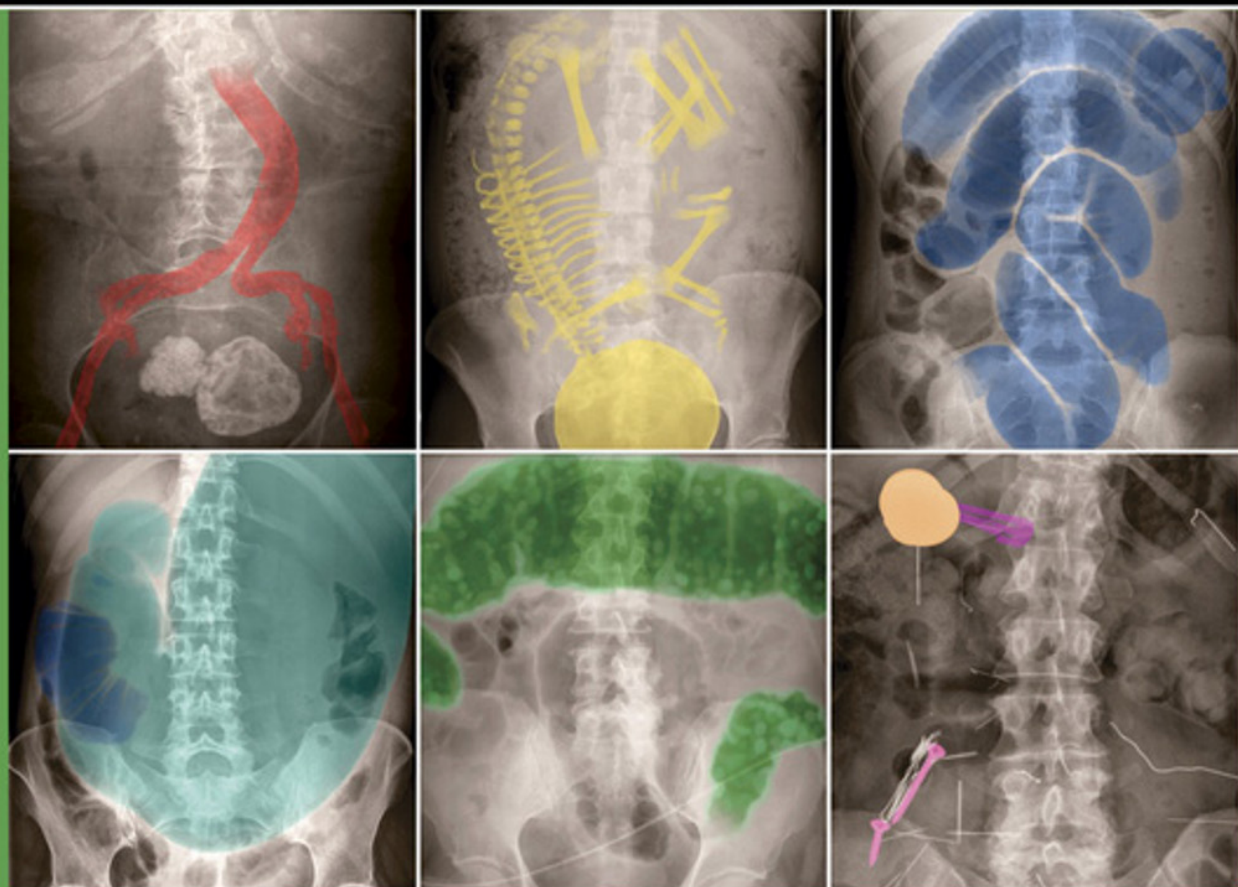


ABDOMINAL X-RAYS FOR MEDICAL STUDENTS



CHRISTOPHER CLARKE & ANTHONY DUX



WILEY Blackwell

Abdominal X-rays

for Medical Students

This book is dedicated to all teaching radiologists and their students.

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Abdominal X-rays **for Medical Students**

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Preface

The abdominal radiograph is commonly encountered within the hospital setting, and often junior doctors are the first to review and act upon the radiograph findings. Medical students therefore need to learn how to interpret basic signs and pathology on an abdominal radiograph.

This book is a follow-up to *Chest X-rays for Medical Students*, which Anthony and I wrote a few years ago to help medical students with chest radiographs. Since publishing the chest X-ray book, I have entered clinical radiology training at Nottingham University Hospitals NHS Trust and passed fellowship exams. Anthony has retired, returning a few days a week to continue reporting and teaching. This book has taken approximately 12 months to write and much longer to collect all the radiographs featured within.

The most novel and exciting aspect of *Abdominal X-rays for Medical Students* is the way colour overlays are used to highlight the anatomy and pathology. This way of 'marking' the radiographs separates this book from others and makes it easy to appreciate the sign or pathology of interest. Generally, two radiographs are displayed side by side with the radiograph on the right marked out in colour and the radiograph on the left unmarked for comparison. This makes it easy to compare and identify the abnormality on the unmarked radiograph. Some signs and pathologies

are difficult to appreciate, and I experimented with different enhancement techniques until I found one that worked. The result of this was that I have ended up using a range of different techniques to show or enhance pathology in this book.

This book is not intended to be used as an encyclopaedic reference but as a colourful and informative teaching aid to help medical students, junior doctors, radiographers and nurses learn the basics of abdominal X-ray interpretation in a simplified, logical and systematic way. We try to avoid confusing terms and fully explain any commonly used radiographic signs such as *thumbprinting* or *Rigler's sign*.

I hope that by the end of this book, you should have a system to use for analysing and presenting abdominal radiographs and know how to recognise the important common pathologies on an abdominal X-ray.

We are constantly improving and refining this teaching resource for future students, so would really appreciate any feedback or suggestions you may have. Please feel free to contact us with any ideas you have.

I hope that you enjoy using this book.

Christopher G.D. Clarke

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First, we would like to thank the staff at Nottingham University Hospitals NHS Trust, University Hospitals of Leicester NHS Trust and Derby Hospitals NHS Foundation Trust, without whose dedication and work none of this would be possible. We would like to acknowledge our colleagues who have read this workbook and made numerous suggestions and contributions including many of the Nottingham and Leicester clinical radiology trainees. It would be impossible to name everyone, but we are very grateful.

We would like to thank Dr Tim Taylor and Benjamin Troth for providing many excellent radiograph examples. A special thanks goes to Dr Gill Turner for providing us with access to her fantastic collection of abdominal radiographs, many of which are used in this book. I just hope the colouring has done her collection justice!

Special thanks also go to the many medical students who attended focus groups, lectures and teaching sessions and gave fantastic feedback. I would like to thank Elizabeth Bridges, Sally Wege, Stephanie Ainley and Mark Evans for giving up their time to help in the very early stages of writing. Also I would like

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Finally, thank you to Stewart Petersen for his advice, encouragement and support in publishing *Chest X-rays for Medical Students*. Without his contribution and kindness, *Abdominal X-rays for Medical Students* would never have been developed.

Learning objectives checklist

(Keep track of your learning by ticking the ☐ when you have covered that topic)

By the end of this workbook, students should:

- | | | | |
|--|--------------------------|---|--------------------------|
| • Have a basic understanding of what X-rays are and how the image is produced. | ☐ | • Calcified mesenteric lymph nodes | ☐ |
| • Have a system for analysing (ABCDE) and presenting an abdominal radiograph. | ☐ | • Calcified uterine fibroids | ☐ |
| • Know how to recognise the following on a plain abdominal radiograph: | | • Prostate calcification | ☐ |
| • Pneumoperitoneum (gas in the peritoneal cavity) | ☐ | • Abdominal aortic calcification (normal calibre) | ☐ |
| • Pneumoretroperitoneum (gas in the retroperitoneal space) | ☐ | • Splenic artery calcification | ☐ |
| • Pneumobilia (gas in the biliary tree) | ☐ | • Pelvic fractures – 3 Polo rings test | ☐ |
| • Portal venous gas (gas in the portal vein) | ☐ | • Sclerotic and lucent bone lesions | ☐ |
| • Dilated small bowel | ☐ | • Spine pathology | ☐ |
| • Dilated large bowel | ☐ | • Solid organ enlargement | ☐ |
| • Volvulus | ☐ | • Surgical clips/staples/sutures | ☐ |
| • Dilated stomach | ☐ | • Urinary catheter | ☐ |
| • Hernia | ☐ | • Supra-pubic catheter | ☐ |
| • Bowel wall inflammation | ☐ | • Nasogastric (NG) and nasojejunal (NJ) tubes | ☐ |
| • Faecal loading | ☐ | • Flatus tube | ☐ |
| • Faecal impaction | ☐ | • Surgical drain | ☐ |
| • Gallstones in the gallbladder (cholelithiasis) | ☐ | • Nephrostomy catheter | ☐ |
| • Renal stones (urolithiasis) | ☐ | • Peritoneal dialysis (PD) catheter | ☐ |
| • Bladder stones | ☐ | • Gastric band device | ☐ |
| • Nephrocalcinosis | ☐ | • Percutaneous endoscopic gastrostomy (PEG)/radiologically inserted gastrostomy (RIG) | ☐ |
| • Pancreatic calcification | ☐ | • Stoma bag | ☐ |
| • Adrenal calcification | ☐ | • Stents | ☐ |
| • Abdominal aortic aneurysm (AAA) calcification | ☐ | • Inferior vena cava (IVC) filter | ☐ |
| • Fetus | ☐ | • Intra-uterine device (IUD) | ☐ |
| • Calcified costal cartilage | ☐ | • Pessary | ☐ |
| • Phleboliths ('vein stones') | ☐ | • Retained surgical swab | ☐ |
| | | • Swallowed objects | ☐ |
| | | • Objects inserted per-rectum (PR) | ☐ |
| | | • Clothing artefact | ☐ |
| | | • Piercings | ☐ |
| | | • Body packer | ☐ |
| | | • Lung bases | ☐ |

About X-rays

What are X-rays?

X-rays are a form of **ionising radiation**. They are part of the electromagnetic spectrum and have sufficient energy to cause ionisations. They contain more energy than ultraviolet (UV) waves but less energy than gamma rays.

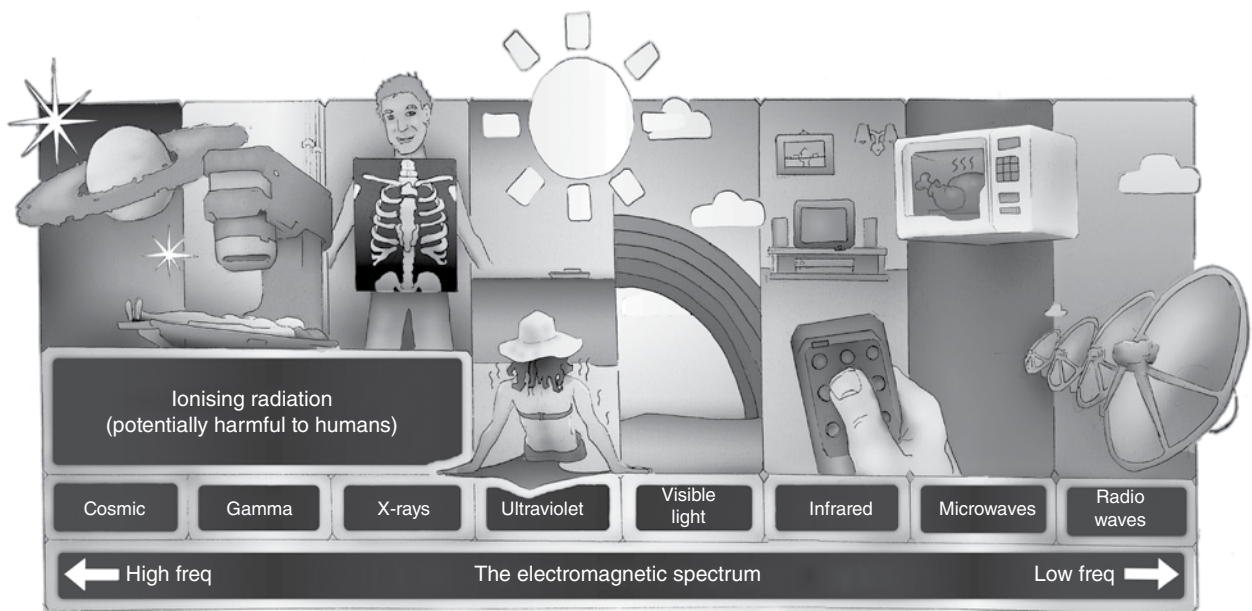


Figure 1: The electromagnetic spectrum (Freq is short for frequency).

Radiation is the transfer of energy in the form of particles or waves.

Ionising radiation is the radiation with sufficient energy to cause ionisations, which is a process whereby radiation removes an outer shell electron from an atom. Thus ionising radiation is able to cause changes on a molecular level in biologically important molecules (e.g. DNA).

Uses of ionising radiation include conventional X-rays (plain radiographs), contrast studies, computed tomography (CT), nuclear medicine and positron emission tomography (PET).

How are X-rays produced?

X-rays are produced by focusing a high-energy beam of electrons onto a metal target (e.g. tungsten). The electrons hit the metal target and some will have enough energy to knock out another electron from the inner shell of one of the metal atoms. As a result, electrons from higher energy levels then fill up this vacancy and