ABC
Emergency Radiology
Second Edition
ABC series

The revised and updated ABC series – written by specialists for non-specialists

- With over 40 titles, this extensive series provides a quick and dependable reference on a broad range of topics in all the major specialties
- An easy-to-use resource, covering the symptoms, investigations, treatment and management of conditions presenting in your day-to-day practice
- Full colour photographs and illustrations aid diagnosis and patient understanding of a condition
- Each book in the new series now offers links to further information and articles, and a new dedicated website provides even more support
- A highly illustrated, informative and practical source of knowledge for GPs, GP registrars, junior doctors, doctors in training and those in primary care

For further information on the entire ABC series, please visit: www.abcbookseries.com

Blackwell Publishing  BMJ Books
Contents

Contributors, vii
Preface, ix
General Aspects of Trauma, 1
Lee F Rogers
1 General Principles: How to Interpret Radiographs, 5
Otto Chan, Robin Touquet
2 Hand, 13
Otto Chan, Tudor H Hughes
3 Wrist, 17
Otto Chan, Caroline C. Perker-Cuan, Ali Naraghi
4 Elbow, 24
Gerald de Lacey, Otto Chan
5 Shoulder, 31
May-ai Seah, David A Elias, Otto Chan
6 Pelvis and Hip, 37
James AS Young, Jeremy WR Young, Otto Chan
7 Knee, 45
Rashika Fernando, David A Elias, Otto Chan
8 Ankle, 52
Paula McAlinden, James Teh
9 Foot, 58
Peter Renton, Muaaze Ahmad, Otto Chan
10 Chest, 64
Ali Naraghi, Otto Chan
11 Abdomen, 73
Niall Power, Tim Forthetgham, Otto Chan
12 Head, 83
Ameerish Mehta, Otto Chan
13 Face, 94
Simon Holmes, Laurence H Berman, Otto Chan
14 Cervical Spine, 101
Clint W Stlker, Kathirkamanathan Shusmuganathan
15 Thoracic and Lumbar Spine, 109
Roger N Bodley, Andreas Koureas, Otto Chan

16 Emergency Paediatrics Radiology, 115
Marina J Easty, Rasy Jalan

17 Major Trauma, 124
Otto Chan, Alastair Wilson, Michael Walsh
Index, 129
Contributors

Muaaze Ahmad  
Consultant Musculoskeletal Radiologist, Barts and The Royal London NHS Trust, London

Laurence H Berman  
Ultrasound Consultant, Addenbrooke's Hospital, Cambridge

Roger N Bodley  
Consultant Radiologist, Stoke Mandeville Hospital, Buckinghamshire

Otto Chan  
Consultant Radiologist, The London Independent Hospital, London

Gerald de Lacey  
Consultant Radiologist, Radiology Red Dot Courses, London

Marina J Easty  
Consultant in Paediatric Radiology, Great Ormond Street Hospital, London

David A Elias  
Consultant Radiologist, King's College Hospital, London

Rashika Fernando  
Specialist Registrar in Diagnostic Radiology, King's College Hospital, London

Tim Fotheringham  
Consultant Interventional Radiologist, The Royal London Hospital, London

Simon Holmes  
Consultant Maxillofacial Surgeon, The Royal London Hospital, London

Tudor H Hughes  
Associate Professor of Radiology, University of California San Diego, USA

Rosy Jalan  
Consultant Paediatric Radiologist, Royal London Hospital, London

Andreas Koureas  
Lecturer, University of Athens, Athens, Greece

Paula McAlinden  
Consultant Radiologist, Royal Bournemouth Hospital, Bournemouth

Amrish Mehta  
Consultant Neuroradiologist, Charing Cross Hospital, London

Ali Naraghi  
Assistant Professor of Radiology, Mount Sinai Hospital and University Health Network, University of Toronto, Toronto, Canada

Caroline C Parlier-Cuau  
Hôpital Lariboisière, Paris, France

Niall Power  
Consultant Radiologist, Royal London Hospital, London

Peter Renton (deceased)  
Formerly Consultant Radiologist, University College Hospital London

Lee F Rogers  
Professor, University of Arizona Health Sciences Center, Tucson, Arizona, USA

May-ai Seah  
Specialist Registrar in Diagnostic Radiology, King's College Hospital, London

Kathirkamanathan Shanmuganathan  
Professor, Department of Diagnostic Radiology, University of Maryland School of Medicine, Baltimore, USA

Clint W Sliker  
Assistant Professor, University of Maryland Medical School, Baltimore, USA

James Teh  
Consultant Radiologist, Nuffield Orthopaedic Centre, Oxford

Robin Touquet  
Consultant in Emergency Medicine, St Mary's Hospital, London
<table>
<thead>
<tr>
<th>Contributors</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Michael Walsh</strong></td>
<td>Consultant Trauma and Vascular Surgeon, The Royal London Hospital, London</td>
</tr>
<tr>
<td><strong>Alastair Wilson</strong></td>
<td>Consultant in Accident and Emergency, The Royal London Hospital, London</td>
</tr>
<tr>
<td><strong>James AS Young</strong></td>
<td>Specialist Registrar in Radiology, Barts and The Royal London NHS Trust, London</td>
</tr>
<tr>
<td><strong>Jeremy WR Young</strong></td>
<td>DISC Imaging, Mount Pleasant SC United States</td>
</tr>
</tbody>
</table>
Preface

There have been dramatic technological advances in diagnostic imaging over the past two decades, but the rapid acquisition and interpretation of plain radiographic images remains the mainstay of initial successful management of sick or traumatised patients in accident and emergency departments.

Virtually any medical condition can present to accident and emergency departments, and so the volume of medical knowledge needed to manage these patients satisfactorily is enormous. It is unfortunate that most of these patients are initially seen and treated by relatively inexperienced staff – usually medical students, house officers, senior house officers, specialist registrars, or nurses – who often have had little or no training in the interpretation of plain radiographs.

Rapid and accurate interpretation of these radiographs is often the key to quick and correct management of patients in the accident and emergency department. Although safety nets exist, specialist radiological advice is often not available at the time of presentation – when it is most needed. Staff in the accident and emergency department who manage these patients need to be able to interpret these radiographs for quick, accurate, and effective initial treatment, to avoid errors in interpretation, inappropriate treatment, and medicolegal consequences.

The authors of the ABC of Emergency Radiology have produced a simple and logical step by step approach on how to interpret radiographs. The book is divided into anatomical regions and followed by chapters in paediatrics and major trauma. The chapters start with normal basic radiological anatomy, followed by the standard radiographs, then a simple ABCs systematic approach on basic interpretation of the radiographs, a review of abnormalities, and a summary.

This book provides a simple, concise, and systematic approach to the interpretation of plain radiographs. It should be very helpful to medical students, foundation doctors, specialist registrars, and consultants in all specialties, and also other health professionals working in accident and emergency, in particular radiographers and nurses.

Otto Chan
To my family.
General Aspects of Trauma

Lee F Rogers

Trauma was long regarded as a subject unworthy of study and research in medicine. The serious collective morbidity and mortality caused by trauma has now been acknowledged, and the enormous collective costs of the initial treatment and subsequent care have been computed and tabulated. The numbers are large. As a result, trauma is now a matter of conscious concern to the medical profession and government at all levels. Trauma is finally receiving the attention it deserves.

In 1966, publication of the landmark white paper, Accident death and disability, the neglected disease of modern society, by the National Academy of Sciences showed the full impact of trauma. It resulted in dramatic changes. Guidelines were published to establish regionalised trauma care, and they have been adopted widely in the United States. Anderson and colleagues carried out a similar study in the United Kingdom, and this has led to a sea change in the management of trauma in the United Kingdom. The introduction of advanced trauma life support training has been of great importance. Where adopted and implemented, specialised trauma centres have substantially improved the care of the injured. The need for research into trauma is vital because of its effect on the quality of life of people who have sustained trauma injuries and because of the high cost of treatment (more than $20 billion a year in the United States alone).

Epidemiology of trauma

Trauma can occur to anyone at any time. Skeletal injuries occur during the course of all human activities. The expectation and risk of injury varies with the nature of the endeavour. Nobody is immune, irrespective of age, sex, activity, or state of health. Trauma is unexpected and sudden. At best, an injury may cause a minor degree of inconvenience; at worst, it can cause death. Before the event, those affected may have been in excellent health. In the next moment, life may hang precariously in the balance. Of course, criminal activities, assaults, and beatings result in skeletal injury, but no human activity is free of the risk of injury. Even mundane activities in the home, at work, or at play carry a finite risk.

Repetitive activities in industrial settings lend themselves to analysis, and preventive measures can be taken to reduce the incidence of injury. In other situations, effective preventive measures have been identified, but they have been only partially accepted by the public. Laws have long been in place that set speed limits, prohibit driving

Prevention and minimisation of accidents are now recognised as important contributions to people’s lives, as well as a means of reducing healthcare expenditure.

Injuries and death associated with motor vehicle crashes at high speed have reached plague-like proportions. With permission from Peter Menzel/Science Photo Library.

Motorcyclists are 13 times more likely to die in a road traffic crash than drivers of cars, even though it has been shown repeatedly that the use of helmets reduces head injury, death, and disability in motorcyclists.
while under the influence of alcohol, and mandate the use of seat belts, yet many people ignore these laws and are a menace to themselves and others.

**Frequency and distribution of fractures**

The location, nature, and number of fractures depend on the age of the individual, the nature and severity of the trauma, and the status of the skeletal system.

The activity in which a person is engaged when injured can be predicted by their age. The young will probably be injured in the course of play or sports activities. Mature adults (aged 20-50 years) are more likely to sustain an injury while travelling in a motor vehicle or at work. Falls are more often a source of injury in elderly people than other causes, including motor vehicle crashes. Many elderly people are sedentary, often affected by osteoporosis, and more likely to be injured in a fall during the course of normal activities – for example, walking, descending stairs, stepping from a curb, or moving about in a bathroom.

**Fatalities in trauma**

In the developed world, injuries are the leading cause of death for more than half of the human life span (1-43 years). Trauma is the fourth most common cause of death after heart disease, cancer, and stroke. About 150 000 US citizens of all ages die from trauma each year, and about a third of these deaths are from motor vehicle crashes. Motor vehicle crashes are the leading cause of death between the ages of 5 and 34 years.

The World Health Organization (WHO) has estimated that in the year 2000, 1.26 million people worldwide died from road traffic crashes. Injuries outnumber all other causes of death in children and young adults. Almost half of all deaths in US children are the result of trauma. Crashes involving motor cars and children who are pedestrians are the leading source of multiple injuries in children. Such incidents are followed distantly by motor vehicle crashes with children as passengers, crashes involving children on bicycles and motor vehicle crashes involving motor cycles, and falls from great heights. Children tend to survive multiple injuries more often than adults.

The overall death rate of those who sustain multiple injuries is about 10-25%. People >70 years are affected more severely by accidents than those from other age groups. Trauma is the fifth leading cause of death in patients >65 years. Although people in this age group are less likely to be injured than those in younger age groups, older individuals are more likely to die from their injuries. In older people, mortality from accidents is five times higher than that in younger people.

**Initial evaluation of injured people**

The first two steps in the care of an injured person should be a carefully performed medical history and physical examination. An evaluation of the airway and checks for the presence of shock, haemorrhage, and open wounds are essential. In each of these areas, corrective measures must be taken immediately if necessary. Fractures
should be noted and splints applied. These actions will assist in the handling of the patient and reduce morbidity in seriously injured patients.

The physical examination of comatose patients or patients with multiple injuries (often seen in patients from vehicle accidents) is difficult because the patient is unable to cooperate or respond to queries. Injuries can be easily overlooked, which heightens the importance of imaging.

Radiographic examination should never be considered a substitute for taking a patient’s history and doing a physical examination. Serious injuries can often exist even if they are not found on a radiograph.

**Imaging to assess injured people**

Successful treatment of skeletal injury starts with accurate diagnosis. A good history and physical examination, and to ensure the patient is haemodynamically stable is necessary for this. Then the patient needs a well performed and accurately interpreted radiographic examination. The standard views for radiographs have been adopted because they show most abnormalities. Failing to obtain all of the standard views heightens the chance for oversights and diagnostic errors.

A radiographic examination to exclude a skeletal injury of any anatomical part should never be obtained in a single plane only. Radiographs obtained in two planes at right angles are the minimum, and radiographic examinations of joints need additional oblique views to exclude fractures and dislocations. Patients who have severe trauma require computed tomography to identify or exclude injuries of the central nervous system, vascular area, chest, and intra-abdominal visceral injuries, as well as injuries of the face skeleton, spine, and pelvis.

The physician or radiologist’s interpretation of a radiographic examination (or any type of imaging examination) is facilitated greatly by an appropriate history on the request form. Unfortunately, the history being included for the radiologist can be perfunctory, incomplete, or even misleading. The lack of a good history compromises the radiologist’s evaluation. The history should state precisely where the patient hurts and the initial clinical impression – for example, “Pain in snuff box, rule out fracture of the scaphoid.” Knowledge of where the patient hurts directs attention to the area of principal clinical concern and, at the same time, steers the radiologist away from questionable findings in other parts of the film that have no clinical importance.

Injuries are repetitive. That is to say, in each anatomical part injuries occur at some sites more often than at others. People who interpret radiographs of patients with trauma should be aware of the sites of the most common injuries in each anatomical part. They should exclude injuries at those specific sites. For example, with pain in the wrist – epiphyseal fractures of the distal radius should be excluded in adolescents, scaphoid and triquetral fractures are most common in young adults, and Colles’ fractures should be looked for in elderly people.
Soft tissue signs that point to underlying injury of the bone and joint should be specifically identified or excluded. These include the fat pad sign at the elbow joint, which indicates haemarthrosis, and the fat-fluid sign at the knee, which alerts the doctor to an intra-articular fracture of the knee joint.

KEY POINTS

- Traumatic injury is common at all ages and is the leading cause of death in children and young adults
- Imaging plays a key role in the evaluation and treatment of injured people
- Prompt and accurate identification of injuries assures appropriate treatment, thus reducing the morbidity and mortality of those injured. This is a worthy goal for all involved in their care