpretation of urine drug test results. *Forensic Sci Rev* 1995; 7:42-60.

175 Cone EJ, Johnson RE, Darwin WD, et al. Passive inhalation of marijuana smoke: urinalysis and room air levels of delta9-tetrahydrocannabinol. *J Anal Toxicol* 1987; 11:89-96.

176 Kidwell DA, Blank DL. Environmental exposure - the stumbling block of hair testing. In Kintz P (ed.) *Drug testing in hair*. Boca Raton, FL: CRC Press, 1996, pp. 17-68.

177 Haley NJ, Hoffmann D. Analysis for nicotine and cotinine in hair to determine cigarette smoker status. *Clin Chem* 1985; 31:1598-1600.

178 Kintz P, Ludes B, Mangin P. Evaluation of nicotine and cotinine in human hair. *J Forensic Sci* 1992; 37:72-6.

179 Smith FP, Kidwell DA. Cocaine in hair, saliva, skin swabs and urine of cocaine users' children. *Forensic Sci Int* 1996; 83:179-189.

180 Blank DL, Kidwell DA. Decontamination procedures for drugs of abuse in hair: are they sufficient? *Forensic Sci*

Int 1995; 70:13-38.

181 Davis KH, Hawks RL, Blanke RV. Assessment of laboratory quality in urine drug testing - a proficiency testing pilot study. JAMA 1988; 260:1749-54.

182 Kelly K. The accuracy and reliability of tests for drugs of abuse in urine samples. Pharmacotherapy 1988; 8:263-75.

183 Badia R, Segura J, Artola A, de la Torre R. Survey on drugsof-abuse testing in the European Union. J Anal Toxicol 1998; 22:117-26.

184 McRorie TI, Lynn AM, Nespeca MK, et al. The maturation of morphine clearance and metabolism. Am J Dis Child 1992; 146:972-6.

185 Furlanut M, Benetello P, Baraldo M, et al. Chlorpromazine disposition in relation to age in children. Clin Pharmacokinetics 1990; 18:329-31.

186 Mikkelsen SL, Ash KD. Adulterants causing false negatives in illicit drug testing. Clin Chem 1988; 34:2333-6.

187 Cody JJ, Schwarzhoff H. Impact of adulterants on RIA analysis of urine for drugs of abuse. J Anal Toxicol 1989; 13:277-284.

188 Schwarzhoff R, Cody JT. The effects of adulterating agents on FPIA analysis of urine for drugs of abuse. J Anal Toxicol 1993; 17:14-17.

189 Soper JW, Canfield V. Description of a screening assay system to detect adulteration of urine samples. J Anal Toxicol 1996; 20:77.

190 Goldberger BA, Caplan YH. Effect of glutaraldehyde (UrinAid) on detection of abused drugs in urine by immunoassay. Clin Chem 1994; 40:1605.

191 Cody JT, Valtier S. Effects of Stealth adulterant on immunoassay testing for drugs of abuse. J Anal Toxicol 2001; 25:466-70.

192 on-site adulterant detection devices for urine specimens. J Anal Toxicol 2002; 26:464-70. 194 Shepherd MF, Lake KD, Kamps MA. Postmortem changes and pharmacokinetics: review of the literature and case report.

Ann Pharmacother 1992; 26:510-14. 195 Hilberg T, Rogde S, Morland J. Postmortem drug redistribution - human cases related to results in experimental animals. J Forensic Sci 1999; 44:3-9. 196 Pelissier-Alicot AL, Gaulier JM, Champsaur P, Marquet P. Mechanisms underlying postmortem redistribution of drugs: a review. J Anal Toxicol 2003; 27:533-44. 198 Drummer OH. Postmortem toxicology of drugs of abuse. Forensic Sci Int 2004; 142:101-13. 198 Skopp G. Preanalytic aspects in postmortem toxicology. Forensic Sci Int 2004; 142:75-100. 199 Yarema MC, Becker CE. Key concepts in postmortem drug redistribution. Clin Toxicol (Phila) 2005; 43:235-41. 200 Drummer OH. Post-mortem toxicology. Forensic Sci Int 2007; 165:199-203. 201 Pounder DJ, Jones GR. Post-mortem drug redistribution - a toxicological nightmare. Forensic Sci Int 1990; 45: 253-63. 202 Gomez HF, McKinney P, Philipps S, et al. Postmortem acetaminophen pharmacokinetics: an experimental study of site and time-dependent concentration changes. J Forensic Sci 1995; 40:980-2. 203 Hilberg T, Mørland J, Bjørneboe A. Postmortem release of amitriptyline from the lungs: a mechanism of postmortem redistribution. Forensic Sci Int 1994; 64:47-55. 204 Koren G, Klein J. Postmortem redistribution of morphine in rats. Ther Drug Monit 1992; 14:461-3. 205 Koren G, MacLeod SM. Postmortem redistribution of digoxin in rats. J Forensic Sci 1985; 30:92-6. 206 Quatrehomme G, Bourre F, Liao Z, Ollier A. An experimental methodology for the study of postmortem changes in toxic concentrations of drugs using secobarbital as an example. J Forensic Sci 1994; 39:1300-4. 207 Imamura T, Nagat T, Kimura K, et al. Pharmacokinetics and postmortem changes of cimetidine in body tissues. Nippon Hoigaku Zasshi 1994; 48:75-78. 208 Aderjan R, Mattern R. Validity of digoxin concentrations in blood determined postmortem. Zeitschrift für Rechtsmedizin 1980; 86:13-20. 209 Hearn WL, Keran EE, Wei HA, Hime G. Site-dependent postmortem changes in blood cocaine concentrations. J Forensic Sci 1991; 36:673-84. 210 Levine B, Wu SC, Dixon A, Smialek JE. Site dependence of postmortem blood methadone concentrations. Am J Forensic Med Pathol 1995; 16:97-100. 211 Miyazaki T, Kojima J, Yashiki M, et al. Site dependence of methamphetamine concentrations in blood samples collected from cadavers of people who had been methamphetamine users. Am J Forensic Med Pathol 1993; 14:121-4. 212 Kuhlman JJ, Mayers RW, Levine B, et al. Chloroquine distribution in postmortem cases. J Forensic Sci 1991; 36:1572-9. 213 Pounder DJ, Hartley AK, Watmough PJ. Postmortem redistribution and degradation of dothiepin: human case studies and an animal model. Am J Forensic Med Pathol 1994; 15:231-5. 214 Pounder DJ, Owen V, Quigley C. Postmortem changes in blood amitriptyline concentration. Am

J Pathol 1994; 15:224-30. 215 Pohland RC, Bernhard NR. Postmortem serum and tissue redistribution of fluoxetine and norfluoxetine in dogs @ tranlylcypromine concentration: competing redistribution and degradation effects. Forensic Sci Int 1993; 59: 177-84.

217 Yonemitsu K, Pounder DJ. Postmortem toxicokinetics of co-proxamol. Int J Legal Med 1992; 104:347-53.

218 Hanzlick R. Postmortem tricyclic antidepressant concentrations: lethal versus nonlethal levels. Am J Forensic Med Pathol 1989; 10:326-9.

219 Martin A, Pounder DJ. Postmortem toxicokinetics of trazadone. Forensic Sci Int 1992; 56:201-7.

220 Pounder DJ, Davies JI. Zopiclone poisoning: tissue distribution and potential for postmortem diffusion. Forensic Sci Int 1994; 65:177-83.

221 Hilberg T, Bugge A, Beykich KM, et al. Diffusion as a mechanism of postmortem drug redistribution: an experimental study in rats. Int J Leg Med 1992; 105:87-91.

222 Pounder DJ, Fuke C, Cox DE, et al. Postmortem diffusion of drugs from gastric residue. Am J Forensic Med Pathol 1996; 17:1-7.

223 Pounder DJ, Smith RW. Postmortem diffusion of alcohol from the stomach. Am J Forensic Med Pathol 1995; 16:89-96.

224 Skopp G, Pötsch L, König I, Mattern R. A preliminary study on the stability of benzodiazepines in blood and plasma stored at 4°C. Int J Leg Med 1998; 111:1-5.

225 Mayer W, Erbe S, Wolf G, Voigt R. Beiträge zur Analytik und Stabilität einiger pharmazeutisch interessanter 1,4-Benzodiazepine. Pharmazie 1974; 29:700-7.

226 Koves EM, Lawrence K, Mayer JM. Stability of diltiazem in whole blood: forensic implications. J Forensic Sci 1997; 43:587-97.

227 Benhamou-Batut F, Demotes-Mainard F, Labat L, Vincon G. Determination of flunitrazepam in plasma by liquid chromatography. J Pharm Biomed Anal 1994; 12:931-6.

228 Augsburg M, Mangin P. LSD, le phénix des hallucinogènes. Toxicorama 1998; 10:61-6.

- 229 Ferner RE. Forensic Pharmacology. Oxford, NF: Oxford University Press, 1996.
- 230 Paterson S. Drugs and decomposition. Med, Sci and Law 1993; 33:103-109.
- 231 Hadidi FA, Oliver JS. Stability of morphine and buprenorphine in whole blood. Int J Leg Med 1998; 111:165-7.
- 232 McCurdy HH, Callahan LS, Williams RD. Studies on the stability and detection of cocaine, benzoylecgonine and 11-nor- Δ^9 -tetrahydrocannabinol-9-carboxylic acid in whole blood using Abuscreen radioimmunoassay. J Forensic Sci 1989; 34:858-70.
- 233 Robertson MD, Drummer OH. Postmortem drug metabolism by bacteria. J Forensic Sci 1995; 40:382-6.
- 234 Robertson MD, Drummer OH. Stability of nitrobenzodiazepines in postmortem blood. J Forensic Sci 1998; 43:5-8.
- 235 Robertson MD, Drummer OH. Postmortem distribution and redistribution of nitrobenzodiazepines in man. J Forensic Sci 1998; 43:9-13.
- 236 Corry JEL. Possible sources of ethanol ante- and postmortem: its relationship to the biochemistry and microbiology of decomposition. J Appl Bacteriol 1978; 44:1-56.
- 237 Hoiseth G, Kristoffersen L, Larssen B, et al. In vitro formation of ethanol in autopsy samples containing fluoride ions. Int J Legal Med 2008; 122:63-6.
- 238 Schmitt G, Aderjan R, Keller T, Wu M. Ethyl glucuronide: an unusual ethanol metabolite in humans. Synthesis, analytical data, and determination in serum and urine. J Anal Toxicol for the determination of the ethanol consumption markers ethyl glucuronide, ethyl phosphate, and ethyl sulfate in human urine by reversed-phase/weak anion exchange liquid chromatography-tandem mass spectrometry. Anal Chem 2006; 78:5884-92. 240 Caplan YH, Levine B. Vitreous humor in the evaluation of postmortem blood ethanol concentrations. J Anal Toxicol 1990; 14:305-7. 241 Pounder DJ, Kuroda N. Vitreous alcohol is of limited value in predicting blood alcohol. Forensic Sci Int 1994; 65:73-80. 242 Laure P, Lecerf T, Friser A, Binsinger C. Drugs, recreational drug use and attitudes towards doping

of high school athletes. *Int J Sports Med* 2004; 25:133-8.

243 Laure P, Binsinger C. Doping prevalence among preadolescent athletes: a 4-year follow-up. *Br J Sports Med* 2007; 41:660-3; discussion 3.

244 Saugy M, Avois L, Saudan C, et al. Cannabis and sport. *Br J Sports Med* 2006; 40 (Suppl 1):i13-5.

245 Bowers LD. Analytical advances in detection of performanceenhancing compounds. *Clin Chem* 1997; 43:1299-304.

246 Cowan DA, Kickman AT. Doping in sport: misuse, analytical tests, and legal aspects. *Clin Chem* 1997; 43:1110-13.

247 Thevis M, Schanzer W. Mass spectrometry in sports drug testing. Structure characterization and analytical assays. *Mass Spectrom Rev* 2007; 26:79-107.

248 Saudan C, Baume N, Robinson N, et al. Testosterone and doping control. *Br J Sports Med* 2006; 40 (Suppl 1):i21-4.

249 Dawson RT. Drugs in sport - the role of the physician. *J Endocrinol* 2001; 170:55-61.

250 Sjoqvist F, Garle M, Rane A. Use of doping agents, particularly anabolic steroids, in sports and society. *Lancet* 2008; 371:1872-82.

251 Musshoff F, Daldrup T, Ritsch M. Black market in anabolic steroids - analysis of illegally distributed products. *J Forensic Sci* 1997; 42:1119-25.

252 Catlin DH, Hatton CK, Starcevic SH. Issues in detecting abuse of xenobiotic anabolic steroids and testosterone by analysis of athletes' urine. *Clin Chem* 1997; 43:1280-8.

253 Thevis M, Thomas A, Schanzer W. Mass spectrometric determination of insulins and their degradation products in sports drug testing. *Mass Spectrom Rev* 2008; 27:35-50.

254 Huestis MA. Technical and legal aspects of drugs of abuse testing in hair. In Kintz P (ed.) *Drug testing in hair*. Boca Raton, FL: CRC Press, 1996, pp. 5-15.

255 Lewis D, Moore C, Morrissey P, Leikin J. Determination of drug exposure using hair: application to child protective cases. *Forensic Sci Int* 1997; 84:123-8.

256 Strano-Rossi S, Offidani C, Chiarotti M. Application of hair analysis to document coercive heroin administration to a child. *J Anal Toxicol* 1998; 22:75-7.

257 Xiang P, Shen M, Zhuo X. Hair analysis for ketamine and its metabolites. *Forensic Sci Int* 2006; 162:131-4.

258 Marchei E, Munoz JA, Garcia-Algar O, et al. Development and validation of a liquid chromatography-mass spectrometry assay for hair analysis of methylphenidate. *Forensic Sci Int* 2008; 176:42-6.

259 Kintz P, Villain M, Tracqui A, et al. Buprenorphine in drugfacilitated sexual abuse: a fatal case involving a 14-year-old boy. *J Anal Toxicol* 2003; 27:527-9.

260 Negrusz A, Gaensslen RE. Analytical developments in toxicological investigation of drug-facilitated sexual assault. *Anal Bioanal Chem* 2003; 376:1192-7.

261 Cheze M, Villain M, Pepin G. Determination of bromazepam, clonazepam and metabolites after a single intake in urine and hair by LC-MS/MS. Application to forensic cases of drug

chromatography-tandem mass spectrometry (LC-MS/MS) to test blood and urine samples for the toxicological investigation of drug-facilitated crimes. *Ther Drug Monit* 2008; 30:225-8.

263 Rey-Salmon C, Pépin G. [Drug-facilitated crime and sexual abuse: a pediatric observation]. *Arch Pediatr* 2007; 14:1318-20.

264 Kintz P, Evans J, Villain M, et al. Hair analysis for diphenhydramine after surreptitious administration to a child. *Forensic Sci Int* 2007; 173:171-4.

265 Kintz P, Villain M, Cirimele V. Hair analysis for drug detection. *Ther Drug Monit* 2006; 28:442-6.

266 Kintz P, Villain M, Dumestre-Toulet V, et al. Methadone as a chemical weapon: two fatal cases involving babies. *Ther Drug Monit* 2005; 27:741-3.

267 Kintz P, Cirimele V, Jamey C, Ludes B. Testing for GHB in hair by GC/MS/MS after a single exposure. Application to document sexual assault. *J Forensic Sci* 2003; 48:195-200.

268 Ostrea EM, Chavez CS. Perinatal problems (excluding neonatal withdrawal) in maternal drug addiction: a study of 830 cases. *J Pediatr* 1979; 94:292-5.

269 Ostrea EM, Brady M, Gause S, et al. Drug screening in newborns by meconium analysis: a large-scale prospective, epidemiologic study. *J Pediatr* 1992; 89:107-13.

270 Klein J, Koren G. Hair analysis - a biological marker for passive smoking in pregnancy and childhood. *Hum Exp Toxicol* 1999; 18:279-82.

271 Kukla L, Hrubá D, Tyrlik M. Trends in respiratory morbidity of children in relation to their passive smoking exposure. *Cent Eur J Public Health* 2006; 14:180-5.

272 Bar-Oz B, Klein J, Karaskov T, Koren G. Comparison of meconium and neonatal hair analysis for detection of gestational exposure to drugs of abuse. *Arch Dis Child Fetal Neonatal Ed* 2003; 88:F98-F100.

273 Garcia-Bournissen F, Rokach B, Karaskov T, Koren G. Methamphetamine detection in maternal and neonatal hair: implications for fetal safety. *Arch Dis Child Fetal Neonatal Ed* 2007; 92:F351-5. 274 Garcia-Bournissen F, Rokach B, Karaskov T, Koren G. Cocaine detection in

maternal and neonatal hair: implications to fetal toxicology. *Ther Drug Monit* 2007; 29:71-6. 275 Pragst F, Yegles M. Determination of fatty acid ethyl esters (FAEE) and ethyl glucuronide (EtG) in hair: a promising way for retrospective detection of alcohol abuse during pregnancy? *Ther Drug Monit* 2008; 30:255-63. 276 Moore C, Dempsey D, Deitermann D, et al. Fetal cocaine exposure: analysis of vernix caseosa. *J Anal Toxicol* 1996; 20:509-11. 277 Marks V, Richmond C. Beverly Allitt: the nurse who killed babies. *J R Soc Med* 2008; 101:110-5. 278 Dyer C. Children's nurse convicted of murder. *BMJ* 1993; 306:1431-2. 279 Appleyard WJ. Murder in the NHS. *BMJ* 1994; 308:287-8. 280 Repper J. Munchausen syndrome by proxy in health care workers. *J Adv Nurs* 1995; 21:299-304. 281 Jones DPH, Boots CN. Factitious Illness by Proxy. In David TJ (ed.) *Recent Advances in Paediatrics* 17. London: Churchill Livingstone, 1999, pp. 57-71 282 Jenkins RO, Craig PJ, Goessler W, Irgolic KJ. Antimony leaching from cot mattresses and sudden infant death syndrome (SIDS). *Hum Exp Toxicol* 1998; 17:138-9. 283 Richardson BA. Cot mattress biodeterioration and SIDS. *Lancet* 1990; 335:670. 284 Richardson BA. Sudden infant death syndrome: a possible primary cause. *J Forensic Sci Soc* 1994; 34:199-204. 285 Department of Health. Expert Group to Investigate Cot Death Theories: Toxic Gas Hypothesis. Chairman, Lady Limerick. Final report. London: Department of Health, 1998. 286 Report of the expert working group enquiring into the hypothesis that toxic gases evolved from mattress covers and cot mattresses are a cause of SIDS. *Sudden infant death syndrome (SIDS)* London: Her Majesty's Stationery Office, 1991.

14 Chapter 14. Head and Neck Injuries

- 1 Teasdale G, Jennett B. Assessment of coma and impaired consciousness. A practical scale. *Lancet* 1974; 2:81-4.
- 2 Simpson D, Reilly P. Pediatric coma scale. *Lancet* 1982; 2:450.
- 3 Raimondi AJ, Hirschauer J. Head injury in the infant and toddler. Coma scoring and outcome scale. *Childs Brain* 1984; 11:12-35.
- 4 Jennett B, Teasdale G, Galbraith S et al. Severe head injuries in three countries. *J Neurol Neurosurg Psychiatry* 1977; 40:291-8.
- 5 Huttenlocher PR. Reye's syndrome: relation of outcome to therapy. *J Pediatr* 1972; 80:845-50.
- 6 Seshia SS, Seshia MM, Sachdeva RK. Coma in childhood. *Dev Med Child Neurol* 1977; 19:614-28.
- 7 Morray JP, Tyler DC, Jones TK et al. Coma scale for use in brain-injured children. *Crit Care Med* 1984; 12:1018-20.
- 8 Gordon NS, Fois A, Jacobi G et al. The management of the comatose child. *Neuropediatrics* 1983; 14:3-5.
- 9 Yager JY, Johnston B, Seshia SS. Coma scales in pediatric practice. *Am J Dis Child* 1990; 144:1088-91.
- 10 Yates DW. RAD Lecture Notes on Emergency Medicine. Oxford: Blackwell Scientific.
- 11 Tatman A, Warren A, Williams A, Powell JE, Whitehouse W. Development of a modified paediatric coma scale in intensive care clinical practice. *Arch Dis Child*, 1997; 77:519-21.
- 12 Jennett B, MacMillan R. Epidemiology of head injury. *BMJ (Clin Res)* 1981; 282:101-4.
- 13 Kraus JF, Black MA, Hessol N et al. The incidence of acute brain injury and serious impairment in a defined population. *Am J Epidemiol* 1984; 119:186-201.
- 14 Annegers JF, Grabrow JD, Kurland LT, Laws ER Jr. The incidence, causes, and secular trends of head trauma in Olmsted County, Minnesota, 1935-1974. *Neurology* 1980; 30:912-19.

- 15 Rantakallio P, von Wendt L. Trauma to the nervous system and its sequelae in a one-year birth cohort followed up to the age of 14 years. *J Epidemiol Community Health* 1985; 39:353-6.
- 16 Kraus JF, Fife D, Cox P et al. Incidence, severity, and external causes of pediatric brain injury. *Am J Dis Child* 1986; 140:687-93.
- 17 Chan BS, Walker PJ, Cass DT. Urban trauma: an analysis of 1,116 paediatric cases. *J Trauma* 1989; 29:1540-7.
- 18 Brookes M, MacMillan R, Cully S et al. Head injuries in accident and emergency departments. How different are children from adults? *J Epidemiol Community Health* 1990; 44:147-51.
- 19 Sharples PM, Storey A, Aynsley-Green A, Eyre JA. Causes of fatal childhood accidents involving head injury in northern region, 1979-86. *BMJ* 1990; 301:1193-7.
- 20 Tepas JJ III, DiScala C, Ramenofsky ML, Barlow B. Mortality and head injury: the pediatric perspective. *J Pediatr Surg* 1990; 25:92-5; discussion 96.
- 21 Hansen TB, Pless S, Gravers M. Head injuries among children in the county of Ringkøbing. 1. An analysis of hospital data. *Ugeskr Laeger* 1991; 153:2944-6.
- 22 Levin HS, Aldrich EF, Saydjari C et al. Severe head injury in children: experience of the Traumatic Coma Data Bank. *Neurosurgery* 1992; 31:435-43; discussion 443-4.
- 23 Aldrich EF, Eisenberg HM, Saydjari C et al. Diffuse brain swelling in severely head-injured children. A report from the NIH Traumatic Coma Data Bank. *J Neurosurg* 1992; 76:450-4.
- 24 Berney J, Favier J, Froidevaux AC. Paediatric head trauma: influence of age and sex. I. Epidemiology. *Childs Nerv Syst* 1994; 10:514-16. Reykjavik. *Acta Paediatr* 1995; 84:96-9. 26 Jennett B. Epidemiology of head injury. *J Neurol Neurosurg Psychiatry* 1996; 60:362-9. 27 Gabella B, Hoffman RE, Marine WW, Stallones L. Urban and rural traumatic brain injuries in Colorado. *Ann Epidemiol* 1997; 7:207-12. 28 Emanuelson I, Wendt L. Epidemiology of traumatic brain injury in children and adolescents in south-western Sweden. *Acta Paediatr* 1997; 86:730-5. 29 Suominen P, Kivioja A, Ohman J et al. Severe and fatal

childhood trauma. *Injury* 1998; 29:425-30. 30 Durkin MS, Laraque D, Lubman L, Barlow B. Epidemiology and prevention of traffic injuries to urban children and adolescents. *Pediatrics* 1999; 103:e74. 31 Morrison A, Stone DH, Redpath A et al. Trend analysis of socioeconomic differentials in deaths from injury in childhood in Scotland, 1981-95. *BMJ* 1999; 318:567-8. 32 Thurman D, Guerrero J. Trends in hospitalization associated with traumatic brain injury. *JAMA* 1999; 282:954-7. 33 Benoit R, Watts DD, Dwyer K et al. Windows 99: a source of suburban pediatric trauma. *J Trauma* 2000; 49:477-81; discussion 481-2. 34 Thurman D. Traumatic brain injury in children and youth as a public health problem: an overview. In Langlois JA (ed.) *Traumatic Brain Injury in the United States: Assessing Outcomes in Children*. Atlanta, GA: Department of Health and Human Services, Centers for Disease Control and Prevention, 2000, pp. 31-5. 35 Reid SR, Roesler JS, Gaichas AM, Tsai AK. The epidemiology of pediatric traumatic brain injury in Minnesota. *Arch Pediatr Adolesc Med* 2001; 155 :784-9. 36 Masson F, Thicoipe M, Aye P et al. Epidemiology of severe brain injuries: a prospective population-based study. *J Trauma* 2001; 51:481-9. 37 Adekoya N, Thurman DJ, White DD, Webb KW. Surveillance for traumatic brain injury deaths: United States, 1989-1998. *MMWR Surveill Summ* 2002; 51:1-14. 38 Williamson LM, Morrison A, Stone DH. Trends in head injury mortality among 0-14 year olds in Scotland (1986-95). *J Epidemiol Community Health* 2002; 56:285-8. 39 Masson F, Thicoipe M, Mokni T et al. Epidemiology of traumatic comas: a prospective population-based study. *Brain Injury* 2003; 17:279-93. 40 Andersson EH, Bjorglund R, Emanuelson I, Stalhammer D. Epidemiology of traumatic brain injury: a population-based study in western Sweden. *Acta Neurol Scand* 2003; 107:256-9. 41 Roberts I, Power C. Does the decline in child injury mortality vary by social class? A comparison of class-specific mortality in 1981 and 1991. *BMJ* 1996; 313:784-6. 42 Reed JM, Browning JG, Wilkinson AG, Beattie T. Can we abolish skull X-rays for head injury? *Arch Dis Child* 2005; 90:859-64. 43 Minns RA, Millar C, Minns FC et al. Non-accidental head injury in Scotland: Scottish Database. In Minns RA, Brown JK (eds) *Shaken Baby Syndrome and Other Non-accidental Head Injuries*. London: Mac Keith Press, 2005, pp. 154-84. 44 Barlow KM, Minns RA. Annual incidence of shaken impact syndrome in young children. *Lancet* 2000; 356:1571-2. 45 Jayawant S, Rawlinson A, Gibbon F et al. Subdural haemorrhages in infants: population-based study. *BMJ* 1998; 317:1558-61. 46 Brown JK, Purvis RJ, Forfar JO, Cockburn F. Neurological aspects of perinatal asphyxia. *Dev Med Child Neurol* 1974; 16:567-80. 47 Whitby EH, Paley MN, Smith MF et al. Low field strength magnetic resonance imaging of the

neonatal brain. Arch Dis resonance imaging examination of normal term neonates: a pilot study. J Child Neurol 1999; 14:708-10.

49 Yonas H, Wolfson SK Jr, Dujovny M et al. Selective lenticulostriate occlusion in the primate. A highly focal cerebral ischemia model. Stroke 1981; 12:567-72.

50 Shaffer L, Rich PM, Pohl KR, Ganesan V. Can mild head injury cause ischaemic stroke? Arch Dis Child 2003; 88:267-9.

51 Kors EE, Terwindt GM, Vermeulen FL et al. Delayed cerebral edema and fatal coma after minor head trauma: role of the CACNA1A calcium channel subunit gene and relationship with familial hemiplegic migraine. Ann Neurol 2001; 49:753-60.

52 Umile EM, Sandel ME, Alvaria A et al. Dynamic imaging in mild traumatic brain injury: support for the theory of medial temporal vulnerability. Arch Phys Med Rehabil 2002; 83:1506-13.

53 Jones PA, Andrews PJ, Midgley S et al. Measuring the burden of secondary insults in head-injured patients during intensive care. J Neurosurg Anesthesiol 1994; 6:4-14.

54 Jiang JY, Gao GY, Li P, Yu MK, Zhu C. Early indicators of prognosis in 846 cases of severe traumatic brain injury. J Neurotrauma 2002; 19:869-74.

55 Chiaretti A, Piastra M, Pulitano S et al. Prognostic factors and outcome of children with severe head injury: an 8-year experience. Childs Nerv Syst 2002; 18:129-36.

56 Chiaretti A, De Benedictis R, Della Corte F et al. The impact of initial management on the outcome of children with severe head injury. Childs Nerv Syst 2002; 18:54-60.

57 Coats TJ, Kirk CJ, Dawson M. Outcome after severe head injury treated by an integrated trauma system. J Acc Emerg Med 1999; 16:182-5.

58 Zauner A, Bullock R, Di X, Young HF. Brain oxygen, CO₂, pH, and temperature monitoring: evaluation in the feline brain. Neurosurgery 1995; 37:1168-76; discussion 1176-7.

59 Jeevaratnam DR, Menon DK. Survey of intensive care of severely head-injured patients in the United Kingdom. BMJ 1996; 312:944-7.

60 Matta B, Menon D. Severe head injury in the United Kingdom and Ireland: a survey of practice and implications for management. Crit Care Med 1996; 24:1743-8.

61 Segal S, Gallagher AC, Shefler AG et al. Survey of the use of intracranial pressure monitoring in children in the United Kingdom. Intensive Care Med 2001; 27:236-9.

62 Gambardella G, Zacccone C, Cardia E, Tomasello F. Intracranial pressure monitoring in children: comparison of external ventricular device with the fiberoptic system. Childs Nerv Syst 1993; 9:470-3.

63 Piek J, Bock WJ. Continuous monitoring of cerebral tissue pressure in neurosurgical practice: experiences with 100 patients. Intensive Care Med 1990; 16:184-8.

64 Yablon JS, Latner HJ, McCormack TM et al. Clinical experience with a fiberoptic intracranial pressure monitor. J Clin Monit 1993; 9:171-5.

65 Shapiro S, Bowman R, Callahan J, Wolfla C. The fiberoptic intraparenchymal cerebral pressure monitor in 244 patients. Surg Neurol 1996; 45:278-82.

66 Friedman WA, Vries JK. Percutaneous tunnel ventriculostomy. Summary of 100 procedures. J Neurosurg 1980; 53:662-5.

67 Narayan RK, Kishore PR, Becker DP et al. Intracranial pressure: to monitor or not to monitor? A review of our experience with severe head injury. J Neurosurg 1982; 56:650-9.

68 North B, Reilly P. Comparison among three methods of intracranial pressure recording. Neurosurgery 1986; 18:730-2.

69 Paramore CG, Turner DA. Relative risks of ventriculostomy infection and morbidity. Acta Neurochir (Wien) 1994; pressure with intraparenchymal fiberoptic transducer. Technical aspects and clinical reliability. Ann Fr Anesth Reanim 1992; 11:424-9. 71 Pople IK, Mahlbauer MS, Sanford RA, Kirk E. Results and complications of intracranial pressure monitoring in 303 children. Pediatr Neurosurg 1995; 23:64-7. 72 Jensen RL, Hahn YS, Ciro E. Risk factors for intracranial pressure monitoring in children with fiberoptic devices: a critical review. Surg Neurol 1997; 47:16-22. 73 Meyer JS, Kondo A, Nomura F et

al. Cerebral hemodynamics and metabolism following experimental head injury. *J Neurosurg* 1970; 32:304-19. 74 Kaiser AM, Whitelaw AG. Hypertensive response to raised intracranial pressure in infancy. *Arch Dis Child* 1988; 63:1461-5. 75 Rossi S, Zanier ER, Mauri I et al. Brain temperature, body core temperature, and intracranial pressure in acute cerebral damage. *J Neurol Neurosurg Psychiatry* 2001; 71:448-54. 76 Albrecht RF II, Wass CT, Lanier WL. Occurrence of potentially detrimental temperature alterations in hospitalized patients at risk for brain injury. *Mayo Clin Proc* 1998; 73:629-35. 77 Hutchinson PJ, al-Rawli PG, O'Connell MT et al. Head injury monitoring using cerebral microdialysis and Paratrend multiparameter sensors. *Zentralbl Neurochir* 2000; 61:88-94. 78 Gupta AK, al-Rawli PG, Hutchinson PJ, Kirkpatrick PJ. Effect of hypothermia on brain tissue oxygenation in patients with severe head injury. *Br J Anaesth* 2002; 88:188-92. 79 Smith LW, Fay T. Observations on human beings with cancer, maintained at reduced temperature of 75-90 degree Fahrenheit. *Am J Clin Pathol* 1940; 10:1-11. 80 Fay T. Early experiences with local and generalised refrigeration of the human brain. *J Neurosurg* 1959; 16:239-60. 81 Clasen RA, Pandolfi S, Russell J et al. Hypothermia and hypotension in experimental cerebral edema. *Arch Neurol* 1968; 19:472-86. 82 Laskowski EJ, Klatzo I, Baldwin M. Experimental study of the effects of hypothermia on local brain injury. *Neurology* 1960; 10:499-505. 83 Rosomoff HL, Gilbert R. Brain volume and cerebrospinal fluid pressure during hypothermia. *Am J Physiol* 1955; 183:19-22. 84 Rosomoff HL, Shulman K, Raynor R, Grainger W. Experimental brain injury and delayed hypothermia. *Surg Gynecol Obstet* 1960; 110:27-32. 85 Clifton GL, Allen S, Barrowdale P et al. A phase II study of moderate hypothermia in severe brain injury. *J Neurotrauma* 1993; 10:263-71; discussion 273. 86 Marion DW, Oozer R, de Vries L et al. The use of moderate therapeutic hypothermia for patients with severe head injuries: a preliminary report. *J Neurosurg* 1993; 79:354-62. 87 Clifton GL, Miller ER, Choi SC et al. Lack of effect of induction of hypothermia after acute brain injury. *N Engl J Med* 2001; 344:556-63. 88 Connell J, Oozer R, de Vries L et al. Continuous EEG monitoring of neonatal seizures: diagnostic and prognostic considerations. *Arch Dis Child* 1989; 64:452-8. 89 Dusser A, Navalet Y, Devictor D, Landrieu P. Short- and longterm prognostic value of the electroencephalogram in children with severe head injury. *Electroencephalogr Clin Neurophysiol* 1989; 73:85-93. 90 Altafullah I, Asaika S, Torres F. Status epilepticus: clinical experience with two special devices for continuous cerebral monitoring. *Acta Neurol Scand* 1991; 84:374-81. 91 Aoki Y, Lombroso C.

Prognostic value of electroencephalography in Reye's syndrome. *Neurology* 1973; near-drowning encephalopathy in children. *Electroencephalogr Clin Neurophysiol* 1982; 53:182-91.

93 Pampiglione G, Harden A. Resuscitation after cardiocirculatory arrest. Prognostic evaluation of early electroencephalographic findings. *Lancet* 1968; 1:1261-5.

94 Tasker RC, Boyd S, Harden A, Matthew DJ. Monitoring in non-traumatic coma. Part II. Electroencephalography. *Arch Dis Child* 1988; 63:895-9.

95 Tasker RC, Boyd SC, Harden A, Matthew DJ. The cerebral function analysing monitor in paediatric medical intensive care: applications and limitations. *Intensive Care Med* 1990; 16:60-8.

96 Lassen NA, Christensen MS. Physiology of cerebral blood flow. *Br J Anaesth* 1976; 48:719-34.

97 Aaslid R, Markwalder TM, Nornes H. Noninvasive transcranial Doppler ultrasound recording of flow velocity in basal cerebral arteries. *J Neurosurg* 1982; 57:769-74.

98 Weber M, Grolimund P, Seiler RW. Evaluation of posttraumatic cerebral blood flow velocities by transcranial Doppler ultrasonography. *Neurosurgery* 1990; 27:106-12.

99 Martin NA, Doberstein C, Zane C et al. Posttraumatic cerebral arterial spasm: transcranial Doppler ultrasound, cerebral blood flow, and angiographic findings. *J Neurosurg* 1992; 77:575-83.

100 Chan KH, Miller JD, Dearden NM. Intracranial blood flow velocity after head injury: relationship to severity of injury, time, neurological status and outcome. *J Neurol Neurosurg Psychiatry* 1992; 55:787-91.

101 Ungerstedt U. Microdialysis - principles and applications for studies in animals and man. *J Intern Med* 1991; 230:365-73.

102 Hillered L, Persson L. Neurochemical monitoring of the acutely injured human brain. *Scand J Clin Lab Invest* 1999; 229(Suppl.):9-18.

103 Hillered L, Persson L, Nilsson P et al. Neurometabolic monitoring of the ischaemic human brain using

microdialysis. *Acta Neurochir (Wien)* 1990; 102:91-7.

104 Hillered L, Valtysson J, Enblad P, Persson L. Interstitial glycerol as a marker for membrane phospholipid degradation in the acutely injured human brain. *J Neurol Neurosurg Psychiatry* 1998; 64:486-91.

105 Goodman JC, Valadka AB, Gopinath SP et al. Extracellular lactate and glucose alterations in the brain after head injury measured by microdialysis. *Crit Care Med* 1999; 27:1965-73.

106 Hovda, DA, Lee SM, Smith ML et al. The neurochemical and metabolic cascade following brain injury: moving from animal models to man. *J Neurotrauma* 1995; 12:903-6.

107 Nilsson OG, Brandt L, Ungestedt U, Saveland H. Bedside detection of brain ischemia using intracerebral microdialysis: subarachnoid hemorrhage and delayed ischemic deterioration. *Neurosurgery* 1999; 45:1176-84; discussion 1184-5.

108 Bullock R, Zaune A, Woodward JJ et al. Factors affecting excitatory amino acid release following severe human head injury. *J Neurosurg* 1998; 89:507-18.

109 Bell MJ, Robertson CS, Kochanek PM et al. Interstitial brain adenosine and xanthine increase during jugular venous oxygen desaturations in humans after traumatic brain injury. *Crit Care Med* 2001; 29:399-404.

110 Pang D, Wilberger JE Jr. Spinal cord injury without radiographic abnormalities in children. *J Neurosurg* 1982; 57:114-29.

111 Marshall LF, Marshall SB, Klauber MR et al. A new classification of head injury based on computerized injury in children: relationship to clinical features and outcome. *Childs Nerv Syst* 1992; 8:445-52. 113 Caffey J. On the theory and practice of shaking infants. Its potential residual effects of permanent brain damage and mental retardation. *Am J Dis Child* 1972; 124:161-9. 114 Guthkelch AN. Infantile subdural haematoma and its relationship to whiplash injuries. *BMJ* 1971; 2:430-1. 115 Minns RA, Brown JK. Neurological features of NAHI and whiplash shaken baby syndrome. In Minns RA, Brown JK (eds) *Shaken Baby Syndrome and Other Non-accidental Head Injuries*. London: Mac Keith Press, 2005, pp. 1-105. 116 Geddes JF, Vowles CH, Hackshaw AK et al. Neuropathology of inflicted head injury in children. II. Microscopic brain injury in infants. *Brain*

2001; 124:1299-306. 117 Geddes JF, Vowles CH, Hackshaw AK et al. Neuropathology of inflicted head injury in children. I. Patterns of brain damage. *Brain* 2001; 124:1290-8. 118 Barlow KM, Minns RA. The relation between intracranial pressure and outcome in non-accidental head injury. *Dev Med Child Neurol* 1999; 41:220-5. 119 Ludwig S, Warman M. Shaken baby syndrome: a review of 20 cases. *Ann Emerg Med* 1984; 13:104-7. 120 Schloff S, Mulhaney PB, Armstrong DC et al. Retinal findings in children with intracranial hemorrhage. *Ophthalmology* 2002; 109:1472-6. 121 Reece RM, Nicholson CE. *Inflicted Childhood Neurotrauma*. Bethesda, MD: American Academy of Pediatrics, 2002. 122 Goldstein B, Kelly MM, Bruton D, Cox C. Inflicted versus accidental head injury in critically injured children. *Crit Care Med* 1993; 21:1328-32. 123 Kivlin JD, Simons KB, Laronitz S, Ruttum MS. Shaken baby syndrome. *Ophthalmology* 2000; 107:1246-54. 124 Rao P, Carty H, Pierce A. The acute reversal sign: comparison of medical and non-accidental injury patients. *Clin Radiol* 1999; 54:495-501. 125 Zimmerman RA, Bilaniuk LT, Bruce D et al. Interhemispheric acute subdural hematoma: a computed tomographic manifestation of child abuse by shaking. *Neuroradiology* 1978; 16:39-40. 126 Ewing-Cobbs L, Kramer L, Prasad M et al. Neuroimaging, physical, and developmental findings after inflicted and noninflicted traumatic brain injury in young children. *Pediatrics* 1998; 102:300-7. 127 Duhaime AC, Alario AJ, Lewander WJ et al. Head injury in very young children: mechanisms, injury types, and ophthalmologic findings in 100 hospitalized patients younger than 2 years of age. *Pediatrics* 1992; 90:179-85. 128 Joffe M, Ludwig S. Stairway injuries in children. *Pediatrics* 1988; 82:457-61. 129 Boyles I, Minns RA. How Often Do Toddlers Fall and Injure Themselves? A prospect study. Special Study Module, University of Edinburgh, 2004. 130 Hall JR, Reyes HM, Horvat M et al. The mortality of childhood falls. *J Trauma* 1989; 29:1273-5. 131 Claydon SM. Fatal extradural hemorrhage following a fall from a baby bouncer. *Pediatr Emerg Care* 1996; 12:432-4. 132 Stoffman JM, Bass MJ, Fox AM. Head injuries related to the use of baby walkers. *Can Med Assoc J* 1984; 131:573-5. 133 Plunkett J. Fatal pediatric head injuries caused by shortdistance falls. *Am J Forensic Med Pathol* 2001; 22:1-12. 134 Reiber GD. Fatal falls in childhood. How far must children fall to sustain fatal head injury? Report of cases and review of the literature. *Am J Forensic Med Pathol* 1993; 14:201-7. 135 Milhorat TH. Pediatric neurosurgery. *Contemp Neurol Ser* children fall out of bed. *Pediatrics* 1977; 60:533-5.

137 Margulies SS, Thibault KL. Infant skull and suture properties: measurements and implications for mechanisms of

pediatric brain injury. J Biomech Eng 2000; 122:364-71.

138 Scarfo GB, Mariottini A, Tomaccini D, Palma L. Growing skull fractures: progressive evolution of brain damage and effectiveness of surgical treatment. Childs Nerv Syst 1989; 5:163-7.

139 Carty H. Training in paediatric radiology. Clin Radiol 1989; 40:227-8.

140 Royal College of Radiologists. Guidelines for Doctors, 5th edn. London: Royal College of Radiologists, 2003.

141 Zimmerman RA, Bilaniuk LT, Bruce D et al. Computed tomography of craniocerebral injury in the abused child. Radiology 1979; 130:687-90.

142 Johnson H, Faerber EN (ed.). Trauma. In CNS Magnetic Resonance Imaging in Infants and Children. London: Mac Keith Press, 1995, pp. 98-115.

143 Barlow KM, Gibson RJ, McPhillips M, Minns RA. Magnetic resonance imaging in acute non-accidental head injury. Acta Paediatr 1999; 88:734-40.

144 Biouesse V, Suh DY, Newman NJ et al. Diffusion-weighted magnetic resonance imaging in shaken baby syndrome. Am J Ophthalmol 2002; 133:249-55.

145 Hovind KH. Traumatic brain injuries. In Raimondi AJ, Choux M, DoiRocco C (eds) Head Injuries in the Newborn and Infant. New York: Springer-Verlag, 1986, p. 87.

146 Duhaime AC, Genarelli TG, Thibault LE et al. The shaken baby syndrome. A clinical, pathological, and biomechanical study. J Neurosurg 1987; 66:409-15.

147 Morison CN, Minns RA. Biomechanics of shaking. In Minns RA, Brown JK (eds) Shaking and Other Non-accidental Head Injuries in Children. London: Mac Keith Press, 2005, pp. 106-46.

148 Choux M, Lena G, Genitori L. Intracranial hematomas. In Raimondi AJ, Choux M, DoiRocco C (eds) Head Injuries in the Newborn and Infant. New York: Springer-Verlag, 1986, p. 203.

149 Geddes JF, Tasker RC, Hackshaw AK et al. Dural haemorrhage in non-traumatic infant deaths: does it explain the bleeding in 'shaken baby syndrome'? Neuropathol Appl

150 Byard RW, Blumberg P, Rutty G et al. Lack of evidence for a causal relationship between hypoxic/ischaemic encephalopathy and subdural haemorrhage in fetal life, infancy and early childhood. *Pediatr Dev Pathol* 2007; 10:348-50.

151 Ommaya AK, Gennarelli TA. Cerebral concussion and traumatic unconsciousness. Correlation of experimental and clinical observations of blunt head injuries. *Brain* 1974; 97:633-54.

152 Jaspan T, Narbrough G, Punt JA, Lowe J. Cerebral contusional tears as a marker of child abuse: detection by cranial sonography. *Pediatr Radiol* 1992; 22:237-45.

153 Strich SJ. Shearing of nerve fibers as a course of brain damage due to head injury. *Lancet* 1961; 2:443-8.

154 Crompton R. Closed head injury in children. In Crompton R (ed.) *Closed Head Injury in Children*. London: Edward Arnold, 1986.

155 Adams JH, Mitchell DE, Graham DI, Doyle D. Diffuse brain damage of immediate impact type. Its relationship to 'primary brain-stem damage' in head injury. *Brain* 1977; 100:489-502.

156 Vowles H, Scholtz CL, Cameron JM. Diffuse axonal injury in early infancy. *J Clin Pathol* 1987; 40:185-9.

157 Chesnut RM, Marshall LF, Klauser MR et al. The role of secondary brain injury in determining outcome from severe still common in fatal non-missile head injury. *J Neurol Neurosurg Psychiatry* 1989; 52:346-50. 159 Miller JD, Becker DP. Secondary insults to the injured brain. *J R Coll Surg Edin* 1982; 27:292-8. 160 Gentleman D, Jennett B. Hazards of inter-hospital transfer of comatose head-injured patients. *Lancet* 1981; 2:853-4. 161 Kohi YM, Mendelow AD, Teasdale GM, Allardice GM. Extracranial insults and outcome in patients with acute head injury: relationship to the Glasgow Coma Scale. *Injury* 1984; 16:25-9. 162 Miller JD, Butterworth JF, Gudema SF et al. Further experience in the management of severe head injury. *J Neurosurg* 1981; 54:289-99. 163 Miller JD, Sweet RC, Narayan R, Becker DP. Early insults to the injured brain. *JAMA* 1978; 240:439-42. 164 Price DJ, Murray A. The influence of hypoxia and hypotension on recovery from head injury. *Injury* 1972; 3:218-24. 165 Marmarou A, Anderson RL, Ward JD et al. NINDS

Traumatic Coma Data Bank: Intracranial pressure monitoring methodology. *J Neurosurg* 1991; 75(Suppl.):21-7. 166 Andrews PJ, Piper IR, Dearden NM, Miller JD. Secondary insults during intrahospital transport of head-injured patients. *Lancet* 1990; 335:327-30. 167 Sharples PM, Matthews DS, Eyre JA. Cerebral blood flow and metabolism in children with severe head injury. Part 1: Relation to age, Glasgow Coma Score, outcome, intracranial pressure, and time after injury. *J Neurol Neurosurg Psychiatry* 1995; 58:145-52. 168 Muizelaar JP, Ward JD, Marmaron A et al. Cerebral blood flow and metabolism in severely head-injured children. Part 1: Relationship with GCS score, outcome, ICP, and PVI. *J Neurosurg* 1989; 71:63-71. 169 Sharples PM, Matthews DS, Eyre JA. Cerebral blood flow and metabolism in children with severe head injuries. Part 2: Cerebrovascular resistance and its determinants. *J Neurol Neurosurg Psychiatry* 1995; 58:153-9. 170 Minns RA. Infectious and parainfectious encephalopathies. In Minns RA (ed.) *Problems of Intracranial Pressure in Childhood*. London: Mac Keith Press, 1991, pp. 170-282. 171 Report of the Second Task Force on Blood Pressure Control in Children: 1987. Task Force on Blood Pressure Control in Children. National Heart, Lung, and Blood Institute, Bethesda, Maryland. *Pediatrics* 1987; 70:1-25. 172 Donmall MC. Anthropometric and blood pressure studies in children from Shetland: reliability of measurement and the use of height-weight indices. *Acta Paediatr Scand* 1985; 318(Suppl.):23-35. 173 Roccella EJ. Update on the 1987 Task Force Report on High Blood Pressure in Children and Adolescents: a working group report from the National High Blood Pressure Education Program. National High Blood Pressure Education Program Working Group on Hypertension Control in Children and Adolescents. *Pediatrics* 1996; 98:649-58. 174 Rosner B, Prineas RJ, Logg JM, Daniels SR. Blood pressure nomograms for children and adolescents, by height, sex, and age, in the United States. *J Pediatr* 1993; 123:871-86. 175 Jackson S, Piper IR, Wagstaff A, Souter M. Quantification of cerebral perfusion pressure (CPP) 'secondary insults' in children: a study of the effects of using different CPP thresholds. *British Journal of Neurosurgery*, 1999; 13:104. 176 Chambers IR, Treadwell L, Mendelow AD. The cause and incidence of secondary insults in severely head-injured adults and children. *Br J Neurosurg* 2000; 14:424-31. 177 Jones PA, Andrews PJ, Eastman VJ, Minns RA. Traumatic brain injury in childhood: Intensive care time-series data injury in children: intensive care time series data and outcome. *Br J Neurosurg* 1982; 17:29-39.

179 Chambers IR, Jones PA, Lo TYM et al. Critical thresholds of ICP and CPP related to age in paediatric head

injury. J Neurol Neurosurg Psych 2007; 77:234-40.

180 Pappius HM, Feindel W. Dynamics of Brain Edema. Berlin: Springer, 1976.

181 King WJ, MacKay M, Sirnick A. Shaken baby syndrome in Canada: clinical characteristics and outcomes of hospital cases. Can Med Assoc J 2003; 168:155-9.

182 Brown JK, Imam H. Interrelationships of liver and brain with special reference to Reye syndrome. J Inherit Metab Dis 1991; 14:436-58.

183 Seshia SS, PN Chow, Sankaran K. Coma following cardiorespiratory arrest in childhood. Dev Med Child Neurol 1979; 21:143-53.

184 Fujimoto T, Walker JTJ, Spatz M, Klatzo I. Pathophysiologic aspects of ischaemic edema. In Pappius HM, Feindel W (eds) Dynamics of Brain Edema. Heidelberg: Springer, 1976, pp. 171-80.

185 Bruce DA, Langfill TW, Miller JD et al. Regional cerebral blood flow, intracranial pressure, and brain metabolism in comatose patients. J Neurosurg 1973; 38:131-44.

186 Dearden NM. Ischaemic brain. Lancet 1985; 2:255-9.

187 Augutis M, Levi R. Pediatric spinal cord injury in Sweden: incidence, etiology and outcome. Spinal Cord 2003; 41:328-36.

188 Hamilton MG, Myles ST. Pediatric spinal injury: review of 61 deaths. J Neurosurg 1992; 77:705-8.

189 Hamilton MG, Myles ST. Pediatric spinal injury: review of 174 hospital admissions. J Neurosurg 1992; 77:700-4.

190 Splendiani A, De Amicis R, Pupillo V et al. Spinal trauma in childhood: a four-year experience at a non-specialist hospital. Rivista di Neuroradiologia 2003; 16:455-7.

191 Aufdermaur M. Spinal injuries in juveniles. Necropsy findings in twelve cases. J Bone Joint Surg Br 1974; 56B:513-19.

192 Zabramski JM, Hadley MN, Browner CM. Pediatric spinal cord and vertebral column injuries. Barrow Neurol Inst Q

193 Lena G, Bollini G. Spinal injuries in children. In Choux M et al (eds) *Pediatric Neurosurgery*. London: Churchill Livingstone, 1999, pp. 381-91. pathophysiology of human spinal cord injury. *J Neurosurg* 1997; 86:483-92. 195 Yates PO. Birth trauma to the vertebral arteries. *Arch Dis Child* 1959; 34:436-41. 196 Bollini G. Thoracic and lumbar spine injuries in children. In Floman Y, Farcy JPC, Argenson C (eds) *Thoracolumbar Spine Fractures*. New York: Raven Press, 1993, pp. 307-25. 197 Holdsworth F. Fractures, dislocations and fracture-dislocations of the spine. *J Bone Joint Surg (Am)* 1971; 52A:1534-51. 198 Jones L. Birth trauma and the cervical spine. *Arch Dis Child* 1970; 45:147. 199 Towbin A. Latent spinal cord and brain stem injury in newborn infants. *Dev Med Child Neurol* 1969; 11:54-68. 200 Cullen JC. Spinal lesions in battered babies. *J Bone Joint Surgery (Br)* 1975; 57B:364-6. 201 Swischuk LE. Spine and spinal cord trauma in the battered child syndrome. *Radiology* 1969; 92:733-8. 202 Friedman G, Froom P, Sazbon L et al. Apolipoprotein E-epsilon4 genotype predicts a poor outcome in survivors of traumatic brain injury. *Neurology* 1999; 52:244-8. 203 Lichtman SW, Seliger G, Tycke B, Marder K. Apolipoprotein E and functional recovery from brain injury following postacute rehabilitation. *Neurology* 2000; 55:1536-9. 204 Utermann G, Langenbeck U, Beisiegel U, Weber W. Genetics of the apolipoprotein E system in man. *Am J Hum Genet* 1980; 32:339-47. 205 Mahley RW. Apolipoprotein E: cholesterol transport protein with expanding role in cell biology. *Science* 1988; 240:622-30. 206 Boyles JK, Pitas RE, Wilson E et al. Apolipoprotein E associated with astrocytic glia of the central nervous system and with nonmyelinating glia of the peripheral nervous system. *J Clin Invest* 1985; 76:1501-13. 207 Teasdale GM, Nicholl JA, Murray G, Fiddes M. Association of apolipoprotein E polymorphism with outcome after head injury. *Lancet* 1997; 350:1069-71. 208 Mattson MP. Cellular actions of beta-amyloid precursor protein and its soluble and fibrillogenic derivatives. *Physiol Rev* 1997; 77:1081-132. 209 Nicoll JA, Roberts GW, Graham DI. Apolipoprotein E epsilon 4 allele is associated with deposition of amyloid beta-protein following head injury. *Nature Med* 1995; 1:135-7.

15 Chapter 15. Heat-Induced Injury or Death

9 McLoughlin E, Marchione M, Hanger L et al. Smoke detector legislation: its effects on owner-occupier homes. *Am J Publ Health* 1985; 75:858-62.

10 Ahrens M. US Experience with Smoke Alarms and Other Fire Alarms. Atlanta, GA: Quincy (MA) National Fire Protection Association, 2004.

11 Miller R, Reisinger K, Blatter M, Wucher F. Pediatric counselling and subsequent use of smoke desecraters. *Am J Publ Health* 1982; 72:392-3.

12 Carlson A, Uden G, Karlsson ED. Burns injuries in small children, a population-based study in Sweden. *J Clin Nursing* 2006; 15:129-34.

13 Anderson RA, Watson AA, Harland WA. Fire deaths in the Glasgow area: general considerations and pathology. *Med Sci Law* 1981; 21:175-83.

14 Napier DH. Hazardous materials and the gases they produce. *Med Sci Law* 1977; 17:83-90.

15 Kojima T, Nishiyama Y, Yashiki M, Une I. Post mortem formation of carbon monoxide. *Forensic Sci Int* 1982; 19:243-4.

16 Anderson RA, Harland WA. Fire deaths in the Glasgow area: the role of hydrogen cyanide. *Med Sci Law* 1982; 22:35-40.

17 Hettiaratchy S, Dziewulski P. ABC of burns: pathophysiology and types of burns. *BMJ* 2004; 328:1427-9.

18 Knight B. Burns and scalds. In Knight B (ed.) *Forensic Pathology*, 2nd edn. London: Arnold, 1996, pp. 305-17.

19 Weaver AM, Himel MHM, Edlich RF. Immersion scald burns: strategies for prevention. *J Emerg Med* 1993; 11:397-402.

20 Erdmann T, Felman K, Rivara F et al. Tap water burn prevention: the effect of legislation. *Pediatrics* 1991; 88:572-7.

21 Smith GA, Knapp JF, Barnett TM, Shields BJ. The rockets' red glare, the bombs bursting in the air: fireworks-related injuries to children. *Pediatrics* 1996; 98:1-9.

22 D'Regenio P, Cafaro L, Santonasrasi F, Taggi F et al. Capodanno Senza Danno: the effects of an intervention program on fireworks injuries in Naples. *Am J Publ Health* 1996; 86:84-6.

23 Walker AR. Emergency department management of house fire burns and carbon monoxide poisoning in children. *Cur Opin Pediatr* 1996; 8:239-42. massive pediatric burns. An analysis of 103 children with 88% TBSA burns (70% full thickness). *Ann Surg* 1997; 225: 554-65, discussion 565-9.

25 Ayoub C, Pfeifer D. Burns as a manifestation of child abuse and neglect. *Am J Dis Child* 1979; 133:910-14.

26 Stone NH, Rinldop L, Humphrey CR et al. Child abuse by burning. *Surg Clin North Am* 1970; 50:1419-24.

27 Showers J, Garrison KM. Burn abuse; a four-year study. *J Trauma* 1988; 28:1581-3.

28 Hight DW, Bakalar HR, Lloyd J. Inflicted burns in children: recognition and treatment. *JAMA* 1979; 242:517-20.

29 Keen JH, Lendrum J, Wolman B. Inflicted burns and scalds in children. *BMJ* 1975; 4:268-9.

30 Hobbs CJ. When are burns not accidental? *Arch Dis Child* 1986; 61:357-61.

31 Lenoski EF, Hunter KA. Specific patterns of inflicted burns injuries. *J Trauma* 1977; 17:842.

32 Canady JW, Thompson SA, Bardach J. Oral commissure burns in children. *Plast Reconstruct Surg* 1996; 97:738-44, discussion 745, 746-55.

33 Luce E. Electrical burns. *Clin Plast Surg* 2000; 27:133-43.

34 Andronicus M, Oates RK, Peat J et al. Non-accidental burns in children. *Burns* 1998; 24:552-8.

35 Bengier JR, McCabe SE. Burns and scalds in pre-school children attending accident and emergency: accident or abuse? *Emerg Med J* 2001; 18:172-4.

36 Garcia CT, Smith GA, Cohen DM, Fernandez K. Electrical injuries in a pediatric emergency department. *Ann Emerg Med* 1995; 26:604-8.

37 Nguyen BH, MacKay M, Bailey B, Klassen TP. Epidemiology of electrical- and lightning-related deaths and injuries among Canadian children and youth. *Injury Prev* 2004; 10:122-4.

38 Jain S, Bandi V. Electrical and lightning injuries. *Crit Care Clin* 1999; 15:319-31.

39 Lee RC. Injury by electrical forces: pathophysiology, manifestations, and therapy. *Curr Probl Surg* 1997; 34:677-764.

40 Rai J, Jeschke MG, Barrow RE, Herndon DN. Electrical injuries: a 30-year review. *J Trauma* 1999; 46:933-6.

41 Bailey B, Gaudreault P, Thivierge RL, Turgeon JP. Cardiac monitoring of children with household electrical injuries. *Ann Emerg Med* 1995; 25:612-17.

16 Chapter 16. Asphyxial Deaths in Children

1 Tardieu A. Étude médico-légale sur les sévices et mauvais traitements exercés sur des enfants. Ann Hyg Publ Med Legale 1860; 13:361-98.

2 Luke JL. Conjunctival petechiae. N Engl J Med 1971; 284:1101.

3 Rao VJ, Wetli CW. The forensic significance of conjunctival petechiae. Am J Forensic Med Pathol 1986; 9:32-4.

4 Jaffe FA. Petechial haemorrhages. Am J Forensic Med Pathol 1994; 15:203-7.

5 Downes AJ, Crossland DS, Mellon AF. Prevalence and distribution of petechiae in well babies. Arch Dis Child 2002; 86:291-2.

6 Hood I, Ryan D, Spitz WU. Resuscitation and petechiae. Am J Forensic Med Pathol 1988; 9:35-7.

7 Beckwith JB. Intrathoracic petechial hemorrhages; a clue to the mechanism of death in SIDS. Ann N Y Acad Sci 1988; 533:37-47.

8 Krous HF, Jordan J. A necropsy study of distribution of petechiae in non-SIDS. Arch Pathol Lab Med 1984; 108:75-6.

9 Kleeman WJ, Wiechern V, Schuck M, Troger HD. Intrathoracic and subconjunctival petechiae in SIDS. Forensic Sci Int 1995; 72:49-52.

10 Bass M, Kravath RE, Glass L. Death-scene investigation in sudden infant death. N Engl J Med 1986; 315:100-5.

11 Iyasu I, Hanzlich R, Rowley D, Willinger M. Proceedings of 'Workshop on Guidelines for Scene Investigation of SIDS'. J Forensic Sci 1994; 39:1126-36.

12 CDC. Guidelines for death scene investigation of sudden, unexplained infant deaths: recommendations of the interagency panel on SIDS. MMWR 1996; 45:RR-10.

13 Haller JA, Donahoo JS. Traumatic asphyxia in children: pathophysiology and management. J Trauma 1971; 11:453-7.

14 Campbell-Hewson G, Egleston CV, Cope AR. Traumatic

asphyxia in children. *Accident Emerg Med* 1997; 14(1):47-9.

15 Sarihan H, Abes M, Akyazici R et al. Traumatic asphyxia in children. *Cardiovasc Surg* 1997; 38:93-5.

16 Holland AJA, Liang RWY, Singh SJ et al. Driveway motor vehicle injuries in children. *MJA* 2000; 173:192-5.

17 Brison RJ, Wicklund K, Mueller BA. Fatal pedestrian injuries to young children: a different pattern of injury. *Am J Public Health* 1988; 78:793-5.

18 Roberts I, Norton R, Jackson R. Driveway-related child pedestrian injuries; a case control study. *Pediatrics* 1995; 95:405-8.

19 Sumrall RE, Petty CS, Holman W. Temperature in closed automobiles in hot weather. *Forensic Sci Gazette* 1976; 7:7-8.

20 Surpure J. Heat-related illness and the automobile. *Ann Emerg Med* 1982; 11:263-5.

21 McGuirt WF, Holmes HD, Feehs R et al. Tracheo-bronchial foreign bodies. *Laryngoscope* 1988; 98:615-18.

22 Weissberg D, Schwartz I. Foreign bodies in the tracheobronchial tree. *Chest* 1987; 1:730-3.

23 Cleveland RH. Symmetry of bronchial angles in children. children following foreign body ingestion. *J Forensic Sci* 1996; 41:438-41. 25 Baharloo F, Veyckemans F, Francis C et al. Tracheo-bronchial foreign bodies: presentation and management in children and adults. *Chest* 1999; 115:1357-62. 26 Plastic bags (Editorial). *BMJ* 1959; 1:1463-4. 27 Knight B, Saukko P. *Forensic Pathology*, 3rd edn. Oxford: Oxford University Press, 2003. 28 The Bible, 1 Kings Ch. 3 v.19. 29 Templeman C. 258 cases of suffocation of children. *Edin Med J* 1891; 38:22-6. 30 Nakamura S, Wind M, Danello MA. Review of hazards associated with children placed in adult beds. *Arch Pediatr Adolesc Med* 1998; 153:1019-23. 31 Drago DA, Dannenberg AL. Infant mechanical suffocation deaths in the United States 1980-1997. *Pediatrics* 1999; 153:103-59. 32 O'Hara M, Harruff R, Smialek J, Fowler D. Sleep location and infant suffocation: how good is the evidence? *Pediatrics* 2000; 10:915-20. 33 Moore L, Byard RW. Pathological findings in hanging and wedging deaths in infants and young children. *Am J Forensic Med Pathol* 1993; 14:296-302. 34 Collins K. Death by overlaying and wedging: a 15-year retrospective study. *Am J Forensic Med Pathol*

2001; 15:155-9. 35 Mitchell E, Krous HF, Byard RW. Pathological findings in overlaying. *J Clin Forensic Med* 2002; 9:133-5. 36 Byard RW, Beal S, Bourne AJ. Potentially dangerous sleeping environment and accidental asphyxia in infancy and early childhood. *Arch Dis Child* 1994; 71:497-500. 37 Kirchner JT. Deaths associated with small children sleeping in adult beds. *Am Acad Fam Phy* 2000; March 1, www.aafp.org/afp. 38 Nakamura S, Wind M, Danello NA. The pediatric forum: should infants sleep with their parents? *Arch Pediatr Adolesc Med* 2000; 154:1171-3. 39 Nixon JW, Kemp AM, Levene S, Sibert JR. Suffocation, choking and strangulation in children in England and Wales; epidemiology and prevention. *Arch Dis Child* 1995; 72:6-10. 40 Rauchschalbe R, Mann NC. Pediatric window cord strangulations in the United States, 1981-95. *JAMA* 1997; 72:1696-8. 41 Sabo RA, Hanigan MC, Flessner K et al. Strangulation injuries in children. *J Trauma* 1996; 40:68-72. 42 Garros D, King WJ, Brady-Fryer B et al. Strangulation with intravenous tubing; a previously undecided adverse event in children. *Pediatrics* 2003; 111:732-4. 43 Emery JL, Taylor EM, Carpenter RG, Waite AJ. Apnoea monitors and accidental strangulation. *BMJ* 1992; 304:117. 44 Petruk J, Shiels E, Cummings GE, Francescutti LH. Fatal asphyxiations in children involving drawstrings in clothing. *Can Med Assoc J* 1996; 155:1417-19. 45 Byard RW, Marcopoulos D et al. Early adolescent suicide; a comparative study. *J Clin Forensic Med* 2000; 7:6-9. 46 Wyatt J, Wyatt PW, Squires T, Busuttil A. Hanging deaths in children. *Am J Forensic Med Pathol* 1998; 19:343-6. 47 Feldman KW, Simms RJ. Strangulation in children: epidemiology and clinical course. *Pediatrics* 1980; 65:1079-85. 48 Cooke CT, Cadden GA, Hilton JMN. Hanging deaths in children. *Am J Forensic Med Pathol* 1989; 10:98-104. 49 Uva JL. Autoerotic asphyxiation in the United States. *J Forensic Sci* 1995; 40:574-81. 50 Byard RW, Lipset J. Drowning deaths in toddlers and preambulatory children in South Australia. *Am J Forensic Med*

52 American Academy of Pediatrics Committee on Injury and Poison Prevention. Drowning in infants, children and adolescents. *Pediatrics* 1993; 92:292-4.

53 Wintemute GJ. Childhood drowning and near drowning in the United States. *Am J Dis Child* 1990; 144:663-9.

54 Byard RH. Covert video surveillance in Munchhausen syndrome by proxy - ethical compromise or essential technique? *Med J Aust* 1994; 160:352-6.

55 Rosen CL, Frost JD, Glaze DG et al. Child abuse and

recurrent infant apnea. *J Pediatr* 1986; 109:1065-7.

56 Southall DP, Stebbens VA, Rees SV. Apnoeic episodes induced by smothering. Two cases identified by covert video surveillance. *BMJ* 1987; 294:1637-41.

57 Samuels MP, McLaughlin W, Jacobson RR. Fourteen cases of imposed airway obstruction. *Arch Dis Child* 1992; 67:162-79.

58 Byard RW, Burnell RH. Covert video surveillance in Munchausen syndrome by proxy: ethics compromise or essential technique? *Med J Austr* 1994; 160:352-4.

59 Southall DP, Plunkett MCB, Banks MM et al. Covert video recordings of life-threatening child abuse: lessons for child protection. *Pediatrics* 1997; 100:735-60.

60 Foreman DM, Farsides C. Ethical use of covert videoing techniques in detecting Munchausen syndrome by proxy. *BMJ* 1993; 307:611-13.

61 Thomas T. Covert video surveillance. *New Law J* 1994; 114:96-7.

62 Shabde N, Kraft AW. Covert video surveillance: an important investigative tool or a breach of trust? *Arch Dis Child* 1999; 81:291-4. 63 Recurrent apparent life-threatening events and intentional suffocation (Editorial). *Arch Dis Child* 1999; 81:189. 64 Friberg TR, Weimreb RN. Ocular manifestations of gravity inversion. *JAMA* 1985; 253:1755-7. 65 Busuttil A, Obafunwa J. Recreational abdominal suspension: a fatal practice. A case report. *Am J Forensic Med Pathol* 1993; 14:141-4. 66 Towner E, Errington G. The Epidemiology of Choking in Childhood and Implications for Prevention. A report prepared for the Department of Health in London, 2002. 67 Amanuel B, Byard RW. Accidental asphyxia in severely disabled children. *J Paediatr Child Health* 2000; 36 :66-8. 68 Beal SM, Byard RW. SIDS in South Australia 1968-97. Part 3: Is bed sharing safer in infants? *J Paediatr Child Health* 2000; 36:552-4. 69 Byard RW, Beal SM. 'V'-shaped pillows and unsafe infant sleeping. *J Paediatr Child Health* 1997; 33:171-3. 70 Byard RW, Bourne AJ, Beal SM. Mesh side cots: yet another potentially dangerous infant sleeping environment. *Forensic Sci Int* 1996; 83:105-9. 71 Moore L, Bourne AJ, Beal S et al. Unexpected infant death in association with suspended rocking cradles. *J Forensic Med Pathol* 1995; 16:177-80. 72 Byard RW, Beal SM, Simpson A et al. Accidental infant deaths and stroller prams. *Med J Aust* 1996; 165:140-1. 73

Byard RW. Is co-sleeping in infancy a desirable or dangerous practice? J Paediatr Child Health 1994; 30:198-9.

74 Byard RW. Is breast feeding in bed always a safe practice? J Paediatr Child Health 1998; 38:498-9. 75

Scragg R, Mitchell EA, Taylor A et al. Bed sharing, smoking and alcohol in the SIDS. BMJ 1993; 307:1312-18.

17 Chapter 17. Accidental Injuries in Children

4 Malek M, Chang BH, Gallagher SS, Guyer B. The cost of medical care for injuries to children. *Ann Emerg Med* 1991; 20:997-1005.

5 Barber MA, Sibert JR. Diagnosing physical child abuse: the way forward. *Postgrad Med J* 2000; 76:743-9.

6 Moyer LA, Boyle CA, Pollack DA. Validity of death certificates for injury-related causes of death. *Am J Epidemiol* 1989; 130:1024-32.

7 MacIntyre CR, Ackland MJ, Chandraraj EJ. Accuracy of injury coding in Victorian hospital morbidity data. *Aust NZ J Publ Health* 1997; 2:779-83.

8 Walton W, Jarvis SN, Lowe PJ et al. Annual incidence of unintentional injury among 54,000 children. *Injury Prev* 1996; 2:16-20.

9 Towner EM, Jarvis SN, Walsh SS, Aynsley-Green A. Measuring exposure to injury risk in school children aged 11-14. *BMJ* 1994; 308:449-52.

10 Levene S. Coroners' records of accidental deaths. *Arch Dis Child* 1991; 66:1239-41.

11 Murdock R, Eva J. Home accidents to children under 15 years: a survey of 910 cases. *BMJ* 1974; 3:103-6.

12 Lenaway DL, Ambler AG, Beaudoin DE. The epidemiology of school-related injuries: new perspectives. *Am J Prev Med* 1992; 8:193-8.

13 Laflamme L, Menckel E. School injuries in an occupational health perspective: what do we learn from community based epidemiological studies? *Injury Prev* 1997; 3:50-6.

14 Hammarstrom A, Janlert U. Epidemiology of school injuries in the northern part of Sweden. *Scan J Soc Med* 1994; 22:120-6.

15 Alwash R, McCarthy M. Accidents in the home among children under 5: ethnic differences or social disadvantage? *BMJ* 1988; 296:1450-3.

16 Avery JG, Vaudin JN, Fletcher JL, Watson JM.

Geographical and social variations in mortality due to childhood accidents in England and Wales 1975-84. *Publ Health* 1990; 104:171-82.

17 Campbell H, O'Driscoll S. The epidemiology of leisure accidents in Scotland. *Health Bulletin* 1995; 53:280-3.

18 Hapgood R, Kendrick D, Marsh P. How well do sociodemographic characteristics explain variation in childhood safety practices? *J Publ Health Med* 2000; 113:285-9.

19 David RM, Pless LB. BMJ bans 'accidents'. Accidents are not unpredictable. *BMJ* 2001; 332:1321-2.

20 Guyer B, Gallagher S, Chang B et al. Prevention of childhood injuries: evaluation of the Statewide Childhood Injury Prevention Program (SCIIPP). *Am J Publ Health* 1989; 79:1521-7.

21 Gielen A, Wilson M, McDonald E et al. Randomised trial of enhanced anticipatory guidance for injury prevention. *Arch Pediatr Adolesc Med* 2001; 155:42-9.

22 Botting B, Crawley R. Trends and patterns in childhood mortality and morbidity. In Botting B (ed.) *The Health of Our Children: a review in the mid-1990s*. Decennial supplement OPCS DS No. 11, 62-81. London: Office of Population Censuses and Surveys, 1995.

23 King A, Wold B, Tudor Smith C, Harel Y. *The Health of Youth; a Cross-national Survey*. WHO regional Publications, European Series No. 69, WHO, 1966.

24 Bijur P, Golding J, Haslum M, Kurzon M. Behavioural predictors of injury in school-age children. *Am J Dis Child* 1988; 142:1307-12.

25 Waller AE, Marshall SW. Childhood thermal injuries in New Zealand resulting in death and hospitalization. *Burns* 1993; on public playgrounds. *Arch Dis Child* 1994; 71:328-30. 27 Kujala UM, Taimela S, Antti-Poika I et al. Acute injuries in soccer, ice hockey, volleyball, basketball, judo and karate: analysis of national registry data. *BMJ* 1995; 311:1465-8. 28 Swan P. *British Schools, Safety Incidents and The Courts*. www.articlecity.com/articles/legal/article_385.shtml. 29 Lane K. General Defences Relevant to the Tort of Negligence. www.city.londonmet.ac.uk/~shlane/Generaldefences.htm. 30

Kendrick D, Marsh P. Babywalkers: prevalence of use and relationship with other safety practices. *Injury Prev* 1998; 4:295-8. 31 Spiegel C, Lindaman F. Children can't fly: a program to prevent childhood morbidity and mortality from window falls. *Am J Publ Health* 1977; 67:1143-7. 32 Christie N. Social, Economic and Environmental Factors in Child Pedestrian Accidents: a Research Review. Project Report 116 & 117. Crowthorne, Berkshire: Transport Research Laboratory, 1995. 33 Lawson SD, Edwards PJ. The involvement of ethnic minorities in road accidents: data from three studies of young pedestrian casualties. *Traffic Eng Control* 1991; 32:12-19. 34 Boxall JA. School crossing patrols: how effective are they? *Traffic Eng Control* 1988; 29:586. Report CR192. Crowthorne, Berkshire: Transport and London: Department of Transport. 35 Christie N. Social Economic and Environmental Factors in Child Pedestrian Accidents: A Research Review. Project Report no. 116. Crowthorne, Berkshire: Road Research Laboratory, 1995. 36 Jorgensen E. Bicycle tracks in urban areas in Denmark. Evaluation of the effect on safety. In Biecheler M, Lacombe C, Muhlrad N (eds) *Evaluation 85: International Meeting on the Evaluation of Local Traffic Safety Measures, Proceedings of the Paris Conference, 20-23 May 1985*, pp. 755-61. 37 Bicycle Helmet Safety Institute, 1995. <http://www.bhsi.org/webdocs/henderson.htm>. 38 Cameron M, Heiman L, Neiger D. Evaluation of the Bicycle Helmet Wearing Law in Victoria During its First 12 Months. Report No. 32. Victoria, Australia: Accident Research Centre, Monash University, 1992. 39 Vulcan A, Cameron M, Watson W. Mandatory bicycle helmet use: experience in Victoria, Australia. *World J Surg* 1992; 16:389-97. 40 Finch C, Newstead S, Cameron M, Vulcan A. Head Injury Reductions in Victoria Two Years After Introduction of Mandatory Bicycle Helmet Use. Report No. 51. Victoria, Australia: Accident Research Centre, Monash University, 1993. 41 Cameron M, Vulcan A, Finch C, Newstead S. Mandatory bicycle helmet use following a decade of helmet promotion in Victoria, Australia - an evaluation. *Accident Anal Prev* 1994; 26:325-37. 42 McDermott F. Bicyclist head injury prevention by helmets and mandatory wearing legislation in Victoria, Australia. *Ann R C Surg Engl* 1995; 77:38-44. 43 Puczynski M, Marshall D. Helmets! All the pros wear them. *Am J Dis Child* 1992; 146:1465-7. 44 Lee A, Mann N, Takriti R. A hospital-led promotion campaign aimed to increase bicycle helmet-wearing among children aged 11-15 living in West Berkshire 1992-98. *Injury Prev* 2000; 6:151-3. 45 Britt J, Silver I, Rivara F. Bicycle helmet promotion among low income preschool children. *Injury Prev* 1998; 4:280-3. 46 Abularrage J, De Luca A, Abularrage C. Effect of education and legislation on bicycle helmet use in a multiracial

population. Arch Pediatr Adolesc Med 1997; 151:41-4. 47
Dannenberg A, Gielen A, Beilenson P et al. Bicycle helmet
83:667-74.

48 MacKay M. Playground injuries. Injury Prev 2003; 9:194-6.

49 Chalmers DJ, Marshall SW, Langley JD et al. Height and
surfacing as risk factors for injury in falls from
playground equipment: a case control study. Injury Prev
1996; 2:98-104.

50 Laforest S, Robitaille, Lesage D et al. Surface
characteristics, equipment height, and the occurrence and
severity of playground injuries. Injury Prev 2001; 7:35-40.

51 Platt SL, Fine JS, Foltin GL. Escalator-related injuries
in children. Pediatrics 1997; 100:E2.

52 Lillis KA, Jaffe DM. Playground injuries in children.
Pediatr Emerg Care 1997; 13:149-53.

53 Laforest S, Robitaille Y, Dorval D et al. Severity of
fall injuries on sand or grass in playgrounds. J Epidemiol
Community Health 2000; 54:475-7.

54 Roseveare CA, Brown JM, Barclay McIntosh JM, Chalmers
DJ. An intervention to reduce playground equipment hazards.
Injury Prev 1999; 5:124-8.

55 Sosin D. Surface-specific fall injury rates on Utah
school playgrounds. Am J Publ Health 1993; 83:733-5.

56 Mott A, Rolfe K, James R et al. Safety of surfaces and
equipment for children in playgrounds. Lancet 1997;
349:1874-6.

57 Subvert JR, Mott A, Rolfe K et al. Preventing injuries
in public playgrounds through partnership between health
services and local authority: community interwoven study.
BMJ 1999; 318:1595-8.

58 Mayr J, Russel O, Spitzer P et al. Playground accidents.
Acta Paediatr 1995; 84:573-6.

59 Macarthur C, Hu X, Wesson DE, Parkin PC. Risk factors
for severe injuries associated with falls from playground
equipment. Accident Anal Prev 2000; 32:377-82.

60 Langran MA. Summary of the research presented at the
16th International Symposium of the ISSS held in at Mount

Arai, Japan, April 2005. www.ski-injury.com.

61 Barone GW, Rodgers BM. Pediatrics equestrian injuries: a 14-year review. *J Trauma* 1989; 29:245-7.

62 Bond GR, Christoph RA, Rodgers BM. Pediatric equestrian injuries; assessing the impact of helmet use. *Pediatrics* 1995; 95:487-9.

63 Holland AJA, Roy V, Goh V et al. Horse-related injuries in children. *Med J Aust* 2001; 175:609-11.

64 Ghosh A, Di Scala C, Drew C et al. Horse-related injuries in pediatric patients. *J Pediatr Surg* 2000; 35:1766-9.

65 Aronson H, Tough SC. Horse-related fatalities in the province of Alberta 1975-1980. *Am J Forensic Med Pathol* 1993; 14:28-30.

66 Chitnavis JP, Gibbins CLMH, Hirigoyen M et al. Accidents with horses. What has changed in 20 years? *Injury* 1996; 27:103-5.

67 Byard RW, Gilbert J, Lipset J, James R. Farm- and tractor-related fatalities in South Australia. *J Pediatr Child Health* 1998; 32:139-41.

68 Cogbill TH, Busch HM, Stiers GR. Farm accidents in children. *Pediatrics* 1986; 76:562-6.

69 Rivara FP. Fatal and non-fatal farm injuries in the United States. *Pediatrics* 1985; 76:567-73.

70 Cameron D, Bishop C, Sibert JR. Farm accidents in children. *BMJ* 1992; 305:23-5.

71 Millward LM, Morgan A, Kelly MP. NHS Health Development Agency. Health Development Agency. Prevention and Reduction of Accidental Injury in Children and Older People. Evidence briefing, June 2003.

72 Grayling T, Hallam K, Graham D et al. Streets Ahead: Safe and Liveable Streets for Children. London: Institute for Public Preventing Unintentional Injuries in Children and Young Adolescents? An Updated Systematic Review. London: Health Development Agency, 2001. 74 Svanström L, Haglund BJA. Evidence-based Safety Promotion and Injury Prevention - an Introduction. Department of Public Health Sciences, Division of Social Medicine, Karolinska

Institutet, Stockholm, Sweden, 2000. 75 Anonymous. Solvent abuse: Little progress after 20 years (Editorial). *BMJ* 1990; i:300. 76 McKeganey N, Norrie J. Association between illegal drugs and weapon carrying in young people in Scotland; schools' survey. *BMJ* 2000; 320:982-4. 77 Joseph DE, Parker S. Inhalants. *Drugs of Abuse*. New York: United States Drug Enforcement Administration, 2005. 78 First Nations and Inuit Health Committee, Canadian Paediatric Society (CPS). Inhalant abuse. *Paediatr Child Health* 1998; 3:123-6. 79 Shepherd RT. Mechanism of sudden death associated with volatile substance abuse. *Hum Toxicol* 1989; 8:287-91. 80 Anderson HR, MacNair RS, Ramsey JD. Deaths from abuse of substances: a national epidemiological study. *BMJ* 1985; 290:304-7. 81 www.toxlab.co.uk/volatile.htm and www.toxlab.co.uk/dasguide.htm. 82 Sibert JR, Clarke AJ, Mitchell MP. Improvements in child resistant containers. *Arch Dis Child* 1985; 60:1155-7. 83 Rodgers G. The safety effects of child-resistant packaging for oral prescription drugs: two decades of experience. *JAMA* 1986; 275:1661-5. 84 Isolauri E, Huurre A, Salminen S, Impivaara O. The allergy epidemic extends beyond the past few decades. *Clin Exp Allergy* 2004; 34 :1007-10. 85 Host A, Halken S. A prospective study of cow milk allergy in Danish infants during the first 3 years of life. Clinical course in relation to clinical and immunological type of hypersensitivity reaction. *Allergy* 1990; 45:587-96. 86 Sampson HA, Scanlon SM. Natural history of food hypersensitivity in children with atopic dermatitis. *J Pediatr* 1989; 115:23-7. 87 Bock SA, Atkins FM. The natural history of peanut allergy. *J Allergy Clin Immunol* 1989; 83:900-4. 88 Pumphrey RS. Lessons for management of anaphylaxis from a study of fatal reactions. *Clin Exp Allergy* 2000; 8:1144-50. 89 Pallares D. Allergy to macadamia nut. *Ann Allergy Asthma Immunol* 2000; 85:385-6. 90 Yunginger JW, Sweeney KG, Sturmer WQ et al. Fatal food-induced anaphylaxis. *JAMA* 1988; 260:1450-2. 91 Sampson HA, Mendelson L, Rosen JP. Fatal and near-fatal anaphylactic reactions to food in children and adolescents. *N Engl J Med* 1992; 327:380-4. 92 Bock SA, Munoz-Furlong A, Sampson HA. Fatalities due to anaphylactic reactions to foods. *J Allergy Clin Immunol* 2001; 1:191-3. 93 Yunginger JW, Nelson DR, Squillace DL et al. Laboratory investigation of deaths due to anaphylaxis. *J Forensic Sci* 1991; 36:857-65. 94 Simons FE, Chan ES, Gu X, Simons KJ. Epinephrine for the out-of-hospital [first aid] treatment of anaphylaxis in infants: is the ampoule, syringe, needle method practical? *J Allergy Clin Immunol* 2001; 108:1040-4. 95 Simons FE, Gu X, Silver NA, Simons KJ. EpiPen Jr versus EpiPen in young children weighing 15 to 30 kg at risk for anaphylaxis. *J Allergy Clin Immunol* 2002; 109:171-5.

18 Chapter 18. Drowning and Near Drowning

- 1 Centers for Disease Control and Prevention (CDC). Nonfatal and fatal drownings in recreational water settings - United States, 2001-2002. *MMWR* 2004; 53:447-52.
- 2 Meyer RJ, Theodorou AA, Berg RA. Childhood drowning. *Pediatr Rev* 2006; 27:163-9.
- 3 Fingerhut LA, Cox CS, Warner M. International comparative analyses of injury mortality. Findings from the ICE on injury statistics. International Collaborative Effort on Injury Statistics. *Adv Data* 1998; 303:1-20.
- 4 Peden MM, McGee K. The epidemiology of drowning worldwide. *Injury Cont Safety Promotion* 2003; 10:195-9.
- 5 Laraque D, Barlow B, Durkin M. Prevention of youth injuries. *J Natl Med Assoc USA* 1999; 91:557-71.
- 6 Australian Institute of Health and Welfare. Australia's Health 2000. The Seventh Biennial Health Report of the Australian Institute of Health and Welfare. 4.2 Children and Young People. Canberra: Aust Inst Health Welfare (AIHW Cat. No. 19), 2000, pp. 184-92.
- 7 Byard RW. Accidental childhood death and the role of the pathologist. *Pediatr Dev Pathol* 2000; 3:405-18.
- 8 Pearn JH, Nixon J. An analysis of the causes of freshwater immersion accidents involving children. *Accident Anal Prev* 1979; 11:173-8.
- 9 Collins KA, Nichols CA. A decade of pediatric homicide: a retrospective study at the Medical University of South
Characteristic features of suicidal drownings: a 20-year study. *Am J Forensic Med Pathol* 2001; 22:134-8. 11 Pearn JH. Drowning. In Pearn J, Leditschke JF, Marshall V et al. *The Science of First Aid. Theoretical and Experimental Basis of Modern First Aid Practice*. Canberra: St John Ambulance Australia, 1996, pp. 138-47. 12 Ludes B, Coste M, North N et al. Diatom analysis in victim's tissues as an indication of the site of drowning. *Int J Legal Med* 1999; 112:163-6. 13 Pearn JH. The management of near drowning. In Aochi O, Amaha A, Takeshita H (eds) *Intensive Critical Care Medicine*. Amsterdam: Excerpta Medica, 1990, pp. 139-46. 14 Mukaida M, Kimura H, Takada Y. Detection of bathsalts in the lungs of a baby drowned in a bathtub: a case report. *Forensic Sci Int* 1998; 93:5-11. 15 Modell JH, Bellefleur M, Davis JH. Drowning without aspiration: is this an

- appropriate diagnosis? *J Forensic Sci* 1999; 44:1119-23. 16 Gilbert FF, Gofton N. Terminal dives in mink, muskrat and beaver. *Physiol Behav* 1982; 28:835-40. 17 Pearn JH. Drowning. In Dickermann JD, Lucey JF (eds) *The Critically Ill Child*, 3rd edn. Philadelphia, PA: WB Saunders, 1985, pp. 129-56. 18 Gooden BA. Mechanism of the human diving response. *Integrative Physiol Behav Sci* 1994; 29 :6-16. 19 Torre C, Varetto L, Tappi E. Scanning electron microscopic ultrastructural alterations of the pulmonary alveolus in experimental drowning. *J Forensic Sci* 1983; 28:1008-12. 20 Gu MN, Xiao JF, Huang YR et al. Study of direct injury by seawater in canine models. *Di Yi Jun Yi Da Xue Xue Bao* 2003; 23:201-5. 21 Tabata N, Morita M, Azumi J. A frozen newborn infant: froth in the air-passage after thawing. *Forensic Sci Int* 2000; 24:67-74. 22 Gotohda T, Kubo S, Kitamura O et al. HSP70 and c-Fos expression of brain stem hypoglossal nucleus in drowning. *J Med Invest* 2000; 47:76-9. 23 Sachdeva RC. Near drowning. *Crit Care Clin* 1999; 15:281-96. 24 Heinemann A, Puschel K. Discrepancies in homicide statistics by suffocation. *Arch Kriminol* 1996; 197:129-41. 25 Norman MG, Smialek JE, Newman DE, Horembala EJ. The post-mortem examination on the abuse child. Pathological, radiographic, and legal aspects. *Perspect Pediatr Pathol* 1984; 8:313-43. 26 Saunders E. Neonaticides following 'secret' pregnancies: seven case reports. *Public Health Rep* 1989; 104:368-72. 27 Shiono H, Maya A, Tabata N et al. Medicolegal aspects of infanticide in Hokkaido District, Japan. *Am J Forensic Med Pathol* 1986; 7:104-6. 28 Scott PD. Fatal battered baby cases. *Med Sci Law* 1973; 13:197-206. 29 Kondo T, Ohshima T. Retrospective investigation of medicolegal autopsy cases involving mentally handicapped individuals. *Nippon Hoigaku Zasshi* 1995; 49:478-83. 30 Geertinger P, Voigt J. Death in the bath. A survey of bathtub deaths in Copenhagen, Denmark and Gothenburg, Sweden. *J Forensic Med* 1970; 17:136-47. 31 Bourget D, Gagne P. Maternal filicide in Quebec. *J Am Psychiatry Law* 2002; 30:345-51. 32 Rouge-Maillart C, Jousset N, Gaudin A et al. Women who kill their children. *Am J Forensic Med Pathol* 2005; 26:320-6. 33 Vanamo T, Kauppi A, Karkola K et al. Intra-familial child homicide in Finland 1970-1994: incidence, causes of death and demographic characteristics. *Forensic Sci Int* 2001; 117:199-204. 34 DiMaio VJ. Homicidal asphyxia. *Am J Forensic Med Pathol childhood. Arch Pediatr Adolesc Med* 1996; 150:298-303.
- 36 Schmidt P, Grass H, Madea B. Child homicide in Cologne (1985-94). *Forensic Sci Int* 1996; 31:131-44.
- 37 Scott PH, Eigen H. Immersion accidents involving pails

of water in the home. *J Pediatr* 1980; 96:282-4.

38 Walker S, Middelkamp JN. Pail immersion accidents. *Clin Pediatr* 1981; 20:341-3.

39 Copeland AR. Suicide by drowning. *Am J Forensic Med Path* 1987; 8:18-22.

40 Schmidt P, Madea B. Homicide in the bathtub. *Forensic Sci Int* 1995; 72:135-46.

41 Pearn JH, Brown H, Wong R, Bart R. Bathtub drownings: report of seven cases. *Pediatrics* 1979; 64:68-70.

42 Kemp AM, Mott AM, Sibert JR. Accidents and child abuse in bathtub submersions. *Arch Dis Child* 1994; 70:435-8.

43 Pearn J. Predisposing factors leading to child trauma. *J Epidemiol Comm Hlth* 1978; 32:190-3.

44 Byard RW, deKoning C, Blackbourne B et al. Shared bathing and drowning in infants and young children. *J Pediatr Child Health* 2001; 37:542-4.

45 Somers GR, Chiasson DA, Smith CR. Pediatric drowning: a 20year review of autopsied cases: III Bathtub drownings. *Am J Forensic Med Pathol* 2006; 27:113-16.

46 Sibert J, John N, Jenkins D et al. Drowning of babies in bath seats: do they provide false reassurance? *Child Care Health Dev* 2005; 31:255-9.

47 Nixon J, Pearn J. Non-accidental immersion in the bath: another extension to the syndrome of child abuse and neglect. *Child Abuse Neglect* 1977; 1:455-8.

48 Griest KJ, Zumwalt RE. Child abuse by drowning. *Pediatrics* 1989; 83:41-6.

49 Marleau JD, Roy R, Laporte L et al. Infanticide committed by the mother. *Can J Psychiatry* 1995; 40:142-9.

50 Pearn JH, Nixon J. Swimming pool immersion accidents. An analysis from the Brisbane Drowning Study. *Med J Aust* 1977; 1:432-7.

51 Brenningstall GN. Mortality in pediatric epilepsy. *Pediatr Neurol* 2001; 25:9-16.

52 Pearn J, Bart R, Yamaoka R. Drowning risks to epileptic

children. A study from Hawaii. *BMJ* 1978; 4:1284-5.

53 Wilkey I, Pearn J, Petrie G, Nixon J. Neonaticide, infanticide and child homicide. *Med Sci Law* 1982; 22:31-5.

54 Wilkinson JL. Sudden cardiac death in childhood and adolescence. *J Paediatr Child Health* 1994; 30:384-5.

55 Somers GR, Smith CR, Wilson GJ et al. Association of drowning and myocarditis in a pediatric population: an autopsy-based study. *Arch Pathol Lab Med* 2005; 129:205-9.

56 Stumpp JW, Schneider J, Bar W. Drowning of a girl with anomaly of the bundle of His and the right bundle branch. *Am J Forensic Med Pathol* 1997; 18:208-10.

57 Schmidt P, Madea B. Death in the bathtub involving children. *Forensic Sci Int* 1995; 72:147-55.

58 Lunt DWR, Rose AG. Pathology of the human heart in drowning. *Arch Pathol Lab Med* 1987; 111:939-42.

59 Pearn JH, Brown J, Hsia EY. Swimming pool drownings and near-drownings involving children. A total population study from Hawaii. *Milit Med* 1980; 145:15-18.

60 Brenner RA, Trumble AC, Smith GS et al. Where children drown, United States, 1995. *Pediatrics* 2001; 108:85-9.

61 Brenner RA, Saluja G, Smith GS. Swimming lessons, swimming ability and the risk of drowning. *Injury Cont Safety Promotion* 2003; 10:211-16.

62 Moran K, Stanley T. Parental perceptions of toddler water safety, swimming ability and swimming lessons. *Int J Cont MMWR* 1992; 41:329-31. 64 Patrick M, Bint M, Pearn J. Saltwater drowning and near-drowning accidents involving children. *Med J Aust* 1979; 1:61-4. 65 Schulpen TW. Migration and child health: the Dutch experience. *Eur J Pediatr* 1996; 155:351-6. 66 Pearn JH. The sea, stingers and surgeons: the surgeon's role in prevention, first aid and management of marine envenomations. *J Paediatr Surg* 1995; 30:105-10. 67 Pearn JH. Survival rates after serious immersion accidents in childhood. *Resuscitation* 1978; 6:271-8. 68 Henderson H, Wilson RC. Water incident related hospital activity across England between 1997/8 and 2003/4: a retrospective descriptive study. *BMC Public Health* 2006; 16:210. 69 Wintemute GJ, Kraus JF, Teret SP et al. Deaths resulting from motor vehicle immersions: the nature of the injuries, personal and environmental contributing factors

and potential interventions. *Am J Publ Health* 1990; 80:1068-70. 70 Smith GS, Langley JD. Drowning surveillance: how well do E codes identify submersion fatalities. *Injury Prev* 1998; 4:135-9. 71 Start RD, Delargy-Aziz Y, Dorries CP et al. Clinicians and the coronial system: ability of clinicians to recognise reportable deaths. *BMJ* 1993; 306:1038-41. 72 James DS, Leadbeatter S. Detecting homicide in hospital. *J R Coll Physicians Lond* 1997; 31:296-8. 73 Fornes P, Pepin G, Heudes D, Lecomte D. Diagnosis of drowning by combined computer-assisted histomorphometry of lungs with blood strontium determination. *J Forensic Sci* 1998; 43:772-6. 74 Puschel K, Schulz F, Darrmann I, Tsokos M. Macromorphology and histology of intramuscular haemorrhages in cases of drowning. *Int J Legal Med* 1999; 112:101-6. 75 Hooper WD, Johnson LP. Antiepileptic drugs: pharmacology and therapeutics. In Eadie MJ, Vajda FJ (eds) *Handbook of Experimental Pharmacology*. Berlin: Springer-Verlag, 1999, pp. 173-83. 76 Azparren JE, Vallejo G, Reyes E et al. Study of the diagnostic, chloride, haemoglobin and diatoms in immersion cases. *Forensic Sci Int* 1998; 91:123-32. 77 Boles JM, Mabilille S, Scheydecker JL et al. Hypoglycaemia in salt water near-drowning victims. *Intensive Care Med* 1988; 14:80. 78 Zhu BL, Ishida K, Quan L et al. Post-mortem urinary myoglobin levels with reference to the causes of death. *Forensic Sci Int* 2001; 115:183-8. 79 Pollanen MS. Diatoms and homicide. *Forensic Sci Int* 1998; 9:29-34. Further Reading DROWNING: PATHOLOGY AND PATHOPHYSIOLOGY Colebatch HJH, Halmagyi DFJ. Reflex pulmonary hypotension of fresh-water aspiration. *J Appl Physiol* 1963; 18:179-85. [A classic paper] Gooden B. Why some people do not drown. *Med J Aust* 1992; 157:629-32. Modell JH. *The Pathophysiology and Treatment of Drowning and Near-drowning*. Springfield, IL: Charles C. Thomas, 1971. [A classic book] Pearn JH. Drowning and near-drowning. In Black JA (ed.). *Paediatric Emergencies*, 2nd edn. London: Butterworths, 1987, pp. 40-9.

DROWNING: EPIDEMIOLOGY

Brenner BA, Smith GS, Overpeck MD. Divergent trends in childhood

drowning rates. *JAMA* 1994; 271:1606-8.

Langley JD, Smeijers J. Injury mortality among children and teenagers in New Zealand compared with the United States of America. *Injury Prev* 1997; 3:195-9.

Lifesaving Society (Canada). The National [Canada] Drowning Report, 1997 edn. Ottawa: Lifesaving Soc. (Canada), 1997.

Lindholm P, Steensberg J. Epidemiology of unintentional drowning

and near-drowning in Denmark in 1995. *Injury Prev* 2000;

6:29-31.

Nixon J, Pearn J, Wilkey I, Corcoran A. 15 years of child drowning.

A 1967-81 analysis of all fatal cases from the Brisbane Drowning

Study and an 11-year study of consecutive near-drowning cases.

Accident Anal Prev 1986; 18:199-203.

Pearn JH, Wong RYR, Brown J et al. Drowning and near-drowning

involving children. A five-year total population study from the

City and County of Honolulu. *Am J Publ Hlth* 1979; 69:450-4.

Royal Life Saving Society Australia. The National Drowning Report

2001. Sydney: Royal Life Saving Society Australia, 2001,

pp. 1-7. DROWNING: FORENSIC CONCOMITANTS Boles JM, Mabilille S, Scheydecker JL, Garo B, Garee M. Hypoglycaemia in salt water near-drowning victims. *Intens Care Med* 1988; 14:80. Cummings P, Quan L. Trends in unintentional drowning: the role of alcohol and medical care. *JAMA* 1999; 281:2198-202. Lunt DW, Rose AG. Pathology of the human heart in drowning. *Arch Pathol Lab Med* 1987; 111:939-42. Orlowski JP. Drowning, near-drowning, and ice-water submersions. *Pediatr Clin North Am* 1987; 34:75-92. Pearn J. Aquatics for epileptic children. *Aust Paediatr J* 1982; 18:255-6. Pearn J. Drowning and alcohol. *Med J Aust* 1984; 141:6-7. Pearn J, Bart R, Yamaoka R. Drowning risks to epileptic children. A study from Hawaii. *BMJ* 1978; 4:1284-5. Wilkinson JL. Sudden cardiac death in childhood and adolescence. *J Paediatr Child Health* 1994; 30:384-5.

19 Chapter 19. Sudden Death of Children in Hospital

- 14 Grey TC, Mittleman RE, Wetli CV, Horowitz S. Aorto-esophageal fistula and sudden death. A report of two cases and review of the literature. *Am J Forensic Med Pathol* 1988; 9:19-22.
- 15 Cohle SD, Colby T. Fatal hemoptysis from Behcet's disease in a child. *Cardiovasc Pathol* 2002; 11:296-9.
- 16 Lashley PM, Ramesh J, Ferdinand S. Spontaneous rupture of the spleen. *West Indian Med J* 1998; 47:172-3.
- 17 Vidyashankar C, Basu A, Kulkarni AR, Choudhury RK. Spontaneous rupture of spleen in falciparum malaria. *Indian J Gastroenterol* 2003; 22:101-2.
- 18 Koszyca B, Moore L, Byard RW. Lethal manifestations of neurofibromatosis type 1 in childhood. *Pediatr Pathol* 1993; 13:573-81.
- 19 Ashkenazi S, Leibovici L, Samra Z et al. Risk factors for mortality due to bacteremia and fungemia in childhood. *Clin Infect Dis* 1992; 14:949-51.
- 20 Lascari AD, Pearce JM, Swanson H. Sudden death due to disseminated cryptococcosis in a child with leukemia in remission. *South Med J* 1997; 90:1253-4.
- 21 Brown AP, Khan K, Sinclair S. Bacterial toxicosis/toxic shock syndrome as a contributor to morbidity in children with burn injuries. *Burns* 2003; 29:733-8.
- 22 Doctor A, Harper MB, Fleisher GR. Group A beta-hemolytic streptococcal bacteremia: historical overview, changing incidence, and recent association with varicella. *Pediatrics* 1995; 96:428-33.
- 23 Hidalgo-Carballal A, Suarez-Mier MP. Sudden unexpected death in a child with varicella caused by necrotizing fasciitis and streptococcal toxic shock syndrome. *Am J Forensic Med Pathol* 2006; 27:93-6.
- 24 Tseng HW, Liu CC, Wang SM et al. Complications of varicella in children: emphasis on skin and central nervous system disorders. *J Microbiol Immunol Infect* 2000; 33:248-52.
- 25 Yang YJ, Liu CC, Wang SM et al. Streptococcal toxic

shock syndrome complicating varicella in children. J Formos Med Assoc 1997; 96:749-53.

26 Buck JR, Connors RH, Coon WW et al. Pulmonary embolism in children. J Pediatr Surg 1981; 16:385-91.

27 Byard RW, Cutz E. Sudden and unexpected death in infancy and childhood due to pulmonary thromboembolism. An autopsy study. Arch Pathol Lab Med 1990; 114:142-4.

28 de la Grandmaison GL, Durigon M. Pulmonary embolism: a rare cause of sudden infant death. Am J Forensic Med Pathol 2002; 23:257-9.

29 Baudet EM, Puel V, McBride JT et al. Long-term results of valve replacement with the St. Jude Medical prosthesis. J Thorac Cardiovasc Surg 1995; 109:858-70.

30 Citak A, Emre S, Sairin A et al. Hemostatic problems and thromboembolic complications in nephrotic children. Pediatr Nephrol 2000; 14:138-42.

31 Jones CL, Hebert D. Pulmonary thrombo-embolism in the nephrotic syndrome. Pediatr Nephrol 1991; 5:56-8.

32 Mehls O, Andrassy K, Koderisch J et al. Hemostasis and thromboembolism in children with nephrotic syndrome: differences from adults. J Pediatr 1987; 110:862-7.

33 Zimmerman RL, Novek S, Chen JT, Roggli V. Pulmonary thrombosis in a 10-year-old child with minimal change disease and nephrotic syndrome. A clinical, radiologic, and pathologic correlation with literature review. Am J Clin Pathol 1994; 101:230-6.

34 Baskerville PA. Thromboembolic disease and congenital hemangiomatosis of the small pelvis. Death from lung embolism in an 11-year-old girl. Med Welt 1978; 29:839-43.

36 Machin GA, Kent S. Pulmonary thromboembolism from a large hemangioma in a 4-week-old infant. Pediatr Pathol 1989; 9:73-8. 37 Slavotinek AM, Vacha SJ, Peters KF, Biesecker LG. Sudden death caused by pulmonary thromboembolism in Proteus syndrome. Clin Genet 2000; 58:386-9. 38 Nuss R, Hays T, Manco-Johnson M. Childhood thrombosis. Pediatrics 1995; 96:291-4. 39 Stahl J, Santos LD, Byard RW. Coronary artery thromboembolism and unexpected death in childhood and adolescence. J Forensic Sci 1995; 40:599-601. 40 Muraskas J, Besinger R, Bell T et al. Perinatal myocardial infarction in a newborn with a structurally normal heart. Am J Perinatol 1997; 14:93-7.

41 Tillett A, Hartley B, Simpson J. Paradoxical embolism causing fatal myocardial infarction in a newborn infant. *Arch Dis Child Fetal Neonatal Ed* 2001; 85:F137-8. 42 Zakowski MF, Edwards RH, McDonough ET. Wilms' tumor presenting as sudden death due to tumor embolism. *Arch Pathol Lab Med* 1990; 114:605-8. 43 Moore L, Byard RW. Fatal paradoxical embolism to the left carotid artery during partial resection of Wilms' tumor. *Pediatr Pathol* 1992; 12:551-6. 44 Shurin SB, Gauderer MW, Dahms BB, Conrad WG. Fatal intraoperative pulmonary embolization of Wilms tumor. *J Pediatr* 1982; 101:559-62. 45 Arthur DS, Stephens CA, Brummitt WM et al. Fatal tumor embolism during examination under anesthesia. *Surgery* 1973; 74:466-8. 46 Chan KW, Fryer CJ, Fraser GC, Dimmick JE. Sudden cerebral death in malignant presacral teratoma. *Med Pediatr Oncol* 1985; 13:395-7. 47 Nichols GR, Corey TS, Davis GJ. Nonfracture-associated fatal fat embolism in a case of child abuse. *J Forensic Sci* 1990; 35:493-9. 48 Shapiro G, Green DW, Fatica NS, Boachie-Adjei O. Medical complications in scoliosis surgery. *Curr Opin Pediatr* 2001; 13:36-41. 49 Shulman ST, Grossman BJ. Fat embolism in childhood. Review with report of a fatal case related to physical therapy in a child with dermatomyositis. *Am J Dis Child* 1970; 120:480-4. 50 Edwards KJ, Cummings RJ. Fat embolism as a complication of closed femoral shortening. *J Pediatr Orthop* 1993; 12:542-3. 51 Ganel A, Israeli A, Horoszowski H. Fatal complication of femoral elongation in an achondroplastic dwarf. A case report. *Clin Orthop* 1984; 185:69-71. 52 Pender ES, Pollack CV Jr, Evans OB. Fat embolism syndrome in a child with muscular dystrophy. *J Emerg Med* 1992; 10:705-11. 53 Horton DP, Ferriero DM, Mentzer WC. Nontraumatic fat embolism syndrome in sickle cell anemia. *Pediatr Neurol* 1995; 12:77-80. 54 Vichinsky E, Williams R, Das M et al. Pulmonary fat embolism: a distinct cause of severe acute chest syndrome in sickle cell anemia. *Blood* 1994; 83:3107-12. 55 Vichinsky EP, Neumayr LD, Earles AN et al. Causes and outcomes of the acute chest syndrome in sickle cell disease. National Acute Chest Syndrome Study Group. *N Engl J Med* 2000; 342:1855-65. 56 Gray A, Anionwu EN, Davies SC, Brozovic M. Patterns of mortality in sickle cell disease in the United Kingdom. *J Clin Pathol* 1991; 44:459-63. 57 Haber LM, Hawkins EP, Seilheimer DK, Saleem A. Fat overload syndrome. An autopsy study with evaluation of the total parenteral alimentation. *Pediatr Radiol* 1989; 19:456-7.

59 Levene MI, Batisti O, Wigglesworth JS et al. A prospective study of intrapulmonary fat accumulation in the newborn lung following intra lipid infusion. *Acta Paediatr Scand* 1984; 73:454-60.

- 60 Puntis JW, Rushton DI. Pulmonary intravascular lipid in neonatal necropsy specimens. *Arch Dis Child* 1991; 66:26-8.
- 61 Schroder H, Paust H, Schmidt R. Pulmonary fat embolism after intralipid therapy: a post-mortem artefact? Light and electron microscopic investigations in low-birth-weight infants. *Acta Paediatr Scand* 1984; 73:461-4.
- 62 Shulman RJ, Langston C, Schanler RJ. Pulmonary vascular lipid deposition after administration of intravenous fat to infants. *Pediatrics* 1987; 79:99-102.
- 63 Schulz PE, Weiner SP, Haber LM et al. Neurological complications from fat emulsion therapy. *Ann Neurol* 1994; 35:628-30.
- 64 Valdes-Dapena M. Iatrogenic disease in the perinatal period as seen by the pathologist. *Monogr Pathol* 1981; 22:382-418.
- 65 Lau KY, Lam PK. Systemic air embolism: a complication of ventilator therapy in hyaline membrane disease. *Clin Radiol* 1991; 43:16-18.
- 66 Faberowski LW, Black S, Mickle JP. Incidence of venous air embolism during craniectomy for craniosynostosis repair. *Anesthesiology* 2000; 92:20-3.
- 67 Cina SJ, Downs JC, Conradi SE. Hydrogen peroxide: a source of lethal oxygen embolism. Case report and review of the literature. *Am J Forensic Med Pathol* 1994; 15:44-50.
- 68 Lubec B, Hayn M, Denk W, Bauer G. Brain lipid peroxidation and hydroxy radical attack following the intravenous infusion of hydrogen peroxide in an infant. *Free Radical Biol Med* 1996; 21:219-23.
- 69 Buchino JJ, Keenan WJ, Pietsch JB et al. Malpositioning of the endotracheal tube in infants with tracheoesophageal fistula. *J Pediatr* 1986; 109:524-5.
- 70 Shiotani S, Kohno M, Ohashi N et al. Cardiovascular gas on non-traumatic postmortem computed tomography (PMCT): the influence of cardiopulmonary resuscitation. *Radiat Med* 2005; 23:225-9.
- 71 Rudd PT, Wigglesworth JS. Oxygen embolus during mechanical ventilation with disappearance of signs after death. *Arch Dis Child* 1982; 57:237-9.

72 Denton S, Mileusnic D. Delayed sudden death in an infant following an accidental fall: a case report with review of the literature. *Am J Forensic Med Pathol* 2003; 24:371-6.

73 Cox C. When can nurses be charged with manslaughter? *Nurs Times* 2001; 97:21.

74 Hahn YS, McLone DG. Risk factors in the outcome of children with minor head injury. *Pediatr Neurosurg* 1993; 19:135-42.

75 Chun CH, Johnson JD, Hofstetter M, Raff MJ. Brain abscess. A study of 45 consecutive cases. *Medicine (Baltimore)* 1986; 65:415-31.

76 Shemie S, Jay V, Rutka J, Armstrong D. Acute obstructive hydrocephalus and sudden death in children. *Ann Emerg Med* 1997; 29:524-8.

77 Edge JA. Cerebral oedema during treatment of diabetic ketoacidosis: are we any nearer finding a cause? *Diabetes Metab Res Rev* 2000; 16:316-24.

78 Glaser N, Barnett P, McCaslin I et al. Risk factors for cerebral edema in children with diabetic ketoacidosis. The Pediatric Emergency Medicine Collaborative Research Committee of the American Academy of Pediatrics. *N Engl J Med* 2001; 344:264-9.

79 Marcin JP, Glaser N, Barnett P et al. Factors associated with adverse outcomes in children with diabetic ketoacidosis. *Pediatr Endocrinol Rev* 2006; 3:379-86. 81 Rosenbloom AL. Intracerebral crises during treatment of diabetic ketoacidosis. *Diabetes Care* 1990; 13:22-33. 82 Alper G, Jarjour IT, Reyes JD et al. Outcome of children with cerebral edema caused by fulminant hepatic failure. *Pediatr Neurol* 1998; 18:299-304. 83 Ee LC, Shepherd RW, Cleghorn GJ et al. Acute liver failure in children: a regional experience. *J Paediatr Child Health* 2003; 39:107-10. 84 Liu GT, Union DK, Volp JJ. Cerebral edema in acute hepatic failure: clinicopathologic correlation. *Pediatr Neurol* 1993; 9:224-6. 85 Riviello JJ Jr, Rezvani I, DiGeorge AM, Foley CM. Cerebral edema causing death in children with maple syrup urine disease. *J Pediatr* 1991; 119:42-5. 86 Garson A Jr. Medicolegal problems in the management of cardiac arrhythmias in children. *Pediatrics* 1987; 79:84-8. 87 Smith NM, Bourne AJ, Clapton WK, Byard RW. The spectrum of presentation at autopsy of myocarditis

in infancy and childhood. *Pathology* 1992; 24:129-31. 88
 Critchley LA. Yet another report of anesthetic death due to
 unsuspected myocarditis. *J Clin Anesth* 1997; 9:676-7. 89
 Celermajer DS, Sholler GF, Howman-Giles R, Celermajer JM.
 Myocardial infarction in childhood: clinical analysis of 17
 cases and medium term follow up of survivors. *Br Heart J*
 1991; 65:332-6. 90 Johnsrude CL, Towbin JA, Cecchin F,
 Perry JC. Postinfarction ventricular arrhythmias in
 children. *Am Heart J* 1995; 129:1171-7. 91 Zebrak J, Skuza
 B, Pogorzelski A et al. Partial CFTR genotyping and
 characterisation of cystic fibrosis patients with
 myocardial fibrosis and necrosis. *Clin Genet* 2000;
 57:56-60. 92 Shehata BM, Patterson K, Thomas JE et al.
 Histiocytoid cardiomyopathy: three new cases and a review
 of the literature. *Pediatr Dev Pathol* 1998; 1:56-69. 93
 Stahl J, Couper RT, Byard RW. Oncocytic cardiomyopathy: a
 rare cause of unexpected early childhood death associated
 with fitting. *Med Sci Law* 1997; 37:84-7. 94 Bonnet D,
 Martin D, Pascale DL et al. Arrhythmias and conduction
 defects as presenting symptoms of fatty acid oxidation
 disorders in children. *Circulation* 1999; 100:2248-53. 95
 Allan WC, Gospe SM Jr. Seizures, syncope, or breath-holding
 presenting to the pediatric neurologist - when is the
 etiology a life-threatening arrhythmia? *Semin Pediatr*
Neurol 2005; 12:2-9. 96 Cooke RA, Chambers JB. Anorexia
 nervosa and the heart. *Br J Hosp Med* 1995; 54:313-17. 97
 Swenne I, Larsson PT. Heart risk associated with weight
 loss in anorexia nervosa and eating disorders: risk factors
 for QTc interval prolongation and dispersion. *Acta Paediatr*
 1999; 88:304-9. 98 Vannacci A, Baronti R, Masini E et al.
 Anorexia nervosa and the risk of sudden death. *Am J Med*
 2002; 112:327-8. 99 Tester DJ, Ackerman MJ. The role of
 molecular autopsy in unexplained sudden cardiac death. *Curr*
Opin Cardiol 2006; 21:166-72. 100 Arieff AI, Ayus JC,
 Fraser CL. Hyponatraemia and death or permanent brain
 damage in healthy children. *BMJ* 1992; 304:1218-22. 101 al
 Sabri AM, Smith N, Busuttil A. Sudden death due to
 autoimmune Addison's disease in a 12-year-old girl. *Int J*
Legal the spleen or delayed diagnosis of the splenic
injury? Isr J Med Sci 1980; 16:659-64.

103 Olsen WR, Polley TZ Jr. A second look at delayed
 splenic rupture. *Arch Surg* 1977; 112:422-5.

104 Stambouly JJ, McLaughlin LL, Mandel FS, Boxer RA.
 Complications of care in a pediatric intensive care unit: a
 prospective study. *Intensive Care Med* 1996; 22:1098-104.

105 Young RS, Truax BT. Hypernatremic hemorrhagic
 encephalopathy. *Ann Neurol* 1979; 5:588-91.

- 106 Rouse DA, Hargrove R. An unusual case of gas embolism. *Am J Forensic Med Pathol* 1992; 13:268-70.
- 107 Bagwell CE, Salzberg AM, Sonnino RE, Haynes JH. Potentially lethal complications of central venous catheter placement. *J Pediatr Surg* 2000; 35:709-13.
- 108 Narsinghani U, Chadha M, Farrar HC, Anand KS. Lifethreatening respiratory failure following accidental infusion of polyethylene glycol electrolyte solution into the lung. *J Toxicol Clin Toxicol* 2001; 39:105-7.
- 109 Wetherington AR, Corey TS, Buchino JJ, Burrows AM. Fatal intravenous injection of potassium in hospitalized patients. *Am J Forensic Med Pathol* 2003; 24:128-31.
- 110 Cohen MR. Potassium chloride injection mix-up. *Am J Hosp Pharm* 1990; 47:2457-8.
- 111 Al Ferayan A, Russell NA, Al Wohaibi M et al. Cerebrospinal fluid lavage in the treatment of inadvertent intrathecal vincristine injection. *Childs Nerv Syst* 1999; 15:87-9.
- 112 Alcaraz A, Rey C, Concha A, Medina A. Intrathecal vincristine: fatal myeloencephalopathy despite cerebrospinal fluid perfusion. *J Toxicol Clin Toxicol* 2002; 40:557-61.
- 113 Dettmeyer R, Driever F, Becker A et al. Fatal myeloencephalopathy due to accidental intrathecal vincristine administration: a report of two cases. *Forensic Sci Int* 2001; 122:60-4.
- 114 Fernandez CV, Esau R, Hamilton D et al. Intrathecal vincristine: an analysis of reasons for recurrent fatal chemotherapeutic error with recommendations for prevention. *J Pediatr Hematol Oncol* 1998; 20:587-90.
- 115 Kwack EK, Kim DJ, Park TI et al. Neural toxicity induced by accidental intrathecal vincristine administration. *J Korean Med Sci* 1999; 14:688-92.
- 116 Seale JR. Not again! Erroneous intrathecal injection results from a problem with protocols. *BMJ* 2001; 322:548.
- 117 Walter AW. Errors involving pediatric patients receiving chemotherapy: a literature review. *Med Pediatr Oncol* 1997; 29:155-6.

118 Dyer C. Doctors face trial for manslaughter as criminal charges against doctors continue to rise. *BMJ* 2002; 325:63.

119 Ferner RE. Medication errors that have led to manslaughter charges. *BMJ* 2000; 321:1212-16.

120 Kaushal R, Bates DW, Landrigan C et al. Medication errors and adverse drug events in pediatric inpatients. *JAMA* 2001; 285:2114-20.

121 Koren G, Barzilay Z, Greenwald M. Tenfold errors in administration of drug doses: a neglected iatrogenic disease in pediatrics. *Pediatrics* 1986; 77:848-9.

122 Koren G, Haslam RH. Pediatric medication errors: predicting and preventing tenfold disasters. *J Clin Pharmacol* 1994; 34:1043-5.

123 Conroy S. Unlicensed and off-label drug use: issues and recommendations. *Paediatr Drugs* 2002; 4:353-9.

124 Kozer E, Scolnik D, Macpherson A et al. Variables associated with medication errors in pediatric emergency medicine. *Pediatrics* 2002; 110:737-42.

125 Kozer E, Scolnik D, Keays T et al. Large errors in the dosing of medications for children. *N Engl J Med* 2002; octopus evading defeat. *J Surg Oncol* 2004; 88:182-8. 127 Johnson TN. The development of drug metabolising enzymes and their influence on the susceptibility to adverse drug reactions in children. *Toxicology* 2003; 192:37-48. 128 Swanson JR, Jones GR, Krasselt W et al. Death of two subjects due to imipramine and desipramine metabolite accumulation during chronic therapy: a review of the literature and possible mechanisms. *J Forensic Sci* 1997; 42:335-9. 129 Varley CK. Sudden death of a child treated with imipramine. Case study. *J Child Adolesc Psychopharmacol* 2000; 10:321-5. 130 Gupta M, Thaler HT, Steiner L. Presence of prolonged dispersion of QT intervals in late survivors of childhood anthracycline therapy. *Pediatr Hematol Oncol* 2002; 19:533-42. 131 Krischer JP, Epstein S, Cuthbertson DD et al. Clinical cardiotoxicity following anthracycline treatment for childhood cancer: the Pediatric Oncology Group experience. *J Clin Oncol* 1997; 15:1544-52. 132 Massin MM, Dresse MF, Schmitz V et al. Acute arrhythmogenicity of first-dose chemotherapeutic agents in children. *Med Pediatr Oncol* 2002; 39:93-8. 133 Wortman JE, Lucas VS Jr, Schuster E et

al. Sudden death during doxorubicin administration. *Cancer* 1979; 44:1588-91. 134 Arseneau JC, Bagley CM, Anderson T, Canellos GP. Hyperkalaemia, a sequel to chemotherapy of Burkitt's lymphoma. *Lancet* 1973; 1:10-14. 135 Chasty RC, Liu-Yin JA. Acute tumour lysis syndrome. *Br J Hosp Med* 1993; 49:488-92. 136 Anon. Severe cardiac arrhythmia on cisapride. *Prescrire Int* 2000; 9:144-5. 137 Levy J, Hayes C, Kern J et al. Does cisapride influence cardiac rhythm? Results of a United States multicenter, double-blind, placebo-controlled pediatric study. *J Pediatr Gastroenterol Nutr* 2001; 32:458-63. 138 Ramirez-Mayans J, Garrido-Garcia LM, Huerta-Tecanhuey A et al. Cisapride and QTc interval in children. *Pediatrics* 2000; 106:1028-30. 139 Unlu RE, Alagoz MS, Uysal AC et al. Phenol intoxication in a child. *J Craniofac Surg* 2004; 15:1010-13. 140 Cote CJ, Karl HW, Notterman DA et al. Adverse sedation events in pediatrics: analysis of medications used for sedation. *Pediatrics* 2000; 106:633-44. 141 Cannon ML, Glazier SS, Bauman LA. Metabolic acidosis, rhabdomyolysis, and cardiovascular collapse after prolonged propofol infusion. *J Neurosurg* 2001; 95:1053-6. 142 Parke TJ, Stevens JE, Rice AS et al. Metabolic acidosis and fatal myocardial failure after propofol infusion in children: five case reports. *BMJ* 1992; 305:613-16. 143 Vasile B, Rasulo F, Candiani A, Latronico N. The pathophysiology of propofol infusion syndrome: a simple name for a complex syndrome. *Intensive Care Med* 2003; 29:1417-25. 144 Wolf A, Weir P, Segar P et al. Impaired fatty acid oxidation in propofol infusion syndrome. *Lancet* 2001; 357:606-7. 145 Wolf AR, Potter F. Propofol infusion in children: when does an anesthetic tool become an intensive care liability? *Paediatr Anaesth* 2004; 14:435-8. 146 Pumphrey RS. Lessons for management of anaphylaxis from a study of fatal reactions. *Clin Exp Allergy* 2000; 30:1144-50. 147 Lee JM, Greenes DS. Biphase anaphylactic reactions in pediatrics. *Pediatrics* 2000; 106:762-6. 148 Novembre E, Cianferoni A, Bernardini R et al. Anaphylaxis in children: clinical and allergologic features. *Pediatrics* reaction to ketorolac tromethamine. *Int J Immunopathol Pharmacol* 2006; 19:449-50.

150 Sakaguchi M, Inouye S. Anaphylaxis to gelatin-containing rectal suppositories. *J Allergy Clin Immunol* 2001; 108:1033-4.

151 Bohlke K, Davis RL, Marcy SM et al. Risk of anaphylaxis after vaccination of children and adolescents. *Pediatrics* 2003; 112:815-20.

152 Ponvert C, Ardelean-Jaby D, Colin-Gorski AM et al. Anaphylaxis to the 23-valent pneumococcal vaccine in child:

a case-control study based on immediate responses in skin tests and specific IgE determination. Vaccine 2001; 19:4588-91.

153 Singh A, Biswal N, Nalini P et al. Acute pulmonary edema as a complication of anti-snake venom therapy. Indian J Pediatr 2001; 68:81-2.

154 Zylberberg R, Schott RJ, Fort J et al. Sudden death following white cell transfusion in a premature infant. J Perinatol 1987; 7:90-2.

155 Devenney I, Falth-Magnusson K. Skin prick tests may give generalized allergic reactions in infants. Ann Allergy Asthma Immunol 2000; 85:457-60.

156 Lockey RF, Benedict LM, Turkeltaub PC, Bukantz SC. Fatalities from immunotherapy (IT) and skin testing (ST). J Allergy Clin Immunol 1987; 79:660-77.

157 Reid MJ, Lockey RF, Turkeltaub PC, Platts-Mills TA. Survey of fatalities from skin testing and immunotherapy 1985-1989. J Allergy Clin Immunol 1993; 92:6-15.

158 Burman D, Hodson AK, Wood CB, Brueton NF. Acute anaphylaxis, pulmonary oedema, and intravascular haemolysis due to cryoprecipitate. Arch Dis Child 1973; 48:483-5.

159 Harper JL, Gill JC, Hopp RJ et al. Induction of immune tolerance in a 7-year-old hemophiliac with an anaphylactoid inhibitor. Thromb Haemost 1995; 74:1039-41.

160 Shemin ER. Anaphylactic reaction to gamma-globulin. JAMA 1968; 203:59.

161 Lasser EC, Lyon SG, Berry CC. Reports on contrast media reactions: analysis of data from reports to the U.S. Food and Drug Administration. Radiology 1997; 203:605-10.

162 Shehadi WH. Death following intravascular administration of contrast media. Acta Radiol Diagn (Stockh) 1985; 26:457-61.

163 Pomeranz S, Gimmon Z, Ben Zvi A, Katz S. Parenteral nutrition-induced anaphylaxis. J Parenteral Enteral Nutr 1987; 11:314-15.

164 Birmingham PK, Suresh S. Latex allergy in children: diagnosis and management. Indian J Pediatr 1999; 66:717-24.

165 Moneret-Vautrin DA, Laxenaire MC, Bavoux F. Allergic shock to latex and ethylene oxide during surgery for spinal bifida. *Anesthesiology* 1990; 73:556-8.

166 Bommer J, Ritz E. Ethylene oxide (ETO) as a major cause of anaphylactoid reactions in dialysis (a review). *Artif Organs* 1987; 11:111-17.

167 Hurley RM. Anaphylaxis during hemodialysis. *Int J Pediatr Nephrol* 1984; 5:53-4.

168 Dellinger CT, Miale TD. Comparison of anaphylactic reactions to asparaginase derived from *Escherichia coli* and from *Erwinia* cultures. *Cancer* 1976; 38:1843-6.

169 Zanotti KM, Markman M. Prevention and management of antineoplastic-induced hypersensitivity reactions. *Drug Safety* 2001; 24:767-79.

170 Ganier M, Lieberman P. IgE mediated hypersensitivity to pancreatic extract (PE) in parents of cystic fibrosis (CF) children. *Clin Allergy* 1979; 9:125-32.

171 Haworth CS, Niven RM, Moorcroft AJ et al. Acute anaphylaxis following midline catheterisation in a patient. *Novartis Found Symp* 2004; 257:116-28. 173 Pumphrey RS, Roberts IS. Postmortem findings after fatal anaphylactic reactions. *J Clin Pathol* 2000; 53:273-6. 174 Caughey GH. Tryptase genetics and anaphylaxis. *J Allergy Clin Immunol* 2006; 117:1411-14. 175 Horn KD, Halsey JF, Zumwalt RE. Utilization of serum tryptase and immunoglobulin E assay in the postmortem diagnosis of anaphylaxis. *Am J Forensic Med Pathol* 2004; 25:37-43. 176 Yunginger JW, Nelson DR, Squillace DL et al. Laboratory investigation of deaths due to anaphylaxis. *J Forensic Sci* 1991; 36:857-65. 177 Collier PE, Blocker SH, Graff DM, Doyle P. Cardiac tamponade from central venous catheters. *Am J Surg* 1998; 176:212-14. 178 Collier PE, Goodman GB. Cardiac tamponade caused by central venous catheter perforation of the heart: a preventable complication. *J Am Coll Surg* 1995; 181:459-63. 179 Suarez-Penaranda JM, Rico-Boquete R, Munoz JI et al. Unexpected sudden death from coronary sinus thrombosis. An unusual complication of central venous catheterization. *J Forensic Sci* 2000; 45:920-2. 180 Pezzati M, Filippi L, Chiti G et al. Central venous catheters and cardiac tamponade in preterm infants. *Intensive Care Med* 2004; 30:2253-6. 181 Beardsall K, White DK, Pinto EM, Kelsall AW. Pericardial effusion and cardiac tamponade as complications of neonatal long lines: are they really a problem? *Arch Dis Child Fetal Neonatal Ed* 2003; 88:F292-5. 182 Byard RW,

Bourne AJ, Moore L, Little KE. Sudden death in early infancy due to delayed cardiac tamponade complicating central venous line insertion and cardiac catheterization. Arch Pathol Lab Med 1992; 116:654-6. 183 Leibovitz E, Ashkenazi A, Levin S, Nissim F. Fatal pericardial tamponade complicating total parenteral nutrition via a silastic central vein catheter. J Pediatr Gastroenterol Nutr 1988; 7:306-7. 184 Rogers BB, Berns SD, Maynard EC, Hansen TW. Pericardial tamponade secondary to central venous catheterization and hyperalimentation in a very low birthweight infant. Pediatr Pathol 1990; 10:819-23. 185 Hermansen MC, Hermansen MG. Intravascular catheter complications in the neonatal intensive care unit. Clin Perinatol 2005; 32:141-56. 186 Anon. Radiofrequency interference with medical devices. A technical information statement. IEEE Eng Med Biol Mag 1998; 17:111-14. 187 Betts TR, Simpson IA. Inhibition of temporary pacing by a mobile phone. Heart 2002; 87:130. 188 Robinson MP, Flintoft ID, Marvin AC. Interference to medical equipment from mobile phones. J Med Eng Technol 1997; 21:141-6. 189 Tat FH, Wah KC, Hung YH. A follow-up study of electromagnetic interference of cellular phones on electronic medical equipment in the emergency department. Emerg Med (Fremantle) 2002; 14:315-19. 190 Tri JL, Severson RP, Firl AR et al. Cellular telephone interference with medical equipment. Mayo Clin Proc 2005; 80:1286-90. 191 Boyle J. Wireless technologies and patient safety in hospitals. Telemed J E Health 2006; 12:373-82. 192 Thong ML, Tay LK. Septicaemia from prolonged intravenous infusions. Arch Dis Child 1975; 50:886-9. 193 Garrett DO, McDonald LC, Wanderley A et al. An outbreak of neonatal deaths in Brazil associated with contaminated Immunofluorescence techniques in the investigation of a transfusion fatality due to ABO incompatibility. Forensic Sci Int 1994; 64:97-102.

195 Junsanto T, Chira T. Perimortem intracranial orogastric tube insertion in a pediatric trauma patient with a basilar skull fracture. J Trauma 1997; 42:746-7.

196 Cortesi N, Malagoli M, De Poda D et al. [Iatrogenic ruptures of the stomach]. Minerva Chir 1980; 35:67-72.

197 Knight KM, Doucet HJ. Gastric rupture and death caused by ipecac syrup. South Med J 1987; 80:786-7.

198 Barer J, Hill LL, Hill RM, Martinez WM. Fatal poisoning from salt used as an emetic. Am J Dis Child 1973; 125:889-90.

199 Carter RF, Fotheringham FJ. Fatal salt poisoning due to

gastric lavage with hypertonic saline. Med J Aust 1971;1: 539-41.

200 Krenzelok EP, McGuigan M, Lheur P. Position statement: ipecac syrup. American Academy of Clinical Toxicology; European Association of Poisons Centres and Clinical Toxicologists. J Toxicol Clin Toxicol 1997; 35:699-709.

201 Kapadia FN, Bajan KB, Raje KV. Airway accidents in intubated intensive care unit patients: an epidemiological study. Crit Care Med 2000; 28:659-64.

202 Kaloud H, Smolle-Juettner FM, Prause G, List WF. Iatrogenic ruptures of the tracheobronchial tree. Chest 1997; 112:774-8.

203 Krause MF, Hoehn T. Partial transection of the neonatal trachea. Resuscitation 1998; 38:43-6.

204 Anon. Child dies when ventilator alarms fail to warn of an occluded tracheostomy tube. Health Devices 2004; 33:335-6.

205 Ilce Z, Celayir S, Tekand GT et al. Tracheostomy in childhood: 20 years' experience from a pediatric surgery clinic. Pediatr Int 2002; 44:306-9.

206 Kleinsasser N, Merckenschlager A, Schroter C et al. [Fatal complications in tracheotomized children]. Laryngorhinootologie 1996; 75:77-82.

207 Kremer B, Botos-Kremer AI, Eckel HE, Schlondorff G. Indications, complications, and surgical techniques for pediatric tracheostomies: an update. J Pediatr Surg 2002; 37:1556-62.

208 Puhakka HJ, Kero P, Valli P, Iisalo E. Tracheostomy in pediatric patients. Acta Paediatr 1992; 81:231-4.

209 Shinkwin CA, Gibbin KP. Tracheostomy in children. J R Soc Med 1996; 89:188-92.

210 Kneen R, Solomon T, Appleton R. The role of lumbar puncture in suspected CNS infection: a disappearing skill? Arch Dis Child 2002; 87 :181-3.

211 Rennick G, Shann F, de Campo J. Cerebral herniation during bacterial meningitis in children. BMJ 1993; 306:953-5.

- 212 Selby A, Isaacs D, Gillis J et al. Lumbar punctures in suspected bacterial meningitis: too many or too few? *J Paediatr Child Health* 1994; 30:160-4.
- 213 Shetty AK, Desselles BC, Craver RD, Steele RW. Fatal cerebral herniation after lumbar puncture in a patient with a normal computed tomography scan. *Pediatrics* 1999; 103:1284-7.
- 214 Stephenson T. Clinical management of meningococcal disease. Coning may occur without lumbar puncture being done. *BMJ* 1998; 316:1015.
- 215 Sinniah D, Looi LM, Ortega JA et al. Cerebellar coning and uncal herniation in childhood acute leukaemia. *Lancet* 1982; 2:702-4.
- 216 Iskandar BJ, Tubbs S, Mapstone TB et al. Death in shunted hydrocephalic children in the 1990s. *Pediatr Neurosurg* 1998; 28:173-6.
- 217 Staal MJ, Meihuizen-de Regt MJ, Hess J. Sudden death in hydrocephalic spina bifida aperta patients. *Pediatr Neurosci* stable normal ventricular size. *Pediatr Neurosurg* 2006; 42:151-5. 219 Byard RW. Mechanisms of sudden death and autopsy findings in patients with Arnold-Chiari malformation and ventriculoatrial catheters. *Am J Forensic Med Pathol* 1996; 17:260-3. 220 Wells CA, Senior AJ. Coronary sinus thrombosis and myocardial infarction secondary to ventriculoatrial shunt insertion. *J Pediatr Surg* 1990; 25:1214-15. 221 Byard RW, Koszyca B, Qiao M. Unexpected childhood death due to a rare complication of ventriculoperitoneal shunting. *Am J Forensic Med Pathol* 2001; 22:207-10. 222 Dasmahapatra HK, Jamieson MP, Brewster GM, Doig B, Pollock JC. Permanent cardiac pacemaker in infants and children. *Thorac Cardiovasc Surg* 1986; 34:230-5. 223 McGrath LB, Gonzalez-Lavin L, Morse DP, Levett JM. Pacemaker system failure and other events in children with surgically induced heart block. *Pacing Clin Electrophysiol* 1988; 11:1182-7. 224 Silvetti MS, Drago F, Grutter G et al. Twenty years of paediatric cardiac pacing: 515 pacemakers and 480 leads implanted in 292 patients. *Europace* 2006; 8:530-6. 225 Waelkens JJ. Cardiac pacemakers in infants and children as observed in The Netherlands. *Pediatr Cardiol* 1982; 3:337-40. 226 Campling EA, Devlin HB, Lunn JN. Extremes of age. The 1999 Report of the National Confidential Enquiry into Perioperative Deaths, National Confidential Enquiry into Perioperative Deaths, London, 1999. 227 Morray JP, Geiduschek JM, Ramamoorthy C et al. Anesthesia-related cardiac arrest in children: initial

findings of the Pediatric Perioperative Cardiac Arrest (POCA) Registry. *Anesthesiology* 2000; 93:6-14. 228 Smith RB. Death and the oculocardiac reflex. *Can J Anaesth* 1994; 41:760. 229 Bietti GB. Problems of anesthesia in strabismus surgery. *Int Ophthalmol Clin* 1966; 6:727-37. 230 Cassidy SC, Schmidt KG, Van Hare GF et al. Complications of pediatric cardiac catheterization: a 3-year study. *J Am Coll Cardiol* 1992; 19:1285-93. 231 Vitiello R, McCrindle BW, Nykanen D et al. Complications associated with pediatric cardiac catheterization. *J Am Coll Cardiol* 1998; 32:1433-40. 232 Zeevi B, Berant M, Fogelman R et al. Acute complications in the current era of therapeutic cardiac catheterization for congenital heart disease. *Cardiol Young* 1999; 9:266-72. 233 Bull C, Cooper J, Stark J. Cardioplegic protection of the child's heart. *J Thorac Cardiovas Surg* 1984; 88:287-93. 234 Allwork SP. *Pathological Correlation After Cardiac Surgery*. Oxford: Butterworth Heinemann, 1991. 235 Newland MC, Ellis SJ, Lydiatt CA et al. Anesthetic-related cardiac arrest and its mortality: a report covering 72,959 anesthetics over 10 years from a US teaching hospital. *Anesthesiology* 2002; 97:108-15. 236 Morita K, Kawashima Y, Irita K et al. [Perioperative mortality and morbidity in 1999 with a special reference to age in 466 certified training hospitals of Japanese Society of Anesthesiologists: report of Committee on Operating Room Safety of Japanese Society of Anesthesiologists]. *Masui* 2001; 50:909-21. 237 Cohen MM, Cameron CB, Duncan PG. Pediatric anesthesia morbidity and mortality in the perioperative period. *Anesth Analg* 1990; 70:160-7. 238 Murat I, Constant I, Maud'huy H. Perioperative anaesthetic morbidity in children: a database of 24,165 anaesthetics. Delayed detection of esophageal intubation: Thai Anesthesia Incidents Study (THAI Study) database of 163,403 cases. *J Med Assoc Thai* 2005; 88(Suppl. 7):S69-75.

240 Warner MA, Warner ME, Warner DO et al. Perioperative pulmonary aspiration in infants and children. *Anesthesiology* 1999; 90:66-71.

241 Roe CR, Wiltse HE, Sweetman L, Alvarado LL. Death caused by perioperative fasting and sedation in a child with unrecognized very long chain acyl-coenzyme A dehydrogenase deficiency. *J Pediatr* 2000; 136:397-9.

242 Breucking E, Reimnitz P, Schara U, Mortier W. Anesthetic complications. The incidence of severe anesthetic complications in patients and families with progressive muscular dystrophy of the Duchenne and Becker types. *Anaesthesist* 2000; 49:187-95.

243 Larach MG, Rosenberg H, Gronert GA, Allen GC. Did anesthetics trigger cardiac arrests in patients with occult myopathies? *Anesthesiology* 2001; 94:933-5.

244 Oudesluys-Murphy AM, van Berkel JH, van den Brand HM. Unexplained sudden death under general anaesthesia. *Lancet* 1985; 1:696-7.

245 Schmidt GN, Burmeister MA, Lilje C et al. Acute heart failure during spinal surgery in a boy with Duchenne muscular dystrophy. *Br J Anaesth* 2003; 90:800-4.

246 Cucchiaro G, Rhodes LA. Unusual presentation of long QT syndrome. *Br J Anaesth* 2003; 90:804-7.

247 Lagarde MC, Tunell WP. Surgery in patients with hemoglobin-S disease. *J Pediatr Surg* 1978; 13:605-7.

248 McGarry P, Duncan C. Anesthetic risks in sickle cell trait. *Pediatrics* 1973; 51:507-12.

249 Dover SB, Plenderleith L, Moore MR, McColl KE. Safety of general anaesthesia and surgery in acute hepatic porphyria. *Gut* 1994; 35:1112-15.

250 Tabib A, Loire R, Miras A et al. Unsuspected cardiac lesions associated with sudden unexpected perioperative death. *Eur J Anaesthesiol* 2000; 17:230-5.

251 Galli L, Orrico A, Lorenzini S et al. Frequency and localization of mutations in the 106 exons of the RYR1 gene in 50 individuals with malignant hyperthermia. *Hum Mutat* 2006; 27:830.

252 Halliday NJ. Malignant hyperthermia. *J Craniofac Surg* 2003; 14:800-2.

253 Karger B, Teige K. Fatal malignant hyperthermia: delayed onset and atypical course. *Forensic Sci Int* 2002; 129:187-90.

254 Prescott RJ, Roberts SP, Williams G. Malignant hyperpyrexia: a rare cause of postoperative death. *J Clin Pathol* 1992; 45:361-3.

255 Ellis FR. Malignant hyperpyrexia. *Arch Dis Child* 1984; 59:1013-15.

256 Watkins J. Adverse reaction to neuromuscular blockers: frequency, investigation, and epidemiology. *Acta*

Anaesthesiol Scand 1994; 102(Suppl.):6-10.

257 Fox MH, Hunt PC. Prolonged neuromuscular block associated with mivacurium. Br J Anaesth 1995; 74:237-8.

258 Pasquariello CA, Schwartz RE. Plasma cholinesterase deficiency in a neonate. Can J Anaesth 1993; 40:529-31.

259 Hoffman TM, Wernovsky G, Wieand TS et al. The incidence of arrhythmias in a pediatric cardiac intensive care unit. Pediatr Cardiol 2002; 23:598-604.

260 Arieff AI. Fatal postoperative pulmonary edema: pathogenesis and literature review. Chest 1999; 115:1371-7.

261 Brouh Y, Paut O, Tsimaratos M, Camboulives J. Postoperative hyponatremia in children: pathophysiology, diagnosis and isotonic saline in hospitalised children: a systematic review. Arch Dis Child 2006; 91:828-35. 263 May C, Dhamrait R, Wade A, Walker I. Perioperative fluid therapy in children: a survey of current prescribing practice. Br J Anaesthesiol 2006; 97:371-9. 264 Coplans MP, Curson I. Dental anaesthesia and mortality. Br Med J (Clin ResEd) 1982; 284:661-2. 265 Coplans MP, Curson I. Deaths associated with dentistry and dental disease 1980-1989. Anaesthesia 1993; 48:435-8. 266 Worthington LM, Flynn PJ, Strunin L. Death in the dental chair: an avoidable catastrophe? Br J Anaesth 1998; 80:131-2. 267 Dental Anaesthesia Committee of the Royal College of Anaesthetists. Standards and Guidelines for General Anaesthesia for Dentistry. London: The Royal College of Anaesthetists, 1999. 268 Poswillo D. General Anaesthesia Sedation and Resuscitation in dentistry: Report of an Expert Working Party for the Standing Dental Advisory Committee. London: Department of Health, 1990. 269 Cartwright DP. Death in the dental chair. Anaesthesia 1999; 54:105-7. 270 Malamed SF. Morbidity, mortality and local anaesthesia. Primary Dent Care 1999; 6:11-15. 271 Lifschultz BD, Kenney JP, Sturgis CD, Donoghue ER. Fatal intracranial hemorrhage following pediatric oral surgical procedure. J Forensic Sci 1995; 40:131-3. 272 Keeling JW. Fetal and Neonatal Pathology, 4th edn. London: Springer, 2007. 273 Wigglesworth JS. Perinatal Pathology, 2nd edn. London: WB Saunders, 1996. 274 Polberger S, Svenningsen NW. Early neonatal sudden infant death and near death of full-term infants in maternity wards. Acta Paediatr Scand 1985; 74:861-6. 275 Rodriguez-Alarcon J, Melchor JC, Linares A et al. Early neonatal sudden death or near death syndrome. An epidemiological study of 29 cases. Acta Paediatr 1994; 83:704-8. 276 Dehan M, Imbert MC, Benisvy C

et al. [Sudden newborn infant death in maternity. Anatomo-clinical study of 31 cases]. Arch Fr Pediatr 1992; 49:609-16. 277 Pinar H. Postmortem findings in term neonates. Semin Neonatol 2004; 9:289-302. 278 Keeling JW. Iatrogenic disease in the newborn. Virchows Arch A Pathol Anat Histol 1981; 394:1-29. 279 Byard RW, Kennedy JD. Diagnostic difficulties in cases of sudden death in infants with mandibular hypoplasia. Am J Forensic Med Pathol 1996; 17:255-9. 280 Wigglesworth JS. Performance of the perinatal autopsy. In Perinatal Pathology, 2nd edn. London: Saunders, 1996, p. 36. 281 Abman SH, Burchell MF, Schaffer MS, Rosenberg AA. Late sudden unexpected deaths in hospitalized infants with bronchopulmonary dysplasia. Am J Dis Child 1989; 143:815-19. 282 Espagne S, Hamon I, Thiebaugeorges O, Hascoet JM. [Sudden death of neonates in the delivery room]. Arch Pediatr 2004; 11:436-9. 283 Byard RW, Burnell RH. Apparent life-threatening events and infant holding practices. Arch Dis Child 1995; 73:502-4. 284 Frank DJ, Drobish NL. Toy safety in hospitals: or beware of parents bearing gifts. Clin Pediatr (Phila) 1975; 14:400-2. 285 Millunchick EW, McArtor RD. Fatal aspiration of a makeshift pacifier. Pediatrics 1986; 77:369-70. 286 Levene S, Bonfield G. Accidents on hospital wards. Arch Dis Child 1991; 66:1047-9. 287 Lyons TJ, Oates RK. Falling out of bed: a relatively benign when children fall out of bed. J Pediatr Orthop 1987; 7:184-6.

289 Finberg L, Kiley J, Luttrell CN. Mass accidental salt poisoning in infancy. JAMA 1963; 184:187-90.

290 Finberg L. Unforgettable patients. J Pediatr 1992; 121:323-4.

291 Walter GF, Maresch W. [Accidental saline poisoning in newborn infants. Morphologic findings and pathogenetic discussion]. Klin Padiatr 1987; 199:269-73.

292 Busch KA, Fawcett J, Jacobs DG. Clinical correlates of inpatient suicide. J Clin Psychiatry 2003; 64:14-19.

293 Pfeffer CR, Plutchik R, Mizruchi MS, Lipkins R. Suicidal behavior in child psychiatric inpatients and outpatients and in nonpatients. Am J Psychiatry 1986; 143:733-8.

294 Wolfersdorf M. [Patient suicide in the psychiatric hospital: selected results of the Clinic Suicide Working Group Study I/II 1970-1992 of the 'Suicidal Behavior and the Psychiatric Hospital' Study Group]. Psychiatr Prax 1996; 23:84-9.

295 Noren GR, Staley NA, Bandt CM, Kaplan EL. Occurrence of myocarditis in sudden death in children. *J Forensic Sci* 1977; 22:188-96.

296 Knight DM, James RA, Sims DN et al. Sudden death due to intravenous infusion of hair conditioner. *Am J Forensic Med Pathol* 1998; 19:252-4.

297 Southall DP, Plunkett MC, Banks M et al. Covert video recordings of life-threatening child abuse: lessons for child protection. *Pediatrics* 1997; 100:735-60.

298 Feldman KW, Hickman RD. The central venous catheter as a source of medical chaos in Munchausen syndrome by proxy. *J Pediatr Surg* 1998; 33:623-7.

299 Goldfarb J, Lawry KW, Steffen R, Sabella C. Infectious diseases presentations of Munchausen syndrome by proxy: case report and review of the literature. *Clin Pediatr (Phila)* 1998; 37:179-85.

300 Kamerling LB, Black XA, Fiser RT. Munchausen syndrome by proxy in the pediatric intensive care unit: an unusual mechanism. *Pediatr Crit Care Med* 2002; 3:305-7.

301 Meadow R. Munchausen syndrome by proxy. *Arch Dis Child* 1982; 57:92-8. Care Workers Who Systematically Harm Their Patients. LL.M thesis, University of Wales, 1992. 303 Kinnell HG. Serial homicide by doctors: Shipman in perspective. *BMJ* 2000; 321:1594-7. 304 Park GR, Khan SN. Murder and the ICU. *Eur J Anaesthesiol* 2002; 19:621-3. 305 Yorker BC. Nurses accused of murder. *Am J Nurs* 1988; 88:1327-8, 1332. 306 James DS, Leadbeatter S. Detecting homicide in hospital. *J R Coll Physicians London* 1997; 31:296-8. 307 Start RD, Cross SS. ACP. Best practice no 155. Pathological investigation of deaths following surgery, anaesthesia, and medical procedures. *J Clin Pathol* 1999; 52:640-52. 308 Bush CM, Jones JS, Cohle SD, Johnson H. Pediatric injuries from cardiopulmonary resuscitation. *Ann Emerg Med* 1996; 28:40-4. 309 Maguire S, Mann M, John N et al. Does cardiopulmonary resuscitation cause rib fractures in children? A systematic review. *Child Abuse Negl* 2006; 30:739-51. 310 Peterson DB, Beckwith JB, Benson EA. The sudden infant death syndrome in hospitalized babies. *Pediatrics* 1974; 54:644-6. 311 Gill JR, Goldfeder LB, Hirsch CS. Use of 'therapeutic complication' as a manner of death. *J Forensic Sci* 2006; 51:1127-33. 312 Roberts ISD, Gorodkin LM, Benbow EW. What is a natural cause of death? A survey of how coroners in England and

Wales approach borderline cases. J Clin Pathol 2000; 53:367-73. 313 Buehler JW, Smith LF, Wallace EM et al. Unexplained deaths in a children's hospital. An epidemiologic assessment. N Engl J Med 1985; 313:211-16. 314 Istre GR, Gustafson TL, Baron RC et al. A mysterious cluster of deaths and cardiopulmonary arrests in a pediatric intensive care unit. N Engl J Med 1985; 313:205-11. 315 Hunt J, Goldring J. The case of Beverley Allitt. Med Sci Law 1997; 37:189-97. 316 Clothier C. The Allitt Inquiry. London: HMSO, 1994.

20 Chapter 20. Road Traffic Accidents in Children

- 1 Basham DJ. Traffic Account Management. Springfield, IL: Charles C Thomas, 1979.
- 2 Clark WE. Traffic Management and Collision Investigation. Englewood Cliffs, NJ: Prentice Hall, 1982.
- 3 Centers for Disease Control and Prevention (CDC). Air-bag-associated fatal injuries to infants and children riding in front passenger seats: United States. MMWR 1995; 44:845-7.
- 4 Ashton SJ, Hayes HRM, Mackay GM. Child pedestrian injuries. Proceedings of the International Meeting on Biomechanics of Trauma to Children. Lyon: IRCOBI, September 1974, pp. 83-100 and 159-70.
- 5 Roy AP, Mackay GM, Gloyns PF. Some observations on the modelling of children in car collisions based on field accident investigations. Proceedings of the Fifth International Conference. Birmingham: IRCOBI, September 1980, pp. 286-304.
- 6 Mackay GM. Children in cars and pick-up trucks. Saudi Med J 1987; 8:123-7. (Also: Seat Belt Loading. Proc. A.A.A.M. 36th Annual Conference, Portland, OR, October 1992.)
- 7 MacKay GH. The role of the accident investigator. J Forensic Sci 1970; 10:245-54.
- 8 Hamm ED. Locating an area on a suspect tire for comparative examination to a questioned track. Int J Forensic Identification 1988; 38/40:143-51.
- 9 Dabdoub G, Dixon AC, Watson AD et al. The identification of domestic and foreign automobile manufacturers through body primer characterisation. J Forensic Sci 1989; 34:1395-404.
- 10 Dolan DN. Vehicle lights and their use as evidence. J Forensic Sci Soc 1971; 11:69-82.
- 11 Ambourn RF. The calculation of motor car speeds from curved tire marks. J Forensic Sci 1989; 29:371-86.
- 12 Ryland SG, Kopec RJ. The evidential value of automobile paint chips. J Forensic Sci 1979; 24(1):140-7.

- 13 Monahan DL, Harding HWJ. Damage to clothing: cuts and tears. *J Forensic Sci* 1990; 35:901-13.
- 14 Tunbridge RJ, Everest JT, Wild BR, Johnstone RA. An InDepth Study of Road Accident Casualties and their Injury Patterns. Report RR. Crowthorne: Transport and Road Research Laboratory, 1988, pp. 136-7.
- 15 Ward H, Norrie J, Sang A et al. Urban Safety Project: the Sheffield Scheme. Contractors report CR134. Crowthorne: Department of Transport, Transport and Road Research Laboratory, 1989.
- 16 Kondo T, Saito K, Nishigami J, Ohshima T. Fatal injurers of the brain stem and/or upper cervical spinal cord in traffic cases; nine autopsy cases. *Sci Justice* 1995; 35:197-201.
- 17 Gunji H, Mitusaawa I, Hiraiwa K. The mechanism underlying the occurrence of traumatic brainstem lesions in victims of traffic accidents. *Legal Med* 2002; 4:84-9.
- 18 Shkrum MJ, McCafferty KJ, Green RN et al. Mechanisms of aortic injuries in fatalities accruing in motor vehicle collisions. *J Forensic Sci* 1999; 44:44-60.
- 19 Feezko JD, Lynch L, Pless JE et al. An autopsy review of 142 [non-penetrating] blunt injuries to the aorta. *J Trauma* 1992; 33:846-9.
- 20 Lowne R, Roberts A, Roy P et al. The effect of UK Seat Belt Legislation on Restraint Usage by Children. Technical Paper Series 840526. New York: Society of Automotive Engineers (SAE), 1984.
- 21 Anderson PA, Rivara FP, Maier RV, Drake C. The epidemiology of seatbelt-associated injuries. *J Trauma* 1991; 3:60-7.
- 22 May AK, Chan B, Daniel TM, Young JS. Anterior lung herniation: another aspect of the seat-belt syndrome. *J Trauma* 1995; 38:587-9.
- 23 Reid AB, Letts RM, Black GB. Pediatric chance fractures: vascular injuries associated with seat belt usage. *Am J Forensic Med Pathol* 2001; 22:193-5. 25 Beattie YT, Richards D, Belton N et al. Injuries in the adolescent population in Scotland: patterns and types of injury sustained. *Heath Bulletin* 1999; 57:165-74. 26 Hitotsuigi H, Takatsu A, Sigeta A. Injuries of motorcyclists and bicyclists examined at

autopsy. *Am J Forensic Med Pathol* 1999; 20:251-5. 27 Wilson MH, Baxter SP, Tenet SP et al. *Saving Children. A Guide to Injury Prevention*. Oxford: Oxford University Press, 1991. 28 Hillman M. *Cycle Helmets: The Case For and Against*. London: Policy Studies Institute, 1993. 29 Thomas S, Acton C, Nixon J et al. Effectiveness of bicycle helmets in preventing head injury in children - a case control study. *BMJ* 1994; 308:173-6. 30 Cameron M, Vulcan A, Finch C et al. Mandatory bicycle helmet uses following a decade of helmet promotion in Victoria, Australia: an evaluation. *Accident Anal Prev* 1994; 26:325-37. 31 McDermott FT. Bicyclist head injury prevention by helmets and mandatory wearing legislation in Victoria Australia. *Ann R Coll Surgeons* 1995; 7:38-44. 32 Tong KA, Ashwal S, Holshouser BA et al. Hemorrhagic shearing lesions in children and adolescents with posttraumatic diffuse axonal injury: improved detection and initial results. *Radiology* 2003; 227:332-9. 33 Holshouser BA, Tong KA, Ashwal S. Proton MR spectroscopic imaging depicts diffuse axonal injury in children with traumatic brain injury. *Am J Neuroradiol* 2005; 26:1276-85. 34 Freeman MD, Croft AC, Rossignol AM. Whiplash-associated disorders: redefining whiplash and its management. Quebec Task Force. A critical evaluation. *Spine* 1998; 23:1043-9. 35 Minton R, Galasko CSB, Murray PA, Pitcher M. Whiplash injuries, causative studies: final report 1998. Report of the Transport Research Laboratories ISBN: 1-84608-256-0. 36 Patterson RM. Trauma in pregnancy. *Clin Obstet Gynecol* 1984; 27:32-8. 37 Corsi PR, Rassian S, Bechelli de Oliveira L et al. Trauma in pregnant women; analysis of maternal and fetal mortality. *Trauma* 1999; 30:239-43. 38 Stafford PS, Biddinger PW, Zunwaite RE. Lethal intrauterine fetal trauma. *Am J Obstet Gynecol* 1988; 159:484-9. 39 Weinberg L, Wyatt JP, Busuttil A. Traumatic intrauterine fetal spinal fracture following seat belt use: a case report. *J Trauma* 2001; 51:1195-6. 40 Matthews CD. Incorrectly used seat belts associated with uterine rupture following vehicular collision. *Am J Obstet Gynecol* 1975; 121:1115-16. 41 Schoenfelkd A, Ziv E, Stein L et al. Seat belts in pregnancy and the obstetrician. *Obstet Gynecol Surg* 1987; 42:275-82. 42 Griffiths M, Hillman G, Usherwood M. Seatbelt hazards in pregnancy (Case report). *Br J Obstet Gynaecol* 1991; 98:320-1. 43 Byard RW, Gilbert J, Lipsett J, James RA. Farm and tractorrelated fatalities in children in South Australia. *J Paediatr Child Health* 1998; 34:139-41. 44 Byard RW, Gilbert J, James RA, Lipsett J. Farm and tractorrelated fatalities in children. *J Forensic Med Pathol* 1999; 20:73-7. 45 *Road Accidents - Scotland 2006*. Edinburgh: A Scottish Executive National Statistics Publication, 2007. 46 Andersson A, Jonasson K. *Proceedings of the Sixth International Conference for Accident and*

Traffic Medicine. Melbourne, 1977; 279.

21 Chapter 21. Forensic DNA Profiling in Cases Involving Children

5 Rafferty S. Fingerprint evidence doubts clear policewoman of perjury. Scotsman, Saturday 15 May 1999, p. 4.

6 McKie IAJ. There's nane ever fear'd that the truth should be heard but they whom the truth would indite. Sci Justice 2003; 43:161-5.

7 Cole SA. More than zero: accounting for error in latent fingerprint identification. J Crim Law Criminol 2005; 95:985-1078.

8 Webb J. The myth of fingerprints. New Scientist 2005; 2517:3.

9 Saks MJ, Koehler JJ. The coming paradigm shift in forensic identification science. Science 2005; 309:892-5.

10 Broeders APA. Of earprints, fingerprints, scent dogs, cot deaths and cognitive contamination - a brief look at the present state of play in the forensic arena. Forensic Sci Int 2006; 159:148-57.

11 Dror IE, Charlton D, Péron AE. Contextual information renders experts vulnerable to making erroneous identifications. Forensic Sci Int 2006; 156:74-8.

12 Jain AK, Prabhakar S, Pankanti S. On the similarity of identical twin fingerprints. Pattern Recognition 2002; 35:2653-63.

13 Opdal SH, Rognum MD. The sudden infant death syndrome gene: does it exist? Pediatrics 2004; 114:506-12.

14 Duffy DL, Montgomery GW, Chen W et al. A three-singlenucleotide polymorphism haplotype in intron 1 of OCA2 explains most human eye-color variation. Am J Hum Genet 2007; 80:241-52.

15 Sudbery P. Single-gene disorders. In Human Molecular Genetics, 2nd edn. Harlow, UK: Pearson Education, 2002.

16 Kumar V, Abba AK, Fausto N. Robbin and Cotran's Pathologic Basis of Disease. Philadelphia: Elsevier Saunders, 2005, pp. 489-95.

17 Redon R, Ishikawa S, Fitch KR et al. Global variation in copy number in the human genome. Nature 2006; 444:444-54.

- 18 Shianna KV, Willard HF. In search of normality. *Nature* 2006; 444:428-9.
- 19 Li W-H, Saunders MA. The chimpanzee and us. *Nature* 2005; 437:50-1.
- 20 The Chimpanzee Sequencing and Analysis Consortium. Initial sequence of the chimpanzee genome and comparison with the human genome. *Nature* 2005; 437:69-87.
- 21 Newton G. Discovering DNA fingerprinting. Wellcome Trust: The Human Genome Website. 2004 (accessed April 2007). http://genome.wellcome.ac.uk/doc_wtd020877.html
- 22 Jeffreys AJ, Wilson V, Thein SL. Hypervariable 'minisatellite' regions in human DNA. *Nature* 1985; 314:67-73.
- 23 Rudin N, Inman K. Forensic DNA Analysis. Boca Raton, USA: CRC Press, 2002, pp. 71-6.
- 24 Forensic Science Service Casefiles: Colin Pitchfork - first murder conviction on DNA evidence also clears the prime suspect. The Forensic Science Service Website. www.forensic.gov.uk/forensic_t/inside/news/list_casefiles.php?case=1 (accessed April 2007).
- 25 Butler JM. Overview and history of DNA typing. In Forensic DNA Typing, 2nd edn. Amsterdam: Elsevier, 2005, p. 3.
- 26 Aronson JD. DNA fingerprinting on trial: the dramatic early history of a new forensic technique. *Endeavour* 2005; 29:126-31.
- 27 McKonkey E. Lecture 3 - genetic diseases: the consequences of mutation. In *How the Human Genome Works*. Sudbury, MA: Jones and Bartlett Publishers, 2004, p. 43.
- 28 Butler JM. Appendix II: U.S. population data - STR allele frequencies. In Forensic DNA Typing, 2nd edn. Amsterdam: and bloodstains. In James SH, Nordby JJ (eds) *Forensic Science: an Introduction to Scientific Investigative Techniques*. Boca Raton, FL: CRC Press, 2003.
- 30 Butler JM. Sample collection, DNA extraction and DNA quantitation. In Forensic DNA Typing, 2nd edn. Amsterdam: Elsevier, 2005. 31 Van Hoofstat DEO, Deforce DLD, Brochez V et al. DNA typing of fingerprints and skin debris:

sensitivity of capillary electrophoresis in forensic applications using multiplex PCR. Proceedings from the Second European Symposium of Human Identification, 1988, pp. 131-7. 32 Findlay I, Taylor A, Quirke P et al. DNA fingerprinting from single cells. *Nature* 1997; 389:555-6. 33 Van Oorschot RAH, Jones MK. DNA fingerprints from fingerprints. *Nature* 1997; 387:767. 34 Gill P, Whitaker J, Flaxman C et al. An investigation of the rigor of interpretation rules for STRs derived from less than 100 pg of DNA. *Forensic Sci Int* 2000; 112:17-40. 35 Wickenheiser RA. Trace DNA: a review, discussion of theory, and application of the transfer of trace quantities of DNA through skin contact. *J Forensic Sci* 2002; 47:442-50. 36 Hartl DL, Jones EW. The chemical structure, replication, and manipulation of DNA. *Essential Genetics: A Genomics Perspective*, 3rd edn. Sudbury, MA: Jones and Bartlett Publishers, 2002. 37 Butler JM. The polymerase chain reaction (DNA amplification). In *Forensic DNA Typing*, 2nd edn. Amsterdam: Elsevier, 2005. 38 Butler JM. DNA separation methods: slab gel and capillary electrophoresis. In *Forensic DNA Typing*, 2nd edn. Amsterdam: Elsevier, 2005. 39 Thangaraj K, Reddy AG, Singh L. Is the amelogenin gene reliable for gender identification in forensic casework and prenatal diagnosis? *Int J Leg Med* 2002; 116:121-3. 40 Chang YM, Burgoyne LA, Both K. Higher failures of amelogenin sex test in an Indian population group. *J Forensic Sci* 2003; 48:1309-13. 41 Mitchell RJ, Kreskas M, Baxter E et al. Amelogenin Y negative males: multiple origins. *Int Congress Ser* 2006; 1288:274-6. 42 Jobling MA, Lo IC, Turner DJ et al. Structural variation on the short arm of the human Y chromosome: recurrent multigene deletions encompassing amelogenin Y. *Hum Mol Gen* 2007; 16:307-16. 43 Sudbery P. Human population genetics and evolution. In *Human Molecular Genetics*, 2nd edn. Amsterdam: Pearson Education, 2002. 44 Butler JM. STR population database analysis. In *Forensic DNA Typing*, 2nd edn. Amsterdam: Elsevier, 2005. 45 Hartl DL, Jones EW. Molecular mechanisms of gene regulation. In *Essential Genetics: A Genomics Perspective*, 3rd edn. Sudbury, MA: Jones and Bartlett Publishers, 2002. 46 Winter PC, Hickey GI, Fletcher HL. Section D population genetics and evolution. In Hames BD (ed.) *Genetics: Instant Notes Series*, 2nd edn. Oxford, UK: BIOS Scientific Publishers Ltd, 2002. 47 Butler JM. Profile frequency estimates, likelihood ratios, and source attribution. In *Forensic DNA Typing*, 2nd edn. Amsterdam: Elsevier, 2005. 48 Foreman LA, Evett IW. Statistical analysis to support forensic interpretation for a new ten-locus STR profiling system. *Int J Leg Med* 2001; 114:147-55. 49 Jha A. DNA fingerprinting 'no longer foolproof'. *Guardian, Scientists*. Chichester: John Wiley and Sons, 2005.

- 51 Lucy D. Evaluation of evidence in practice. In Introduction to Statistics for Forensic Scientists. Chichester: John Wiley and Sons, 2005.
- 52 Evett IW. Towards a uniform framework for reporting opinions in forensic science casework. Sci Justice 1998; 38:198-202.
- 53 Forensic Science Service, Association of Police Surgeons and Association of Chief Police. Officers' Guidelines for the Collection of Specimens. London: Forensic Science Service, 2000.
- 54 Inman K, Rudin N. Good field practice - processing a crime scene. In Principles and Practice of Criminalistics: the Profession of Forensic Science. Boca Raton, FL: CRC Press LLC, 2001.
- 55 National Criminal Justice Reference Service. DNA evidence: what law enforcement officers should know. NCJ 200908. Nat Inst Justice J 2003; 249:10-15. also Available online: www.ncjrs.gov/pdffiles1/jr000249c.pdf (accessed April 2007).
- 56 Kaye DH, Sensabaugh Jr GF. Reference guide on DNA evidence. In Reference Manual on Scientific Evidence, 2nd edn. Washington, DC: Federal Judicial Center, 2000, pp. 485-576.
- 57 Faigman DL, Kaye DH, Saks MJ, Sanders J. Modern Scientific Evidence: The Law and Science of Expert Testimony. 25-2.5 DNA Typing; The scientific status of DNA typing: Laboratory performance. St Paul, MN: West Publishing Co., 2002, pp. 257-63.
- 58 Lynch M. The discursive production of uncertainty: the OJ Simpson 'Dream Team' and the sociology of knowledge machine. Soc Stud Sci 1998; 28:829-68.
- 59 Scientific Testimony, an online journal: DNA testing problems. Available online: www.scientific.org/DNAProblems/DNA-Problems.htm (accessed April 2007).
- 60 Toledano T, Quarino L, Leung S et al. An assessment of DNA contamination risks in New York City medical examiner facilities. J Forensic Sci 1997; 42:721-4.
- 61 Ruttly GN. Human DNA contamination of mortuaries: does it matter? J Pathol 2000; 190:410-11.

- 62 Ruttly GN, Watson S, Davison J. DNA contamination of mortuary instruments and work surfaces: a significant problem in forensic practice? *Int J Leg Med* 2000; 114:56-60.
- 63 Lowe A, Murray C, Whitaker J et al. The propensity of individuals to deposit DNA and secondary transfer of low-level DNA from individuals to inert surfaces. *Forensic Sci Int* 2002; 129:25-34.
- 64 Ruttly GN. An investigation into the transference and survivability of human DNA following simulated manual strangulation with consideration of the problem of third party contamination. *Int J Leg Med* 2002; 116:170-3.
- 65 Sullivan K, Johnson P, Rowlands D, Allen H. New developments and challenges in the use of the UK DNA database: addressing the issue of contaminated consumables. *Forensic Sci Int* 2004; 146:S175-6.
- 66 Peel C, Gill P. Attribution of DNA profiles to body fluid stains. *Int Congress Ser* 2004; 1261:53-5.
- 67 Bond JW. Value of DNA evidence in detecting crime. *J Forensic Sci* 2007; 52:128-36.
- 68 Gill P, Kirkham A. Development of a simulation model to assess the impact of contamination in casework using STRs. *J Forensic Sci* 2004; 49:485-91.
- 69 Ruttly GN, Hopwood A, Tucker V. The effectiveness of protective clothing in the reduction of potential DNA contamination of the scene of crime. *Int J Leg Med* 2003; 117:170-4.
- 70 Butler JM. Appendix IV: DNA Advisory Board Quality Assurance Standards. In *Forensic DNA Typing*, 2nd edn. DNA evidence, Part 2: Essential elements of a competent defense review. *Champion Magazine*, 24-28 May 2003, www.nacdl.org/_8525701C006539F8.nsf/0/9C5F7C6D724A475185256E540074C156?Open (accessed April 2007). 72
- Teichroeb R. Rare look inside state crime labs reveals recurring DNA test problems. *Seattle Post-Intelligencer*, Thursday 22 July 2004, http://seattlepi.nwsource.com/local/183007_crimelab22.html (accessed April 2007). 73
- Pompanon F, Bonin A, Bellemain E, Taberlet P. Genotyping errors: causes, consequences and solutions. *Nat Rev Genet* 2005; 6:847-59. 74 Faigman DL, Kaye DH, Saks MJ, Sanders J. *Modern Scientific Evidence: The Law and Science of Expert*

Testimony. 25-1.2 DNA Typing; The legal relevance of DNA tests: Objections to DNA evidence. St Paul, MN: West Publishing Co., 2002, pp. 210-36. 75 Stevens-Simon C, Nelligan D, Breese P et al. The prevalence of genital human papillomavirus infections in abused and nonabused preadolescent girls. *Pediatrics* 2000; 106:645-9. 76 Thompson C. The GUM/Paediatric interface. Presentation at 22nd IUSTI Europe Meeting. Versailles, Abstract O.048, 2006. 77 Klausner JD. The NAAT is out of the bag. *Clin Infect Dis* 2004; 38:820-1. 78 Hammerschlag MR. Use of nucleic acid amplification test in investigating child sexual abuse. *Sex Transm Infect* 2001; 77:153-7. 79 Hammerschlag MR. Appropriate use of nonculture tests for the detection of sexually transmitted diseases in children and adolescents. *Semin Pediatr Infect Dis* 2003; 14:54-9. 80 Kellogg ND, Baillargeon J, Lukefahr JL et al. Comparison of nucleic acid amplification tests and culture techniques in the detection of *Neisseria gonorrhoeae* and *Chlamydia trachomatis* in victims of suspected child sexual abuse. *J Pediatr Adolesc Gynecol* 2004; 17:331-9. 81 Thomas A, Forster G, Robinson A, Rogstad K. National Guidelines on the Management of Suspected Sexually Transmitted Infections in Children and Young people. Clinical Effectiveness Group (Association of Genitourinary Medicine and the Medical Society for the Study of Venereal Diseases), 2002. Available online: www.bashh.org/guidelines/2002/adolescent_final_0903.pdf (accessed April 2007). 82 2001 National Guidelines on the Management of Adult Victims of Sexual Assault. Clinical Effectiveness Group (Association of Genitourinary Medicine and the Medical Society for the Study of Venereal Diseases). Available online: www.bashh.org/guidelines/2002/sexassault_0601.pdf (accessed April 2007). 83 Csete K, Beer Z, Varga T. Prenatal and newborn paternity testing with DNA analysis. *Forensic Sci Int* 2005; 147:S57-60. 84 Robino C, Barilaro MR, Gino S et al. Incestuous paternity detected by STR-typing of chorionic villi isolated from archival formalin-fixed paraffin-embedded abortion material using laser microdissection. *J Forensic Sci* 2006; 51:90-2. 85 Christian CW, Lavelle JM, De Jong AR et al. Forensic evidence findings in prepubertal victims of sexual assault. *Pediatrics* 2000; 106:100-4. 86 American Academy of Pediatrics (Committee on Child Abuse and Neglect). Guidelines for the evaluation of sexual abuse of children: subject review. *Pediatrics* 1999; 103:186-91. 87 Allard JE. The collection of data from findings in cases of sexual assault and the significance of spermatozoa on vaginal, anal and oral swabs. *Sci Justice* 1997; and stains. In James SH, Nordby JJ (eds) *Forensic Science: an Introduction to Scientific and Investigative Techniques*. Boca Raton, FL:

CRC Press, 2003, pp. 203-20.

89 Jackson ARW, Jackson JM. The examination of body fluids. In Forensic Science. Harlow, UK: Pearson Education Ltd, 2004.

90 Delfin FC, Madrid BJ, Tan MP, De Ungria MCA. Y-STR analysis for detection and objective confirmation of child sexual abuse. *Int J Leg Med* 2005; 11:158-63.

91 Sibille I, Duverneuil C, Lorin G et al. Y-STR DNA amplification as biological evidence in sexually assaulted female victims with no cytological detection of spermatozoa. *Forensic Sci Int* 2002; 125:212-16.

92 Butler JM. Y chromosome DNA testing. In *Forensic DNA Typing*, 2nd edn. Amsterdam: Elsevier, 2005.

93 Mulero JJ, Chang CW, Calandro LM et al. Development and validation of the AmpFSTR® Yfiler™ PCR amplification kit: a male specific, single amplification 17 Y-STR multiplex system. *J Forensic Sci* 2006; 51:64-75.

94 Hanson EK, Ballantyne J. Comprehensive annotated STR physical map of the human Y chromosome: forensic implications. *Legal Med* 2006; 8:110-20.

95 YHRD STR Database, www.yhrd.org/index.html (accessed April 2007).

96 Kayser M, Caglia A, Corach D et al. Evaluation of Y-chromosomal STRs: a multicenter study. *Int J Leg Med* 1997; 110:125-33.

97 President's DNA Initiative. Y-Chromosome. Available online: www.dna.gov/research/ychromosome_research/ (accessed July 2007).

98 Gill P, Jeffreys AJ, Werrett DJ. Forensic applications of DNA 'fingerprints'. *Nature* 1985; 318:577-9.

99 Elliott K, Hill DS, Lambert C et al. Use of laser microdissection greatly improves the recovery of DNA from sperm on microscope slides. *Forensic Sci Int* 2003; 137:28-36.

100 Sanders CT, Reisenbigler EK, Peterson DA. Laser microdissection separation of pure spermatozoa populations from mixed cell samples for forensic DNA analysis. *NCJRS Publications* 2007. Available online:

www.ncjrs.gov/pdffiles1/nij/grants/217268.pdf (accessed April 2007).

101 Geddes L. Rapists snared by sperm-free semen. *New Scientist* 2007; 2594:16.

102 Forensic Science Service Fact Sheet (8). Investigating sexual assault. Available online: www.forensic.gov.uk/forensic_t/inside/news/documents/Investigating%20sexual%20assaults.doc (accessed April 2007).

103 Ballantyne J, Fatolitis L, Roewer L. Creating and managing effective Y-STR databases. *Profiles DNA* 2006; 9(2):10-13. Available online: www.promega.com/profiles/902/profilesindna_902_10.pdf (accessed April 2007).

104 President's DNA Initiative. The compilation and management of a comprehensive U.S. Y-STR Reference Database. Available online: www.dna.gov/lab_services/ystrdatabase/ (accessed April 2007).

105 Sykes B, Irven C. Surnames and the Y chromosome. *Am J Hum Gen* 2000; 66:1417-19.

106 King TE, Ballereau SJ, Schürer KE, Jobling MA. Genetic signatures of coancestry within surnames. *Curr Biol* 2006; 16:384-8.

107 Clayton TM, Whitaker JP, Sparkes R, Gill P. Analysis and interpretation of mixed forensic stains using DNA STR profiling. *Forensic Sci Int* 1998; 91:55-70.

108 Torres Y, Flores I, Prieto V et al. DNA mixtures in forensic casework: a 4-year retrospective study. *Forensic Sci Int* contamination, mixed samples and low copy number. In *Forensic DNA Typing*, 2nd edn. Amsterdam: Elsevier, 2005. 110 Butler JM. Approaches to statistical analysis of mixtures and degraded DNA. In *Forensic DNA Typing*, 2nd edn. Amsterdam: Elsevier, 2005. 111 Gill P, Brenner CH, Buckleton JS et al. DNA commission of the International Society of Forensic Genetics: recommendations on the interpretation of mixtures. *Forensic Sci Int* 2006; 160:90-101. 112 Bill M, Gill P, Curran J et al. PENDULUM - a guideline-based approach to the interpretation of STR mixtures. *Forensic Sci Int* 2005; 148:181-9. 113 Lindahl T. Instability and decay of the primary structure of DNA. *Nature* 1993; 362:709-15. 114 Forensic Science Service, Association of Police Surgeons and Association of Chief Police, 2005. Technical update for forensic physicians on

the use of lubricants. Available online:
<http://fflm.ac.uk/upload/documents/1170083110.pdf> (accessed April 2007). 115 von Wurmb-Schwark N, Simeoni E, Ringleb A, Dehmichen M. Genetic investigation of modern burned corpses. *Int Congress Ser* 2004; 1261:50-2. 116 Alshamali F, Alkhayat AQ, Budowle B, Watson N. Y chromosome in forensic casework and paternity testing. *Int Congress Ser* 2004; 1261:353-6. 117 Staiti N, Spitaleri S, Vecchio C, Saravo L. Identification of a carbonized body by DNA profiling. *Int Congress Ser* 2004; 1261:494-6. 118 Alberts B, Johnson A, Lewis J et al. Energy conversion: mitochondria and chloroplasts. In *Molecular Biology of the Cell*, 4th edn. New York: Garland Science Taylor and Francis Group 2002. 119 Anderson S, Bankier AT, Barrell BG et al. Sequence and organization of the human mitochondrial genome. *Nature* 1981; 290:457-65. 120 Satoh M, Kuroiwa T. Organization of multiple nucleoids and DNA molecules in mitochondria of a human cell. *Exp Cell Res* 1991; 196:137-40. 121 Butler JM. Mitochondrial DNA analysis. In *Forensic DNA Typing*, 2nd edn. Amsterdam: Elsevier, 2005. 122 Holland MM, Fisher DL, Mitchell LG et al. Mitochondrial DNA sequence analysis of human skeletal remains: identification of remains from the Vietnam War. *J Forensic Sci* 1993; 38:542-53. 123 Rollo F, Ermini L, Luciani S et al. Fine characterization of the Iceman's mtDNA haplogroup. *Am J Phys Anthropol* 2006; 130:557-64. 124 Green RE, Krause J, Ptak SE et al. Analysis of one million base pairs of Neanderthal DNA. *Nature* 2006; 444:330-6. 125 Krause J, Dear PH, Pollack JL. Multiplex amplification of the mammoth mitochondrial genome and the evolution of Elephantidae. *Nature* 2006; 439:724-7. 126 Bandelt H-J, Kong Q-P, Parson W, Salas A. More evidence for non-maternal inheritance of mitochondrial DNA? *J Med Gen* 2007; 42:957-60. 127 Andrews RM, Kubacka I, Chinnery PF et al. Reanalysis and revision of the Cambridge reference sequence for human mitochondrial DNA. *Nat Genet* 1999; 23:147. 128 Parsons TJ, Muniec DS, Sullivan K. A high observed substitution rate in the human mitochondrial DNA control region. *Nat Genet* 1997; 15:363-7. 129 Sykes B. *The Seven Sisters of Eve*. London: W.W. Norton and Company, 2001. 130 Cann R, Wilson AC. The recent African genesis of humans. gradient-gel electrophoresis assay reveals a high frequency of heteroplasmy in hypervariable region 1 of the human mtDNA control region. *Am J Hum Genet* 2000; 67:432-43.

132 Paneto GG, Martins JA, Longo LVG et al. Heteroplasmy in hair: differences among hair and blood from the same individuals are still a matter of debate. *Forensic Sci Int* 2007; 173:117-21.

133 Gill P, Ivanov PL, Kimpton C et al. Identification of

the remains of the Romanov family by DNA analysis. *Nat Genet* 1994; 6:130-5.

134 Ivanov PL, Wadhams MJ, Roby RK et al. Mitochondrial DNA sequence heteroplasmy in the Grand Duke of Russia Georgij Romanov establishes the authenticity of the remains of Tsar Nicholas II. *Nat Genet* 1996; 12:417-20.

135 Cóllica MV, Rodríguez Cardozo MB, Abovich MA et al. Paternity cases when the alleged father is missing. *Int Congress Ser* 2004; 1261:520-2.

136 Mayor LR, Balding DJ. Discrimination of half-siblings when maternal genotypes are known. *Forensic Sci Int* 2006; 159:141-7.

137 Tracey M. Short tandem repeat-based identification of individuals and parents. *Croatian Med J* 2001; 42:233-8.

138 Linacre A, Goodwin W. Role of and techniques in forensic hematogenetics - paternity testing. In Payne-James J, Busuttill A, Smock W (eds) *Forensic Medicine: Clinical and Pathological Aspects*. London: Greenwich Medical Media Ltd, 2003, pp. 677-88.

139 Fung WK, Hu Y-Q, Chung Y-K. On statistical analysis of forensic DNA: theory, methods and computer programs. *Forensic Sci Int* 2006; 162:17-23.

140 Coleman H, Swenson E. *DNA in the Courtroom: a Trail Watcher's Guide*. Washington, DC: GeneLex Press Seattle, 2000. Available online: www.genelex.com/paternitytesting/paternitybook.html (accessed April 2007).

141 Relationship Testing Program Unit 2004. Annual Report Summary for Testing in 2004. Available online: www.aabb.org/Documents/Accreditation/Parentage_Testing_Accreditation_Program/rtannrpt04.pdf (accessed April 2007).

142 von Wurmb-Schwark N, Málýusz V, Simeoni E et al. Possible pitfalls in motherless paternity analysis with related putative fathers. *Forensic Sci Int* 2006; 159:92-7.

143 Berent J, Jacewicz R, Szram S. Effect on paternity index of substituting the biological father by his brother - preliminary report. *Int Congress Ser* 2004; 1261:476-8.

144 Hartl DL, Jones EW. Population genetics and evolution. In *Essential Genetics: a Genomics Perspective*, 3rd edn. Sudbury, MA: Jones and Bartlett Publishers, 2002.

- 145 McKonkey E. Lecture 3 - Genetic diseases: the consequences of mutation. In *How the Human Genome Works*. Sudbury, MA: Jones and Bartlett Publishers, 2004, pp. 49-50.
- 146 Sasaki H, Ishino F. *Genomic Imprinting*. Basel: Karger, 2006; 113(1-4).
- 147 Naito E, Dewa K, Fukuda M et al. Novel paternity testing by distinguishing parental alleles at a VNTR locus in the differentially methylated region upstream of the human H19 gene. *J Forensic Sci* 2003; 48:1275-9.
- 148 Zhao G, Yang Q, Huang D et al. Study on the application of parent-of-origin specific DNA methylation markers to forensic genetics. *Forensic Sci Int* 2005; 154:122-7.
- 149 Fraga MF, Ballestar E, Paz MF et al. Epigenetic differences arise during the lifetime of monozygotic twins. *Proc Natl Acad Sci* 2005; 102:10604-9.
- 150 Corach D, Penacino G, Marino M et al. Incestuous offspring detection inference by VNTR homozygosity increment. *Int Congress Ser* 2003; 1239:861-4. grouping. *J Am Med Assoc* 1921; 77:682-3.
- 152 Shaw MW. Paternity determination 1921 to 1983 and beyond. *J Am Med Assoc* 1983; 250:2536-7.
- 153 Albrecht K, Schultheiss D. Proof of paternity: historical reflections on an andrological-forensic challenge. *Andrologia* 2004; 36:31-7.
- 154 BBC. Embryo mix-up at IVF hospital. Monday 28 October 2002. <http://news.bbc.co.uk/1/hi/health/2367705.stm> (accessed April 2007).
- 155 BBC. \$1m pay-out for IVF embryo mix-up. Thursday 5 August 2004. Available online: <http://news.bbc.co.uk/1/hi/health/3537950.stm> (accessed April 2007).
- 156 BBC. IVF mix-ups 'occur regularly'. Wednesday 24 July 2002. Available online: <http://news.bbc.co.uk/1/hi/health/2148423.stm> (accessed April 2007).
- 157 Dyer O. Black twins are born to white parents after infertility treatment. *BMJ* 2002; 325:64.
- 158 Spriggs M. IVF mixup: white couple have black babies. *J Med Ethics* 2003; 29:65.
- 159 BBC. Q&A: Legal minefield of IVF 'mistake'. Monday 8 July 2002. Available online: <http://news.bbc.co.uk/1/hi/health/2116589.stm> (accessed April 2007).
- 160 BBC. Court rules on father of IVF mix-up twins. Wednesday 26 February 2003. Available online: <http://news.bbc.co.uk/1/hi/health/2797369.stm> (accessed April 2007).
- 161 McKonkey E. Lecture 2 - the mechanisms of mutation: how the human genome changes. In *How the Human Genome Works*. Sudbury, MA: Jones and Bartlett Publishers,

2004, pp. 19-33. 162 Brinkmann B, Klintscher M, Neuhuber F et al. Mutation rate in human microsatellites: influence of the structure and length of the tandem repeat. *Am J Hum Gen* 1998; 62:1408-15. 163 Sajantila A, Lukka M, Syvänen A-C. Experimentally observed germline mutations at human micro- and minisatellite loci. *Eur J Hum Genet* 1999; 7:263-6. 164 Kayser M, Roewer L, Hedman M et al. Characteristic and frequency of germline mutations at microsatellite loci from the human Y chromosome, as revealed by direct observation in father/son pairs. *Am J Hum Genet* 2000; 66:1580-8. 165 STR DNA Internet Database Mutation Rates for Common Loci. Available online: www.cstl.nist.gov/biotech/strbase/mutation.htm (accessed April 2007). 166 Yamamoto T, Tamaki K, Huang XL et al. The application of minisatellite variant repeat mapping of PCR (MVR-PCR) in a paternity case showing false exclusion due to STR mutation. *J Forensic Sci* 2001; 46:374-8. 167 Brandt-Casadevall C, Gené M, Piqué E et al. Presence of two mutations between father and child in two cases of paternity testing. *Int Congress Ser* 2003; 1239:S15-18. 168 Nutini AL, Mariottini A, Giunti L et al. Double incompatibility at human alpha fibrinogen and penta E loci in paternity testing. *Croatian Med J* 2003; 44:342-6. 169 Thangaraj K, Reddy AG, Singh L. Mutation in the STR locus D21S11 of father causing allele mismatch in the child. *J Forensic Sci* 2004; 49:99-103. 170 Junge A, Brinkmann B, Fimmers R, Madea B. Mutations or exclusion: an unusual case in paternity testing. *Int J Leg Med* 2006; 120:360-3. 171 Crouse CA, Rogers S, Amiot E et al. Analysis and interpretation of short tandem repeat microvariants and three-banded allele patterns using multiple allele detection systems. *J Forensic Sci* 1999; 44:87-94. for anomalous band patterns encountered during DNA STR profiling. *J Forensic Sci* 2004; 49:1207-14.

173 Sudbery P. Human genetic disease. In *Human Molecular Genetics*, 2nd edn. Harlow, UK: Pearson Education, 2002.

174 Dauber EM, Wenda S, Glock B et al. Mosaicism as a possible reason for poor amplification of amelogenin-Y in three human male individuals. *Int Congress Ser* 2004; 1261:508-10.

175 Farber CM, Georges M, De Bock G et al. Demonstration of spontaneous XX/XY chimerism by DNA fingerprinting. *Hum Genet* 1989; 82:197-8.

176 Yu N, Kruskall MS, Yunis JJ et al. Disputed maternity leading to identification of tetragametic chimerism. *N Engl J Med* 2002; 346:1545.

177 Mayne E, Borland S. The mother with three children who don't share her DNA. Mail on Sunday, 5 March 2006.

178 Milde A, Khn-Burmeister R, Ritz-Timme S, Kaatsch HJ. DNA typing in cases of blood chimerism. Int J Leg Med 1999; 112:333-5.

179 Rubocki RJ, McCue BJ, Kelly MT et al. Natural DNA mixtures generated in fraternal twins in utero. J Forensic Sci 2001; 46:120-5.

180 Dauber EM, Faé I, Stadlbacher S et al. STR typing in a pair of chimeric twins. Int Congress Ser 2003; 1239:569-71.

181 Dauber EM, Dorner G, Mitterbauer M et al. Discrepant results of samples taken from different tissues of a single individual. Int Congress Ser 2004; 1261:48-9.

182 Dauber EM, Müller CJ, Schöniger-Hekele M et al. Artificial blood chimerism and graft-versus-host disease after liver transplantation. Int Congress Ser 2006; 1288:840-2.

183 Pope S, Chapman H, Lambert J. The effect of bone marrow transplants on DNA profiles: a case example. Sci Justice 2007; 46:231-7.

184 von Wurmb-Schwark N, Bosinski H, Ritz-Timme S. What do the X and Y chromosomes tell us about sex and gender in forensic case analysis? J Forensic Legal Med 2007; 14:27-30.

185 Aldhous P. Bone marrow donors risk DNA identity mix-up. New Scientist 2005; 2523:11.

186 Rodríguez Cardozo MB, Cólica MV, Abovich MA et al. Maternity testing in a chimerical child. Int Congress Ser 2004; 1261:502-4.

187 Foster EA, Jobling MA, Taylor PG et al. Jefferson fathered slave's child. Nature 1998; 396:27-8.

188 Marshall E. Which Jefferson was the father? Science 1999; 283:153-5.

189 Check E. Jefferson's descendants continue to deny slave link. Nature 2002; 417:213.

190 Pääbo S. Molecular cloning of ancient Egyptian mummy DNA. Nature 1985; 314:644-5.

191 Calacal G, Delfin F, Tan M et al. Identification of exhumed remains of fire tragedy victims using conventional methods and autosomal/Y-chromosomal short tandem repeat DNA profiling. *Am J Forensic Med Pathol* 2005; 26:285-91.

192 Calacal G, De Ungria MC, Delfin F et al. Identification of two fire victims by comparative nuclear DNA typing of skeletal remains and stored umbilical tissues. *Am J Forensic Med Pathol* 2003; 24:148-52. forensic organisation following a mass fatality with 155 victims. *Forensic Sci Int* 2003; 138:1-7. 194 Clayton TM, Whitaker JP, Maguire CN. Identification of bodies from the scene of a mass disaster using DNA amplification of short tandem repeat (STR) loci. *Forensic Sci Int* 1995; 76:7-15. 195 Hsu CM, Huang NE, Tsai LC et al. Identification of victims of the 1998 Taoyuan Airbus crash accident using DNA analysis. *Int J Legal Med* 1999; 113:43-6. 196 President's DNA Initiative. Lessons learned from 9/11: DNA identification in mass fatality incidents, 2006. Available online: www.ncjrs.gov/pdffiles1/nij/214781.pdf (accessed April 2007). 197 Brenner CH, Weir BS. Issues and strategies in the DNA identification of World Trade Center victims. *Theor Popul Biol* 2003; 63:173-8. 198 Coble MD, Butler JM. Characterization of new miniSTR loci to aid analysis of degraded DNA. *J Forensic Sci* 2005; 50:43-53. 199 Butler JM. Single nucleotide polymorphisms and other bi-allelic markers. In *Forensic DNA Typing*, 2nd edn. Amsterdam: Elsevier, 2005. 200 Sobrino B, Brión M, Carracedo A. SNPs in forensic genetics: a review on SNP typing methodologies. *Forensic Sci Int* 2005; 154:181-94. 201 Forensic Science Service Casefiles: Craig Harman - Family DNA link offers crime breakthrough. The Forensic Science Service Website, www.forensic.gov.uk/forensic_t/inside/news/list_casefiles.php?case=24 (accessed April 2007). 202 Beiber FR. Guilt by association. *New Scientist* 2004; 2470:20. 203 Greely HT, Riordan DP, Garrison NA, Mountain JL. Family ties: the use of offender databases to catch offender's kin. *J Law Med Ethics* 2006; 34:248-62. 204 Haimes E. Social and ethical issues in the use of familial searching in forensic investigations: insight from family and kinship studies. *J Law Med Ethics* 2006; 34:263-76. 205 Grimes EA, Noake PJ, Dixon L, Urquart A. Sequence polymorphism in the human melanocortin 1 receptor gene as an indicator of the red hair phenotype. *Forensic Sci Int* 2001; 122:124-9. 206 Rees JL. Genetics of hair and skin color. *Ann Rev Genet* 2003; 37:67-90. 207 Lamason RL, Mohideen MPK, Mest JR et al. SLC24A5, a putative cation exchanger, affects pigmentation in zebrafish and humans. *Science* 2005; 310:1782-6. 208 Cho MK, Sankar P. Forensic

genetics and ethical legal and social implications beyond the clinic. *Nat Genet* 2004; 36:S8-12. 209 Ossorio PN. About face: forensic genetic testing for race and visible traits. *J Law Med Ethics* 2006; 34:277-92. 210 Williams R, Johnson P. Inclusiveness, effectiveness and intrusiveness: issues in the developing uses of DNA profiling in support of criminal investigations. *J Law Med Ethics* 2006; 34:234-47. 211 Alvarez M, Ballantyne J. The identification of newborns using messenger RNA profiling analysis. *Anal Biochem* 2006; 357:21-34.

22 Chapter 22. The Dentist's Role in Child Abuse and Neglect

20 Golder M. Non-accidental injury in children. Dent Update 1995; 22:75-80.

21 Fearn J. Dental aspects of child abuse (Letter). Aust Dent J 1987; 32:227.

22 Cappelleri JC, Eckenrode J, Powers JL. The epidemiology of child abuse: findings from the second National Incidence and Prevalence Study of Child Abuse and Neglect. Am J Publ Hlth 1993; 83:1622.

23 Hobson P. Child abuse: we can help (Letter). Br Dent J 1987; 162:53.

24 Child protection in ethics in dentistry. BDA Advisory Services, 1995, pp. 45-6.

25 Department of Health. Working Together under the Children Act (1989), 48-49, London, HMSO, 1991.

26 Department of Health. Children and Young People on Child Protection Registers, Year Ending 31st March 1995, England. London: Government Statistical Service, 1995, p. 19.

27 Macintyre DR, Jones GM, Pinkney RCN. The role of the dental practitioner in the management of non-accidental injury to children. Br Dent J 1986; 161:108-10.

28 Kittle PE, Richardson DS, Parker JW. Examining for child abuse and child neglect. Pediatr Dent 1986; 8:80-2.

29 Casamassimo PS. Child sexual abuse and the paediatric dentist. Paediatr Dent 1986; 8:102-6.

30 Anasavice KJ. Treatment regimes in preventive and restorative dentistry. J Am Dent Assoc 1995; 126:727-43.

31 Ramos-Gomez F, Rothman D, Blain S. Knowledge and attitudes among California dental care providers regarding child abuse and neglect. J Am Dent Assoc 1998; 129:340-8.

32 Beck JD, Weintraub JA, Disney JA. University of North Carolina. Caries Risk Assessment Study. Community Dent Oral Epidemiol 1992; 20:313-21.

33 Jessee SA. Physical manifestations of child abuse to the head, face and mouth: a hospital survey. ASDC J Dent Child

1995; 62:245-9.

34 Rupp RP. Conditions to be considered in the differential diagnosis of child abuse and neglect. *Gen Dent* 1998; 46:96-100.

35 Jessee SA. Risk factors as determinants of dental neglect in children. *ASDC J Dent Child* 1998; 65:17-20.

36 Kellogg N and the Committee on Child Abuse and Neglect. Oral and dental aspects of child abuse and neglect. *Pediatrics* 2005; 116:1565-8.

37 Sanders B, Brady FA, Johnson R. Injuries. In Saunders B (ed.) *Pediatric Oral and Maxillofacial Surgery*. St Louis: Mosby, 1979, pp. 330-400.

38 Fotana VJ, Donovan MD, Wong RJ. The maltreatment syndrome in children. *N Engl J Med* 1963; 269:1389-94.

39 Skinner AE, Castle RL. *A Retrospective Study*. London: NSPCC, 1969.

40 Willging JP, Bower CM, Cotton RT. Physical abuse of children. A retrospective review and an otolaryngology perspective. *Arch Otolaryngol - Head Neck Surg* 1992; 118:584-90.

41 Mehta MN. Physical abuse of abandoned children in India. *Child Abuse Negl* 1982; 6:171-5.

42 Becker DB, Needleman HL, Kotelchuck M. Child abuse and dentistry: orofacial trauma and its recognition by dentists. *J Am Dent Assoc* 1978; 97:24-8.

43 Feldman KW. Patterned abusive bruises of the buttocks and pinna. *Pediatrics* 1992; 90:633-6.

44 Wilson EF. Estimation of the age of cutaneous contusion in injuries. *J Trauma* 1977; 17:842-6. 46 Kumar P. Child abuse by thermal injury - a retrospective survey. *Burns* 1984; 10:344-8. 47 Prescott PR. Hair dryers and non-accidental injury. *Pediatrics* 1990; 86:692-7. 48 Hobbs CJ. Skull fracture and the diagnosis of abuse. *Arch Dis Child* 1984; 59:246-52. 49 Worlock P, Stower M, Barbor P. Patterns of fractures in accidental and non-accidental injury in children: a comparative study. *Br Med J* 1986; 293:100-2. 50 Kaban LB, Mulliken JB, Murray JE. Facial fractures in children. *Plast Reconstr Surg* 1977; 59:15-20. 51 Kvaal SI. Oral injuries in cases of child abuse. *Rev*

Belge Med Dentaire 1993; 48:49-53. 52 Carrotte PV. An unusual case of child abuse. Br Dent J 1990; 168:444-5. 53 Ablin DS, Reinhart MA. Esophageal perforation by a tooth in child abuse. Pediatr Radiol 1992; 22:339-41. 54 Sperber N. The dual responsibility of dentistry in child abuse. Mt J Orthod 1981; 19:21-8. 55 Schuman NJ. Child abuse and the dental practitioner: discussion and case reports. Quintessence mt 1987; 18:619-22. 56 Troutman KC. Non-consensual touching: your input needed. Am Acad Pediatr Dent 1987; 22:3. 57 MacDonald DG. Bite mark recognition and interpretation. J Forens Sci Soc 1974; 14:299-233. 58 Hodson JJ. Forensic odontology in cases of battered baby syndrome. I Dent Res 1971; 50:656. 59 Sims BG, Grant JH, Cameron JM. Bite marks in the 'battered baby' syndrome. Med Sci Law 1973; 13:207-10. 60 Marr JS, Beck AM, Lugo JA. An epidemiological study of the human bite. Public Health Rep 1979; 94:514-21. 61 Rawson RD, Koot A, Martin C et al. Incidence of bite marks in a selected juvenile population: a preliminary report. J Forens Sci 1984; 29:254-9. 62 Liddiard P. An analysis of bite mark cases in forensic dental practice, with reference to dental anomalies affecting case outcomes. MSc, University of Wales, 2002. 63 Vale GL, Noguchi TT. Anatomical distribution of human bites in a series of 67 cases. J Forens Sci 1983; 28:61-9. 64 Harvey W. Dental Identification and Forensic Odontology. London: Henry Kington, 1976, p. 91. 65 Lowry TMC. The surgical treatment of human bites. Annals Surg 1936; 104:1103-6. 66 Speirs RF. Prevention of human bite infection. Surg Gynec Obstet 1941; 72:619. 67 Sims AP. Non-accidental injury in the child presenting as a suspected fracture of the zygomatic arch. Br Dent J 1985; 158:292-3. 68 Liston PN, Tong DC, Firth NA, Kieser JA. Bite injuries: pathophysiology, forensic analysis and management. N Zealand Dent J 2001; 97:58-63. 69 Pretty IA, Sweet D. Anatomical location of bite marks and associated findings in 101 cases from the United States. J Forens Sci 2002; 45:812-14. 70 Simper RD, Whittaker DK. An analysis of bite marks presenting in two centres in the United Kingdom. J Dent Res 1994; 73:791. 71 Whittaker DK, Aitken M, Burfitt E, Sibert JR. Assessing bite marks in children: working with a forensic dentist. Ambulatory Child Hlth 1997; 3:225. 72 Levine LJ. Bite mark evidence. Dent Clin North Am 1977; 21:145-58. 73 Whittaker DK, Brickley MR, Evans L. A comparison of the characteristic (ROC) analysis. Forens Sci Int 1998; 92:11-20.

74 Kydd WL. Quantitative analysis of forces on the tongue. J Dent Res 1956; 35:171-4.

75 Harvey W, Millington PF, Evans, JH et al. Bite marks -

the clinical picture; physical features of skin and tongue. Standard and scanning electron microscopy. *Int J Leg Med* 1973; 8:3.

76 Baker MD, Moore SE. Human bites in children. A six-year experience. 1987; 141:1285-90.

77 Leung AK, Robson WL. Human bites in children. *Pediatr Emerg Care* 1992; 8:255-7.

78 Levine LJ. The solution of a battered child homicide by dental evidence: report of case. *J Am Dent Assoc* 1973; 87:1234-6.

79 Warnick AJ, Biedrzycki L, Russanow C. Not all bite marks are associated with abuse, sexual activities or homicides: a case study of a self-inflicted bite mark. *J Forens Sci* 1987; 32:788-92.

80 Anderson WR, Hudson RP. Self-inflicted bite marks in battered child syndrome. *Forens Sci* 1976; 7:71-4.

81 Calkins CM, Bensard DD, Patrick DA, Karrer FM. Lifethreatening dog attacks: a devastating combination of penetrating and blunt injuries. *J Pediatr Surg* 2001; 36:1115-17.

82 Gandhi RR, Liebman MA, Stafford BL, Stafford PW. Dog bite injuries in children: a preliminary survey. *Am Surg* 1999; 65:863-4.

83 Applegate JA, Walhout MF. Childhood risks from the ferret. *J Emerg Med* 1998; 16:425-7.

84 Triratana T. Bite marks. *J Dent Assoc Thailand* 1970; 20:259-72.

85 Class RT, Jordan FB, Andrews EE. Multiple animal bite wounds: a case report. *J Forens Sci* 1975; 20:305-14.

86 Rheul J, Bratzke H, Feddersen-Perterson DU et al. Death caused by 'attack' dog bites. *Arch Kriminol* 1998; 202:140-51.

87 Sacks JJ, Sinclair L, Gilchrist J et al. Breeds of dogs involved in fatal human attacks in the United States between 1979 and 1998. *J Am Vet Med Assoc* 2000; 217:836-40.

88 Belardi FG, Pascoe JM, Beegle ED. *Pasteurella multocida* meningitis in an infant following occipital dog bite. *J Fam*

Pract 1982; 778:780-2.

89 Steinbok P, Flodmark O, Scheifele DW. Animal bites causing central nervous system injury in children. A report of three cases. *Pediatr Neurosci* 1985; 12:96-100.

90 Callahan ML. Treatment of common dog bites: infection risk factors. *JACEP* 1978; 7:83-7.

91 Marcy SM. Infections due to dog and cat bites. *Pediatr Infect Dis* 1982; 1:351-6.

92 Brook I. Microbiology of human and animal bite wounds in children. *Pediatr Infect Dis J* 1987; 6:29-32.

93 Griego RD, Rosen T, Orengo IF, Wolf JE. Dog, cat and human bites: a review. *J Am Acad Dermatol* 1995; 33:1019-29.

94 Fuortes L, Melson E. Primary and recurrent herpes simplex infection in a paediatric nurse resulting from a human bite (Comment). *Infect Cont Hosp Epidemiol* 1989; 120:295. of HIV through human bites and scratches. *J Acquir Immune Defic Synd* 1988; 1:505-7. 96 Anonymous. To transmit HIV, biter must have blood in the mouth. *AIDS Policy Law* 1996; 11:5. 97 Pretty IA, Anderson GS, Sweet DJ. Human bites and the risk of human immunodeficiency virus transmission. *Am J Forens Med Pathol* 1999; 20:232-9. 98 Arheart KL, Pretty IA. Results of the 4th ABFO Bitemark Workshop - 1999. *Forens Sci Int* 2001; 124:104-11. 99 Schweich P, Fleisher G. Human bite marks in children. *Pediatr Emerg Care* 1985; 1:51-3. 100 Pereira M. Possibilities and limitations of saliva tests in forensic odontology. *Br Dent J* 1971; 130:161. 101 Sweet D, Lorente M, Lorente JA et al. An improved method to recover saliva from human skin: the double swab technique. *J Forens Sci* 1997; 42:320-2. 102 Dinkel EH. the use of bite mark evidence as an investigative aid. *J Forens Sci* 1974; 19:535-47. 103 Sperber ND. Bite marks, oral and facial injuries - harbingers of severe child abuse? *Paediatrician* 1989; 16: 207-11. 104 Dailey JC, Bowers CM. Ageing of bite marks: a literature review. *J Forens Sci* 1997; 42:792-5. 105 Vanezis P. Interpreting bruises at necropsy. *J Clin Pathol* 2000; 54:348-55. 106 Summers R, Lewi n D. Forensic dental photography. In Clark DH (ed.) *Practical Forensic Odontology*. Oxford: Wright, 1992, p. 188. 107 Krauss TC, Warlen SC. The forensic science use of reflective ultraviolet photography. *J Forens Sci* 1985; 30:262-8. 108 Whittaker DK, MacDonald DG. *A Colour Atlas of Forensic Dentistry*. London: Wolfe Publications, 1989, p. 108. 109 Whittaker DK. Forensic dentistry in the identification of

victims and assailants. J Clin Forens Med 1995; 2:145-51.

110 Sheasby DR, MacDonald DG. A forensic classification of distortion in human bite marks. Forens Sci Intern 2001; 122:75-8.

111 Bowers CM, Johansen RJ. Digital analysis of bite marks and human identification. Dent Clin N Am 2001; 45:327-42.

112 Karazalus KP, Palmbach TT, Lee HC. Digital enhancement of subquality bite mark photographs. J Forens Sci 2001; 46:954-58.

113 Millington PF. Histological studies of skin carrying bite marks. J Forens Sci Soc 1973; 14:239-40.

114 Raekallio J. Histological estimation of the age of injuries. In Perper JA, Wecht CH (eds) Microscopic Diagnosis in Forensic Pathology. Springfield, IL: Charles C Thomas, 1980, pp. 3-16.

115 Rothwell BR, Thien AV. Analysis of distortion in preserved bite mark skin. J Forens Sci 2001; 46:573.

116 Lightelm AJ, Coetzee WJC, Van Niekerk PJ. The identification of bite marks using the reflex microscope. J Forens Odontostomatol 1987; 5:1-8.

117 Sweet D, Parhar M, Wood RE. Computer-based production of bite mark comparison overlays. J Forens Sci 1998; 43:1050-5.

23 Chapter 23. Paediatric Dental Identification

16 Kaste LM, Selwitz RH, Oldakowski RJ et al. Coronal caries in the primary and permanent dentition of children and adolescents 1-17 years of age: United States, 1988-1991. *J Dent Res* 1996; 75:631-41.

17 White BA, Caplan DJ, Weintraub JA. A quarter century of changes in oral health in the United States. *J Dent Educ* 1995; 59:19-57.

18 Flink A, Kallestal C, Holm AK et al. Distribution of caries in 12-year-old children in Sweden. Social and oral healthrelated behavioural patterns. *Community Dent Health* 1999; 16:160-5.

19 Lawrence HP, Sheiham A. Caries progression in 12- to 16-year-old school children in fluoridated and deficient areas in Brazil. *Community Dent Oral Epidemiol* 1997; 25:402-11.

20 Moody GH, Busuttil A. Identification in the Lockerbie air disaster. *Am J Forensic Med Pathol* 1994; 15:63-9.

21 Sholl SA, Moody GH. Evaluation of dental radiographic identification: an experimental study. *Forensic Sci Int* 2001; 115:165-9.

22 Ahlberg JE. We must get our numbers right. *FDI Newsletter* 1987; 158:8-9.

23 Ayton FE, Hill CM, Parfitt HN. The dental role in the identification of the victims of the Bradford City football ground fire. *Br Dent J* 1985; 159:262-4.

24 Ireland RS, Harris RV, Pealing R. Clinical record keeping by General Dental Practitioners piloting the Denplan 'Excel' accreditation programme. *Br Dent J* 2001; 191:260-3.

25 Tesini DA, O'Malley KD, Schwartz S. Development of bite impression technique for use in identification of unknown and missing children. *J Mass Dent Soc* 1985; 34:61, 63, 69, passim.

26 Tesini DA, Harte D, Crowley K. Dentistry's role in the identification of missing and unknown children: update on the dental bite impression technique. *J Mass Dent Soc* 1999; 48:29-34.

27 Tesini DA. Comments on the Toothprints Bite Impression for Search and Identification of Missing and Unknown Children. 2003. <http://www.kerrdental.com/Toothprints/Toothprints%20Position20Paper>

28 Whittaker DK, MacDonald D. A Colour Atlas of Forensic Dentistry. London: Wolfe Medical Publishers, 1989.

29 Aws G. An Overview and Comparison of CAPMI and DAVID Programmes. Dissertation for the Diploma in Forensic Odontology. Hatfield, UK: University of Hertfordshire, 1999.

30 American Board of Forensic Odontology. Body identification guidelines. J Am Dent Assoc 1994; 125:1244-52.

31 Koelmyer TD. Video camera superimposition and facial reconstruction as an aid to identification. Am J Forensic Med Pathol 1982; 3:45-8.

32 Perper JA, Patterson GT. Face imaging reconstructive morphography. A new method for physiognomic reconstruction. Am J Forensic Med Pathol 1988; 9:126-38.

33 Hill B, Macleod RM, Crothers A. Rebuilding the face of George Buchanan (1506-1582). J Audiov Media Med 1996; 19:11-15.

34 Philips VM, Smuts NA. Facial reconstruction: utilization of computerized tomography to measure facial tissue thickness in a mixed race population. Forensic Sci Int 1996; 83:51.

35 Law CA, Bowers CM. Radiographic reconstruction of root morphology in skeletonised remains: a case study. J Forensic Sci 1996; 41:514-17.

36 Shahrom AW, Vanezis P, Chapman RC et al. Techniques in facial reconstruction: computer-aided facial reconstruction using a laser scanner and video superimposition. Int J Legal three-dimensional facial reconstruction: historical review and contemporary developments. J Forensic Sci 1997; 42:653-61. 38 Brocklebank L, Holmgren CJ. Development of equipment for the standardization of skull photographs in personal identification. J Forensic Sci 1989; 31:1373-9. 39 Simpson JDR. The investigation of an unknown skull with superimposition of known faces. Dissertation for a Master of Science Degree. Edinburgh: University of Edinburgh,

1998. 40 Malaver PC, Yunis YY. Different dental tissues as source of DNA for human identification in forensic cases. *Croat Med J* 2003; 44:306-9. 41 Caloni PEB, Lunin M, Stout F. Histologic criteria for age estimation of the developing human dentition. *Oral Surg* 1970; 29:869-76. 42 Kraus BS, Jordan RE. *The Human Dentition Before Birth*. Philadelphia, PA: Lea and Febiger, 1965. 43 Clement JG, Kosa F. The fetal skeleton. In Clark DH (ed.) *Practical Forensic Odontology*. London: Wright, 1992, pp. 43-52. 44 Ashley KF. Identification of children in a mass disaster by estimation of dental age. *Br Dent J* 1970; 129:167-9. 45 Ciapparelli L. The chronology of dental development and age assessment. In Clark DH (ed.) *Practical Forensic Odontology*. London: Wright, 1992, pp. 22-42. 46 Schour L, Hoffman MM. Studies in tooth development, 2. The rate of apposition of enamel and dentine in man and other mammals. *J Dent Res* 1939; 18:161-75. 47 Noble HW. The estimation of age from the dentition. In Harvey W (ed.) *Dental Identification and Forensic Odontology*. London: Kimpton, 1976, pp. 28-35. 48 Moorrees CFA, Fanning EA, Hunt EE. Formation and resorption of three deciduous teeth in children. *Am J Phys Anthropol* 1963; 21:205-13. 49 Moorrees CFA, Fanning EA, Hunt EE. Age variation of formation stages for ten permanent teeth. *J Dent Res* 1963; 42:1490-502. 50 Demirjian A. Postnatal growth. In Falkner F, Tanner JM (eds) *Dentition in Human Growth*. London: Baillière Tindall, 1978, pp. 413-44. 51 Koski M, Garn SM. Tooth eruption sequence in fossil and modern man. *Am J Phys Anthropol* 1957; 15:469-88. 52 Demirjian A, Goldstein H, Tanner JM. A new system of dental age assessment. *Hum Biol* 1973; 45:211-27. 53 Demirjian A, Goldstein H. New systems for dental maturity based upon seven and four teeth. *Ann Hum Biol* 1976; 3:411-21. 54 Schour L, Massler M. The development of the human dentition. *J Am Dent Assoc* 1941; 28:1153-60. 55 Maber M, Liversidge HM, Hector MP. Accuracy of age estimation of radiographic methods using developing teeth. *Forensic Sci Int* 2006; 159:S68-73. 56 Willems G, Van Olmen A, Spiessens B, Carels C. Dental age in Belgian children: Demirjian's technique revisited. *J Forensic Sci* 2001; 46:893-5. 57 De Salvia A, Calzetta C, Orrico M, De Leo D. Third mandibular molar radiological development as an indicator of chronological age in a European population. *Forensic Sci Int* 2004; 146:S9-12. 58 Garamendi PM, Landa MI, Ballesteros J, Solano MA. Reliability of the methods applied to assess age minority in living subjects around 18 years old. A survey on a Moroccan origin population. *Forensic Sci Int* 2005; 154:3-12. 59 Ciapparelli L. The assessment of dental age in Essex school children using panoramic radiographs with forensic applications. Dissertation for the Diploma in Forensic Odontology. London: of tooth development: a new

method based on objective measurements. Scand J Dent Res 1994; 102:137-43.

61 Liversidge HM, Lyons F, Hector MP. The accuracy of three methods of age estimation using radiographic measurements of developing teeth. Forensic Sci Int 2003; 131:22-9.

62 Foti B, Lalys L, Adalian P et al. New forensic approach to age estimation in children based on tooth eruption. Forensic Sci Int 2003; 132:49-56.

63 Ritz-Timme S, Cattaneo C, Collins MJ et al. Age estimation: the state of the art in relation to the specific demands of forensic practice. Int J Legal Med 2000; 113:129-36.

64 Arany S, Ohtani S, Yoshioka N, Gonmori K. Age estimation from aspartic acid racemization of root dentin by internal standard method. Forensic Sci Int 2004; 141:127-30.

65 Yekkal R, Meers C, Van Schepdael A et al. Racemization of aspartic acid from human dentin in the estimation of chronological age. Forensic Sci Int 2006; 159:S89-94.

66 Sajdok J, Pilin A, Pudil F et al. A new method of age estimation based on the changes in human non-collagenous proteins from dentin. Forensic Sci Int 2006; 156:245-9.

67 Aitchison J. Sex differences in teeth, jaws and skulls. Dent Pract 1963; 14:52-7.

68 Biggerstaff RH. Craniofacial characteristics as determinants of age, sex and race in forensic dentistry. Dent Clin North Am 1997; 21:85-97.

69 Botha CT. Craniofacial characteristics as determinants of age, race and sex in forensic dentistry - a hands on guide. J Forensic Odontostomatol 1991; 9:47-61.

70 Harvey W. Effects of sex, race, hereditary and systematic disease on oral tissues. In Harvey W (ed.) Dental Identification and Forensic Odontology. London: Henry Kimpton, 1976, pp. 36-43. Int J Forensic Dent 1973; 1:8-11. 72 Whittaker DK, Llewelyn DR, Jones RW. Sex determination from necrotic pulp tissue. Br Dent J 1975; 139:403-5. 73 Murakami H, Yamamoto Y, Yoshitome K et al. Forensic study of sex determination using PCR on tooth samples. Acta Med Okayama 2000; 54:21-32. 74 Gaillard H, Ludes B, Kaess B, Mangin P. The use of the teeth in genetic fingerprinting. Bull Group Int Rech Sci Stomatol Odontol

1994; 37:65-70. 75 Urbani C, Lastrucci RD, Kramer B. The effect of temperature on sex determination using DNA-PCR analysis of dental pulp. *J Forensic Odontostomatol* 1999; 17:35-9. 76 Karaman F. Use of diagonal teeth measurements in predicting gender in a Turkish population. *J Forensic Sci* 2006; 51 :630-5. 77 Kumar MG, Hegde AM. Sex identification from exfoliated primary teeth - a PCR study. *J Clin Pediatr Dent* 2005; 30:19-21. 78 Fazekas IG, Kossa F. Determination of the body length and age of fetuses on the basis of the dimensions of the facial bones. Chapter X. In Fazekas IG, Kossa F (eds) *Forensic Fetal Osteology*. Budapest: Akademiai Kiado, 1978, pp. 165-96. 79 Hurme VO. Time and sequence of tooth eruption. *J Forens Sci* 1957; 2:371-88. 80 Kiessner JA. *Human Adult Odontometrics. Studies in Biological Anthropology*. Cambridge: Cambridge University Press, 1990. 81 Buck TJ, Vidarsdottir US. A proposed method for the identification of race in sub-adult skeletons: geometric morphometric analysis of mandibular morphology. *J Forensic Sci* 2004; 49:1159-64.

Appendix B: Tables of Standard Measurements

1 Maroun LL, Graem N. Autopsy standards of body parameters and organ weights in non-macerated and macerated human fetuses. *Pediatr Dev Pathol* 2005; 8:204-17.

2 Pinar H, Sung CJ, Oyer CE, Singer DB. Reference values for singleton and twin placental weights. *Pediatr Pathol Lab Med* 1996; 16:901-7. 3 Naeye RD. Umbilical cord length: clinical significance. *J Pediatr* 1985; 107:278-81. 4 Thompson WS, Cohle SD. Fifteen-year retrospective study of infant organ weights and revision of standard weight tables. *J Forensic Sci* 2004; 49:1-11. 5 Altman PL, Dittmer DS. *Growth: Including Reproduction and Morphological Development*. Washington DC: Federation of American Societies for Experimental Biology, 1962.

Table 12 Major organ weights (g) by age (1-18 years) and sex

Age (years) Brain Lungs Heart Liver Spleen Kidneys (right
left) (right left) M F M F M F M F M F M F

1	971	894	107.3	175.3	54	48	400	390	35	34	72	65
2	1076	1012	245.9	244.3	63	62	460	450	42	41	85	75
3	1179	1076	304.7	265.5	73	71	510	500	48	47	93	84
4	1290	1156	314.2	311.7	83	80	555	550	53	52	100	93
5	1275	1206	260.6	319.9	95	90	595	590	58	57	106	102
6	1313	1225	399.5	357.5	103	100	630	635	62	62	112	112
7	1338	1265	365.4	404.4	110	113	665	685	64	67	120	123
8	1294	1208	405.0	382.1	122	126	715	745	68	71	128	135
9	1360	1226	376.4	358.4	132	140	770	810	73	77	138	148
10	1378	1247	474.5	571.2	144	154	850	880	82	85	150	163
11	1348	1259	465.6	535.0	157	168	950	960	91	93	164	180
12	1383	1256	458.8	681.7	180	188	1050	1080	101	103	178	195
13	1382	1243	504.5	602.3	202	207	1150	1180	111	112	196	210
14	1356	1318	692.8	517.0	238	226	1240	1270	127	120	212	222

15 1407 1271 691.7 708.3 258 238 1315 1330 135 127 229 230

16 1419 1300 747.3 626.5 282 243 1380 1360 145 134 244 236

17 1409 1254 776.9 694.5 300 247 1450 1380 152 140 260 240

18 1426 1312 874.7 654.9 310 250 1510 1395 157 146 270 244

Data from ref. 5.

F, female; M, male.