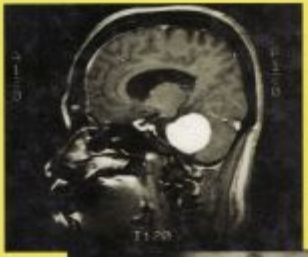

Exercises in Diagnostic Imaging

Sarah Burnett
Asif Saifuddin

harwood academic publishers

Exercises in Diagnostic Imaging

Sarah Burnett and Asif Saifuddin

Exercises in Diagnostic Imaging provides 10 mock papers for those preparing for the film reporting section of higher examinations in radiology. Covering every modality and presenting cases of varying complexity, these exercises offer an ideal opportunity for practising image interpretation. The authors have supplied model answers for comparison and a full list of actual diagnoses is given.

- 80 cases with model answers
- High quality images
- Presents a wide range of abnormalities and conditions
- Ideal for exam preparation and self assessment

Suitable for the FRCR Part 2 and equivalent examinations. *Exercises in Diagnostic Imaging* is also relevant to MRCP candidates and those preparing for other specialist examinations.

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INTRODUCTION

The aim in writing this book was to provide practice for the reporting session of the FRCR examination. Candidates are often given little practice prior to an attempt at this particular component, while there are several books of multiple choice questions and opportunities to practice the viva.

We have attempted to reproduce the content of the exam but have been limited in the number of images for each case and have therefore provided a representative selection. Clearly this does have an implication in terms of timing as more images would be available in the real exam and therefore each case would take slightly longer to assess. Cases are of differing complexity and, whereas some may be adequately answered by one or two sentences, others will need a more detailed reply.

It is intended that each paper of the ten in the book should be worked through and answers produced in one hour. Model answers have been provided for comparison and, in case the reader is interested, there is a list of the actual diagnoses for the cases at the end of the book. The style of writing an answer is left to the reader's personal choice, and ours are in the style of a conventional report, but in providing an answer in the exam it is important to be explicit in terms of side and site when describing the abnormality, and giving appropriate differential diagnoses together with an indication of suitable further action. It is stated in the guidelines to candidates from the Royal College of Radiologists that credit is given for clarity of presentation, correct observations, correct deductions and diagnosis, sensible brief discussion of differential diagnosis, further investigation and management where appropriate. It also states that incorrect statements will be penalised.

We would like to acknowledge Drs Bob Bury and Wady Gedroyc for providing some of the images, and also the invaluable help of Mrs Veronika Chambers in typing the text and Mr Dirk de Camp for producing the photographs.

FOREWORD

There are many different ways for radiologists to learn the art of image interpretation. One method that brings together observational skills, background knowledge, and the ability to provide either a diagnosis or a sensible set of differential diagnoses, is to view films as "unknown cases". This book of exercises provides such cases and resembles the most popular and beneficial form of teaching, namely the tutorial, through which radiologists try to recreate the real-world situation of diagnosing problem cases. The essential requirement is well chosen exercises with technically good images in order to demonstrate signs from which meaningful observations can be made. Collecting a large number of suitable cases and writing informative descriptions and discussions is an expert and time-consuming task. Drs Burnett and Saifuddin have done a wonderful job in providing this book for the radiologist-in-training. It covers all imaging modalities, using carefully chosen pictures of excellent quality.

The exercises are a marvellous learning resource. They allow radiologists-in-training not only to test their interpretative abilities but also to increase their experience of educative cases. Above all, these exercises are a combination of personal challenge and fun.

Peter Armstrong
Professor of Diagnostic Radiology
St Bartholomew's Hospital

EXERCISE 1

Exercises in Diagnostic Imaging

by

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and

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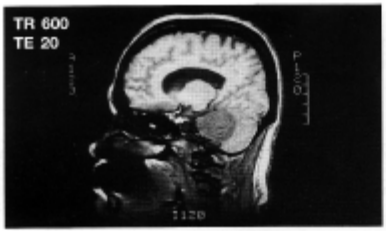
1.1

Case 1.1 A 45-year-old man with a chronic history of recurrent diarrhoea



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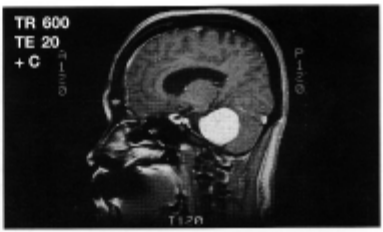

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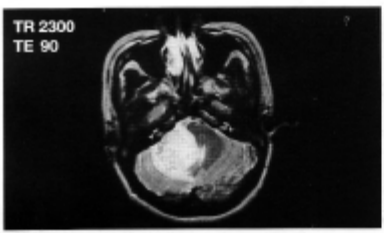

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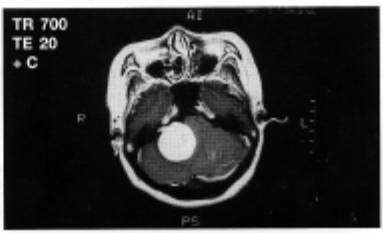

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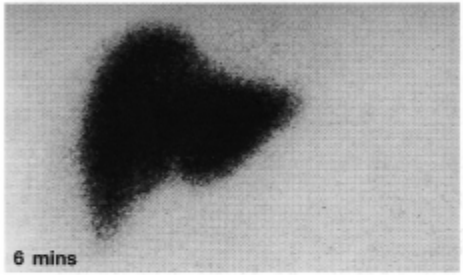
Case 1.2 A 35-year-old man with progressive right-sided deafness



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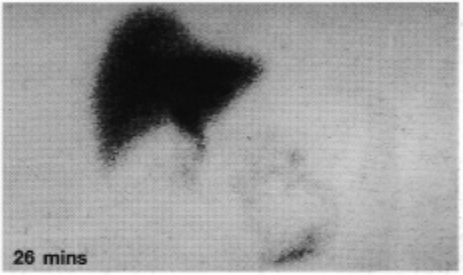

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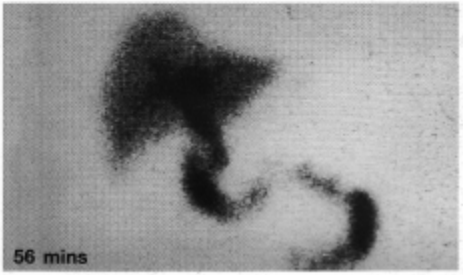
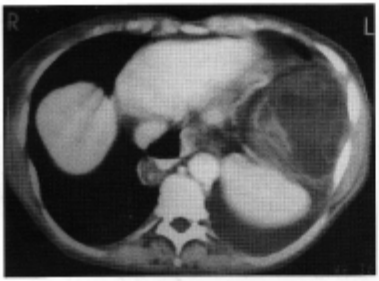


1.3d

Case 1.3 A 46-year-old woman with acute abdominal pain



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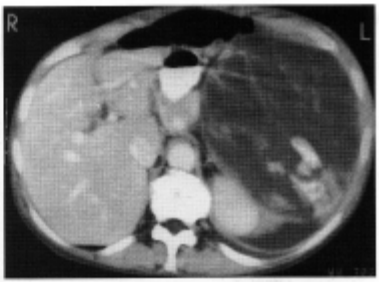

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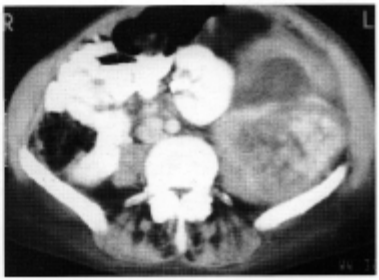


1.4d

Case 1.4 A 60-year-old woman with a distended abdomen

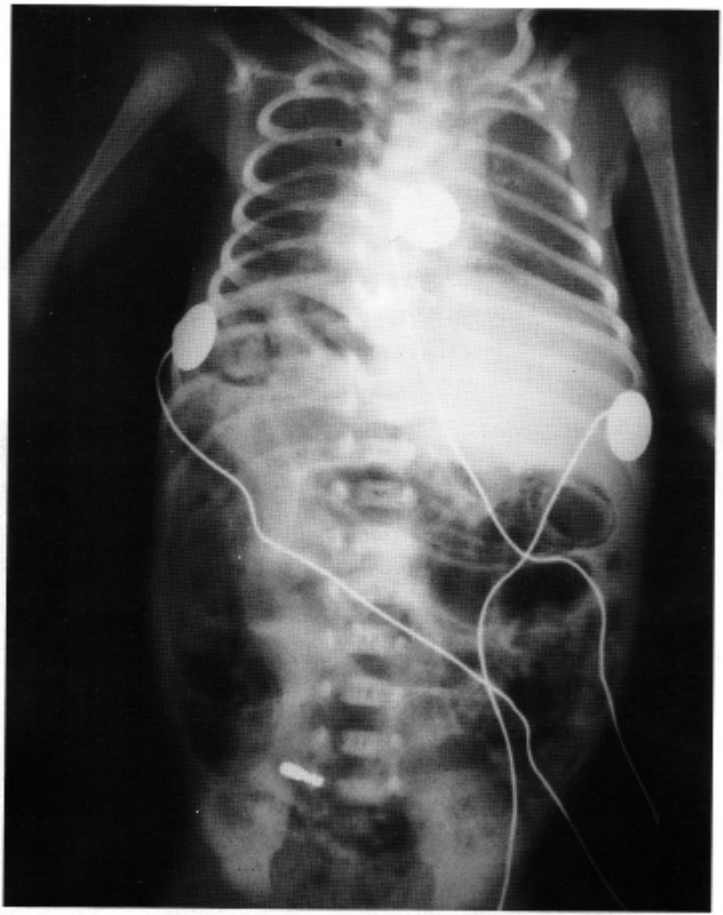
1.5a

1.5b

1.5c

1.5d

Case 1.5 A 60-year-old woman with lower abdominal pain and frequency

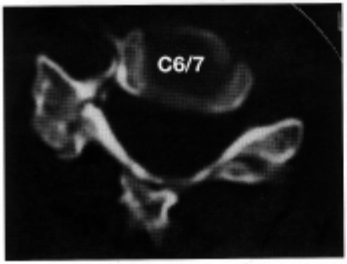


1.6

Case 1.6 Routine film on a neonate

1.7a

1.7b



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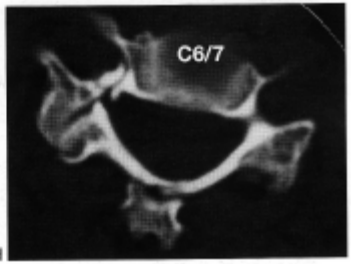

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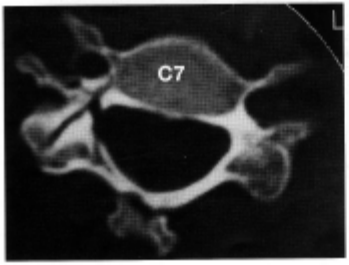

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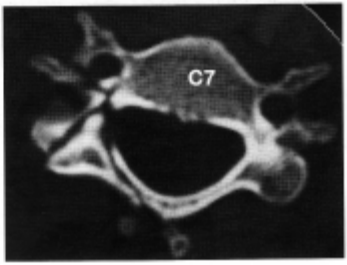
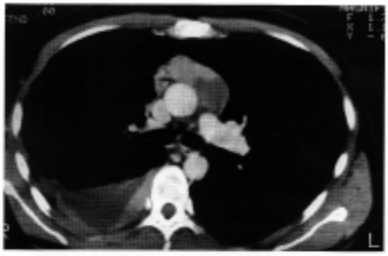


1.7f

Case 1.7 A 45-year-old man with neck pain following a road traffic accident



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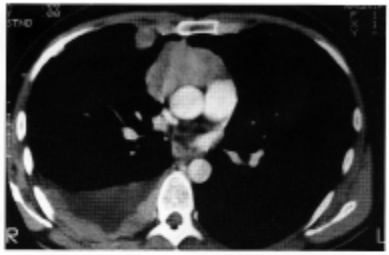

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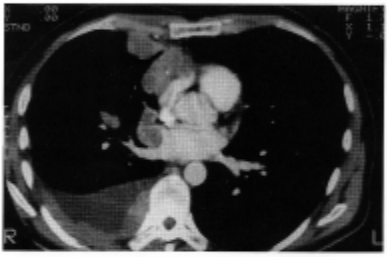

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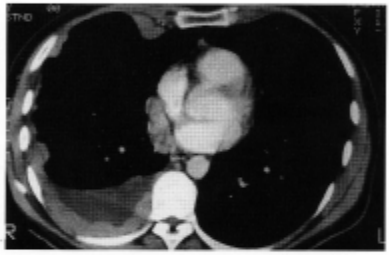


1.8d

Case 1.8 A 42-year-old male with an abnormal chest radiograph

ANSWERS TO EXERCISE 1

Case 1.1
A 45-year-old man with a chronic history of recurrent diarrhoea

Plain film of the abdomen

The distal small bowel shows evidence of dilatation and thickening of the bowel valvulae conniventes. The sacroiliac joints are both ankylosed. No evidence of large bowel dilatation or free air is seen within the abdomen and there are no abdominal calcifications.

The features are those of inflammatory bowel disease associated with seronegative arthropathy.

Case 1.2
A 35-year-old man with progressive right-sided deafness

T_1-weighted sagittal, T_1 post-gadolinium sagittal and axial, and T_2-weighted axial MRI scans

There is an approximately 3–4 cm mass in the right cerebellopontine angle. This shows signal isointense with brain on T_1-weighted scans, but extremely high signal on enhanced T_1- and T_2-weighted scans. There are small foci of signal loss, presumably due to areas of necrosis in the tumour.

The post-enhancement scans show a tongue of enhancing material extending into the right internal auditory meatus.

The differential diagnosis lies between a meningioma and an acoustic neuroma although, in view of the extension into the IAM, the latter is more likely.

CT may be helpful in excluding petrous ridge hyperostosis, but ultimately biopsy would be necessary.

Case 1.3
A 46-year-old woman with acute abdominal pain

Series of images from a HIDA scan

The initial image shows normal liver uptake. Subsequent images show excretion of tracer into the biliary tree and eventually into the small bowel. At no stage is the gall bladder identified.

Given the clinical history, the appearances are those of acute cholecystitis.

Case 1.4
A 60-year-old woman with a distended abdomen

Abdominal CT scans taken following administration of intravenous and oral contrast medium

The aorta and inferior vena cava are pushed to the right of the midline by a large left-sided retroperitoneal mass. This is largely of fat density, but has several enhancing areas within it. Both the spleen and the left kidney can be seen to be separate from the mass, although the latter is significantly displaced. The right adrenal gland is normal; the left is not seen. Due to the large quantity of fat density within this mass, the most likely diagnosis is that of a retroperitoneal liposarcoma. A Tru-cut biopsy could readily be performed under either ultrasound or CT control to confirm the diagnosis.

There is a small mass of similar density in the medial aspect of the right lung base which most likely represents a metastasis, but none are seen within the liver. The distal oesophagus is dilated; this may represent a hiatus hernia.

Case 1.5
A 60-year-old woman with lower abdominal pain and frequency

Pelvic and renal ultrasound scan

There is a complex, mostly solid, mass arising from the pelvis and compressing the bladder. Normal uterus and ovaries are not identified. There is no free fluid in the pelvis.

Free fluid is identified around the right lobe of the liver and splenic tip. There is a left hydronephrosis.

The complex nature of the mass and the ascites would suggest a malignant lesion. The most likely diagnosis is of a primary ovarian neoplasm. Metastasis to the pelvis, or uterine primary, must also be considered.

Chest radiograph and abdominal/pelvic CT should be performed for staging.

Case 1.6
Routine film on a neonate

Babygram

There is ground-glass shadowing with an air bronchogram, predominantly in the left lung, due to hyaline membrane disease. In the abdomen multiple distended loops of bowel are noted and air can be seen within the bowel wall. No gas can be identified in the portal venous system.

The appearances are those of an advanced necrotising enterocolitis.

Incidental note is made of dextrocardia and situs inversus.

Babygrams are no longer recommended and follow-up studies should be performed as separate chest and abdominal radiographs.

Case 1.7
A 45-year-old man with neck pain following a road traffic accident

AP and lateral plain films of the cervical spine

At C6/7 there is subluxation of the body of C6 on C7 together with widening of the interspinous space. On the AP view the right lateral mass appears square and hyperdense, indicating that the facet is rotated anteriorly.

CT scan of cervical spine

Scans have been taken through the body of C6. There is a fracture of the right lateral mass extending forwards into the foramen transversarium and posteriorly into the lamina.

The features are those of a unilateral right facet subluxation with an associated lamino-facet fracture.

MRI is recommended to assess the presence of disc herniation, ligament and spinal cord injury.

Case 1.8
A 42-year-old male with an abnormal chest radiograph

CT scan of the thorax with intravenous enhancement (mediastinal settings only available)

A mass is present in the anterior mediastinum. This is heterogeneous in attenuation and shows patchy enhancement. Anteriorly, in the right lung, there is a nodule which may be pleural in origin, and further areas of pleural thickening are seen posteriorly in the right lung with a pleural effusion. Right hilar lymphadenopathy is present. A bright speck is seen in the centre of the main anterior mediastinal mass, which may represent a vessel or could be calcification. It is impossible to say without the benefit of unenhanced scans. The left lung appears normal.

The most likely diagnosis is invasive thymoma. Differential diagnosis includes metastatic adenocarcinoma, germ cell tumour or possibly mesothelioma.

The pleural tissue could be biopsied under either ultrasound or CT control.

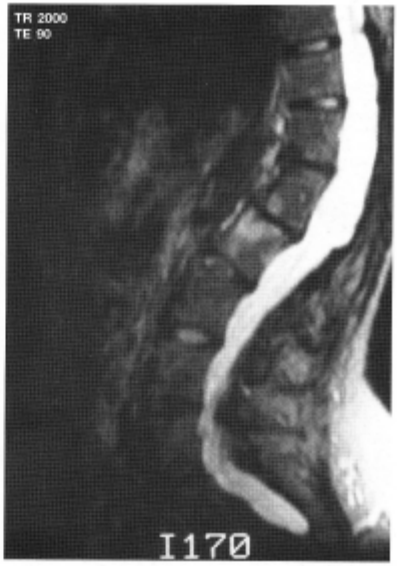
EXERCISE 2

2.1a

2.1b

Case 2.1 A 70-year-old woman with abdominal pain

2.2a



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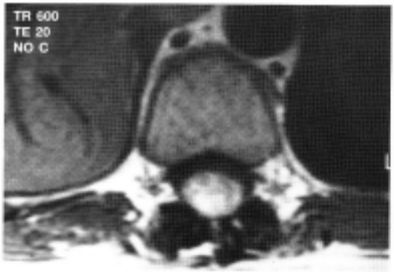

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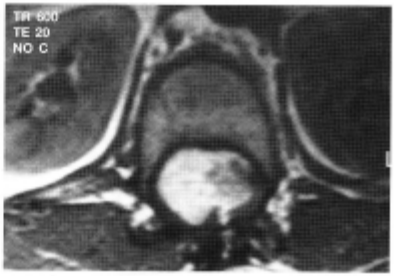
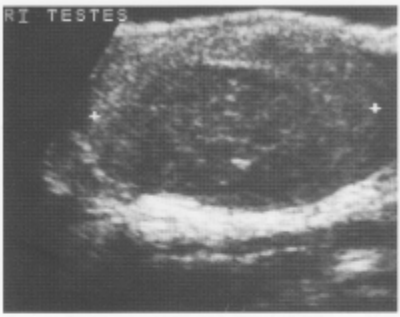


2.2d

Case 2.2 A 50-year-old woman with progressive loss of bladder function



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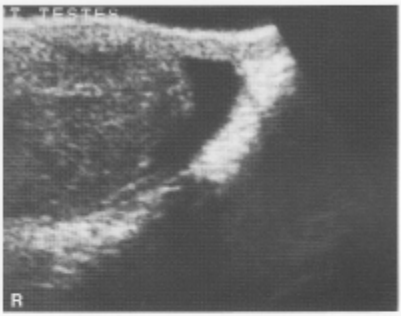

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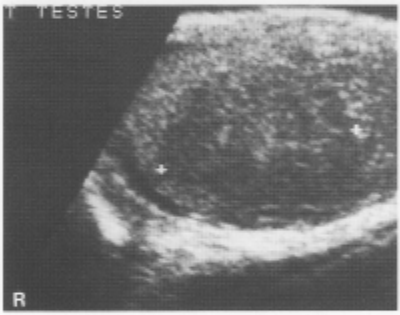

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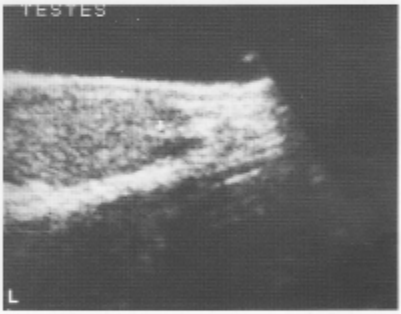
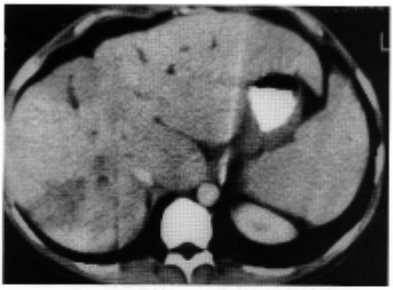


2.3d

Case 2.3 A 24-year-old man with a painless enlarged right testis



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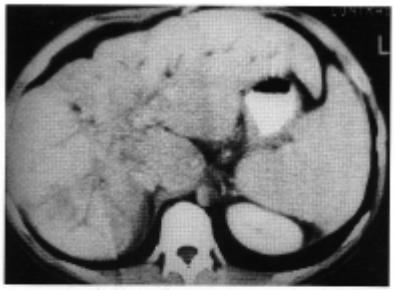

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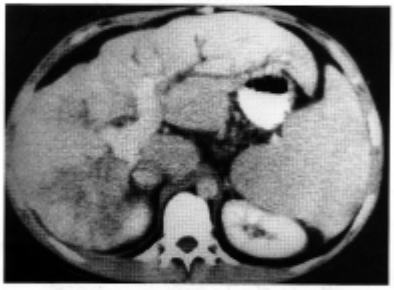

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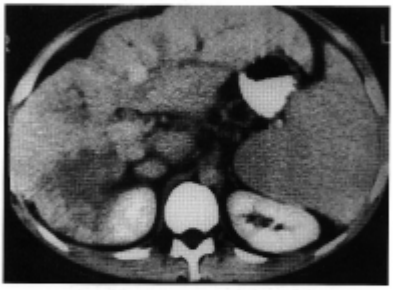

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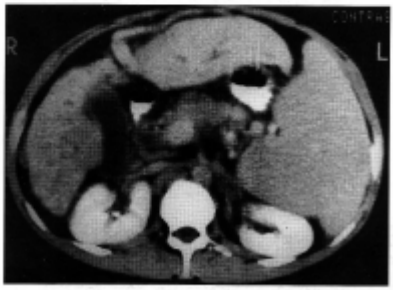
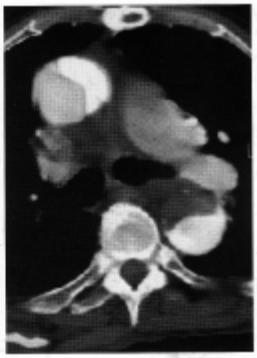


2.4e

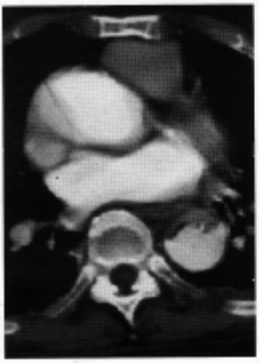
2.4f

Case 2.4 A 54-year-old man with a chronic illness

2.5a

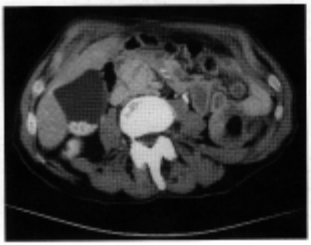


2.5b



2.5c

2.5d



2.5e

2.5f

Case 2.5 A 57-year-old man with sudden pain in the chest

2.6

Case 2.6 Radiograph on a neonate with respiratory symptoms

2.7a

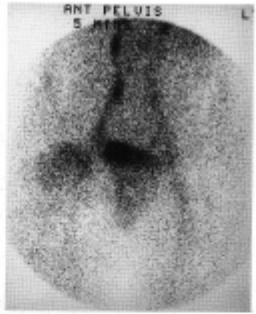
2.7b

2.7c

2.7d

Case 2.7 A 24-year-old lady with chronic wrist pain (Single injection into Right radiocarpal joint)

2.8a



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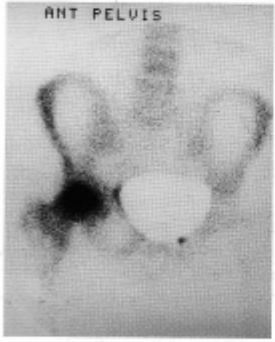
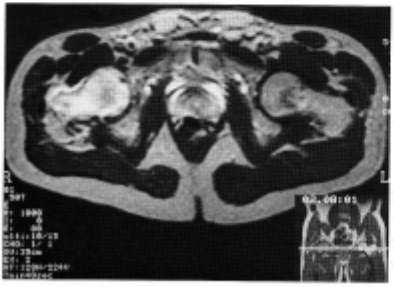


2.8c

2.8d



2.8e

2.8f Five months after the previous MRI

Case 2.8 A 20-year-old man with pain in the right hip

ANSWERS TO EXERCISE 2

Case 2.1
A 70-year-old woman with abdominal pain

Erect and left decubitus views from a double-contrast barium enema series

There is an area of diffuse narrowing in the distal transverse colon extending to the splenic flexure. No obvious mucosal irregularity is seen, although there is a suggestion of mucosal oedema with thumb-printing, particularly on the decubitus view. The remainder of the colon appears normal. Given the age of the patient, the site of the lesion and the absence of mucosal abnormality, the most likely diagnosis is ischaemic colitis. The differential diagnosis includes Crohn's disease or peritoneal metastasis.

Incidental note is made of multiple calcifications in the right upper quadrant, which may be biliary or renal.

Case 2.2
A 50-year-old woman with progressive loss of bladder function

Sagittal T_1- and T_2-weighted spin echo MRI scan of the thoracolumbar spine and axial T_1-weighted spin echo scans

The conus is enlarged by a hyperintense fusiform mass extending from the T11/12 disc level to the inferior aspect of L1. This is causing expansion of the bony spinal canal. Some hypointense areas are seen within the lesion. There is a thoracolumbar kyphosis at the level of the lesion. The L4/5 and L5/S1 discs are degenerate and there are also inflammatory end-plate changes (Modic Type 1) at L1/2.

The appearances are those of to a primary spinal cord tumour with a high fatty content. The areas of low signal within this would be more consistent with a dermoid than a lipoma.

Case 2.3
A 24-year-old man with a painless enlarged right testis

Bilateral testicular ultrasound

The right testis appears generally enlarged and hypoechoic compared to the left testis. Within the right testis is a well-defined hypoechoic mass with heterogeneous echotexture, measuring approximately 3 cm in its maximal dimension. There is no evidence of calcification in the lesion. There is an associated hydrocoele. The scrotal skin appears normal, as does the left testis. The features are those

of a neoplasm rather than an inflammatory lesion and the most likely diagnosis is teratoma. The patient requires further assessment with chest X-ray and CT of the mediastinum, abdomen and pelvis.

Case 2.4
A 54-year-old man with a chronic illness

CT scans following both oral and intravenous contrast enhancement through the upper abdomen

The liver is overall of normal size but has an irregular lobulated contour and a patchy enhancement pattern. There is an area of low density posteriorly in the right lobe and widespread mild intrahepatic bile duct dilatation. The spleen is enlarged. The portal and splenic veins appear enlarged but are patent. There is an excess of vessels in the splenic hilum and a patent umbilical vein is identified. The kidneys, retroperitoneum, gall bladder, pancreas and extrahepatic bile duct appear normal. The appearances are those of cirrhosis with portal hypertension. The low density lesion in the liver raises the possibility of secondary hepatoma. MRI may differentiate between hepatoma and a secondary regenerative nodule, but US-guided biopsy may be necessary.

The commonest cause for this appearance is alcoholic liver disease.

Case 2.5
A 57-year-old man with sudden pain in the chest

Enhanced dynamic CT scan through the mediastinum and upper abdomen

The mediastinal images clearly show a dissection flap extending from the aortic root, through the aortic arch, and into the descending aorta. The lower cuts show that the dissection involves the superior mesenteric artery, and the small bowel is slightly thick-walled and dilated. The dissection extends beyond the renal arteries, but both kidneys enhance normally.

Incidental note is made of multiple small gallstones.

The features are of Type I aortic dissection.

Case 2.6
Radiograph on a neonate with respiratory symptoms

Anteroposterior radiograph of the chest and abdomen

The endotracheal tube, nasogastric tube and umbilical artery catheter all appear satisfactory. There is diffuse coarse nodular shadowing throughout the lungs with bilateral air bronchograms. The lungs are mildly hyperinflated and bilateral pleural effusions are present, larger on the right. The cardiac size is slightly small, possibly due to dehydration. There is no pneumothorax. The bowel gas pattern is normal and there is no evidence of free intra-abdominal air.

The appearances in a post-term child are those of meconium aspiration. Differential diagnosis would include viral or atypical pneumonia.

Case 2.7
A 24-year-old lady with chronic wrist pain

Single contrast right wrist arthrogram

Contrast medium is identified within the radiocarpal joint. Contrast has also entered the intercarpal spaces, indicating rupture of several of the intercarpal ligaments, but this is a non-specific finding. On the neutral and ulnar deviation views, no contrast medium is seen in the distal radioulnar joint. However, on radial deviation, contrast medium enters the distal radioulnar joint and a line of contrast is seen in the radial aspect of the triangular fibrocartilage.

The features are those of a full thickness tear of the triangular fibrocartilage complex.

Case 2.8
A 20-year-old man with pain in the right hip

Plain film

The right hip is osteopenic with some small focal areas of lucency in the femoral neck. No other abnormalities are identified.

Blood pool and static images of the pelvis on bone scan

The right femoral head shows increased activity, both on the blood pool and the static images, indicating increased vascularity and osteoblastic activity.

T_1-weighted coronal and T_2-weighted axial MRI scans through the pelvis

The left hip appears normal. On the right there is reduced signal throughout the femoral head and neck on the T_1-weighted scans, but increased signal on the T_2-weighted scans, where a small hip effusion is also identified. The appearances are consistent with generalised oedema of the femoral head and neck. The subsequent T_1-weighted coronal scan shows the surgical track, but otherwise is now normal.

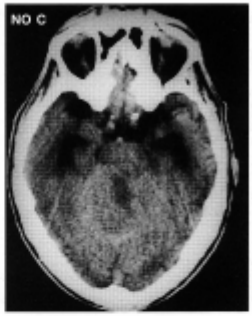
The appearances are those of transient osteoporosis of the hip.

EXERCISE 3

3.1

Case 3.1 A 29-year-old woman with bloody diarrhoea

3.2a



3.2b

3.2c

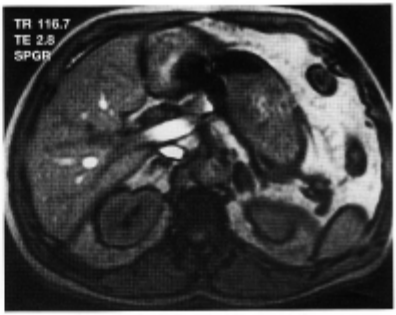
3.2d

3.2e

3.2f

Case 3.2 A 45-year-old man with nausea

3.3a



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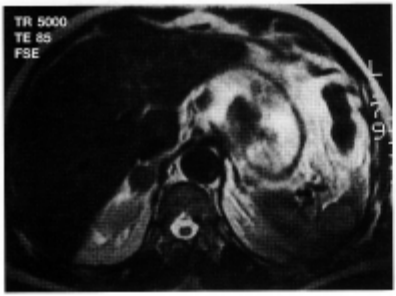
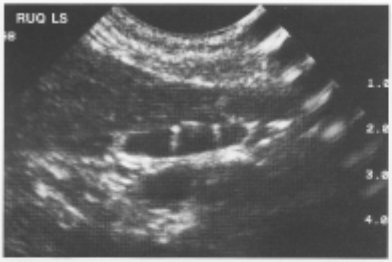


3.3c

3.3d

Case 3.3 A 76-year-old man being investigated for a lesion in the chest



3.4a

3.4b

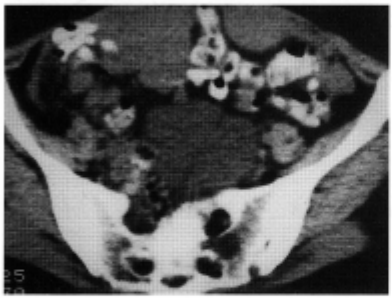
3.4c

3.4d

Case 3.4 A 50-year-old lady with chronic right upper quadrant pain

3.5a

3.5b



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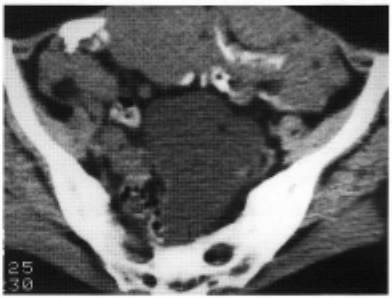


3.5d

3.5e

3.5f

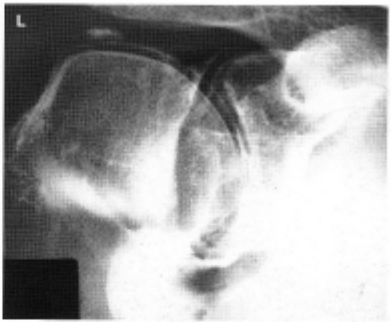
Case 3.5 A 54-year-old woman with a distended abdomen

3.6a

3.6b

Case 3.6 An 18-month-old child, not yet walking

3.7a



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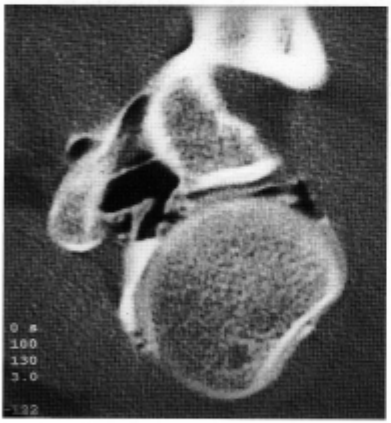

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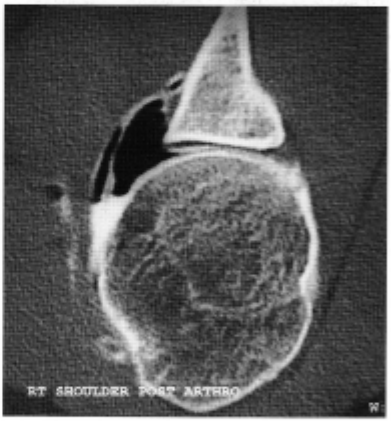
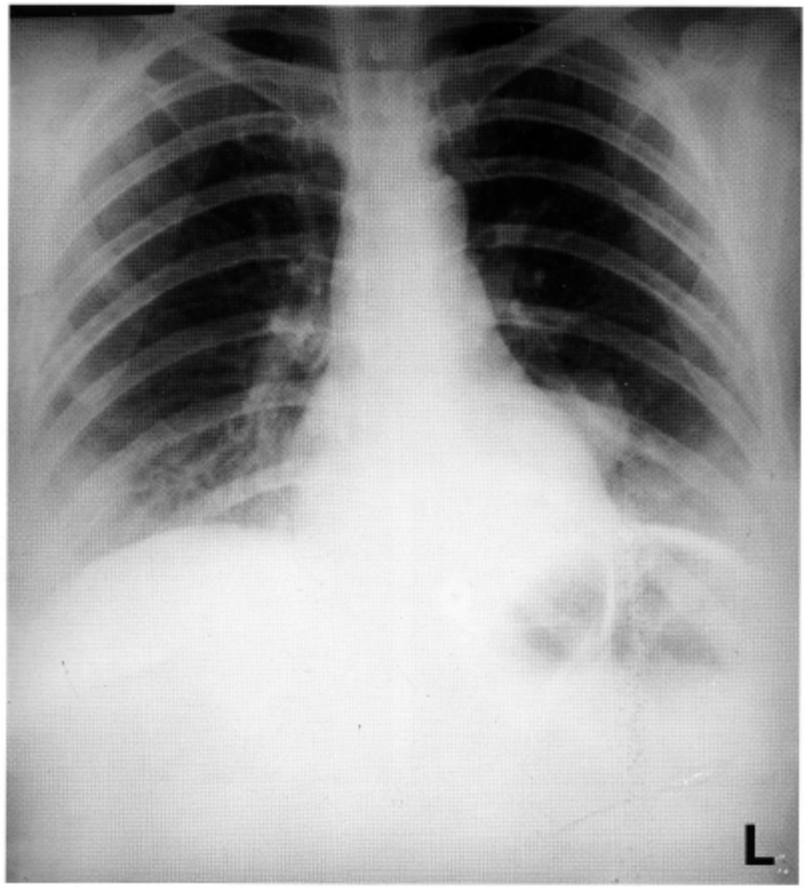


3.7d

Case 3.7 A 28-year-old man with a painful right shoulder



3.8

Case 3.8 A 47-year-old man with a cough

ANSWERS TO EXERCISE 3

Case 3.1
A 29-year-old woman with bloody diarrhoea

Double contrast barium enema — single prone PA view

There is irregularity and narrowing of the terminal ileum, caecum and ascending colon. There is mucosal ulceration, but no evidence of a paracolic abscess. No intraluminal mass is demonstrated. The remainder of the large bowel appears normal.

The features are those of an inflammatory rather than neoplastic process.

The differential diagnosis includes Crohn's disease and tuberculosis, although other atypical infections may also be considered.

Further investigations would include colonoscopy and biopsy, chest radiograph and possibly an abdominal CT.

Case 3.2
A 45-year-old man with nausea

Enhanced CT scan of the head

There is hydrocephalus affecting the lateral and third vertricles. There is an isodense mass in the right cerebellum which is effacing the fourth ventricle, and which shows profound enhancement following contrast administration. There is a small amount of oedema surrounding the lesion. No other definite lesions are seen on these scans.

Differential diagnosis includes a metastasis or a meningioma.

Biopsy may be performed under stereotaxis with CT guidance, and a chest radiograph would be of value.

Case 3.3
A 76-year-old man being investigated for a lesion in the chest

T_2 weighted spin echo and T_1-weighted gradient echo axial MRI scans through the upper abdomen

In both adrenals there are small ovoid masses. These show low to intermediate signal on both sets of sequences. No other abnormality is identified in the upper abdomen or retroperitoneum. Given the signal characteristics, these are very likely to represent adrenal adenomata rather than metastases.

A CT scan may be helpful to allow identification of the low attenuation within the lesions and may also permit biopsy if this is thought necessary.

Case 3.4
A 50-year-old lady with chronic right upper quadrant pain

Abdominal ultrasound

The gall bladder wall is abnormal, showing multiple foci of high echogenicity with acoustic enhancement beyond these areas. There is no evidence of thickening of the gall bladder wall, no pericholecystic fluid and no evidence of gall stones. The pancreas appears normal and there is no evidence of a dilated common duct within the pancreatic head.

The features are typical of adenomyomatosis.

Case 3.5
A 54-year-old woman with a distended abdomen

CT scan of the abdomen and pelvis with intravenous and oral contrast enhancement

A large soft-tissue density mass is seen anteriorly in the pelvis. This is inseparable from the anterior abdominal wall and encases bowel loops. In front of the rectum there is a further low-density soft-tissue mass which is indistinguishable from the uterus but does not show enhancement and, again, appears to encase loops of small bowel. There is no free fluid, no hydronephrosis or focal liver lesions.

The appearances are those of a malignant mesenteric thickening and, although the primary site cannot definitely be identified, in a woman this is likely to be due to an ovarian carcinoma.

Case 3.6
An 18-month-old child, not yet walking

Plain films of both humeri and femora

There is diffuse cortical thickening with bilateral periosteal reactions and metaphyseal fractures affecting the proximal right humerus, distal left femur and proximal left tibia.

These are the manifestations of non-accidental injury. This is particularly likely in view of the inconsistent history that has been given.

A skeletal survey, and possibly a bone scan and cranial MRI, are indicated.

Case 3.7
A 28-year-old man with a painful right shoulder

Images from a double-contrast shoulder arthrogram and subsequent CT scanning

The arthrogram films show contrast tracking up into the under surface of the rotator cuff, indicating a partial inferior surface tear.

The CT scan at the level of the coracoid shows a moderately large Hill-Sachs defect on the posterolateral surface of the humeral head. The long head of biceps is seen in the bicipital groove and the subscapularis tendon is intact.

The glenoid labrum is avulsed and there is stripping of the anterior capsule with air contacting the bone surface on the anterior part of the glenoid (Bankart lesion).

The appearances are consistent with a clinical diagnosis of anterior instability with an associated inferior surface partial tear of the rotator cuff.

Case 3.8
A 47-year-old man with a cough

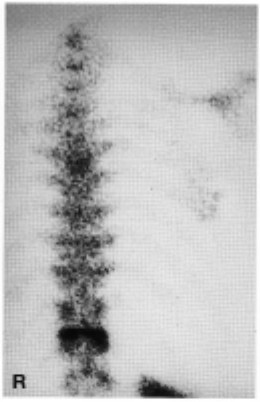
PA chest

There is an approximately 4 cm mass in the left lower lobe. It is largely well-defined with no calcification. There are no other lung lesions detectable. The heart size is normal and there is no evidence of mediastinal or hilar lymphadenopathy. The bones are normal; in particular, there is no evidence of rib erosion or metastases.

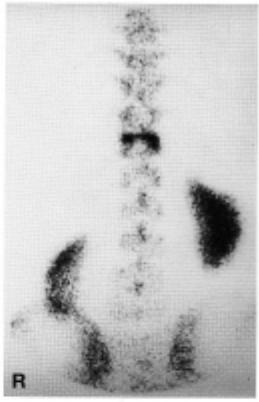
Although this is a well-defined lesion, in a patient of this age a primary bronchial neoplasm is the likely diagnosis. The differential diagnosis is very wide but would include solitary metastasis and hydatid infection. The patient should have bronchoscopy and CT for further characterisation of the lesion and staging.

EXERCISE 4

4.1a



4.1b



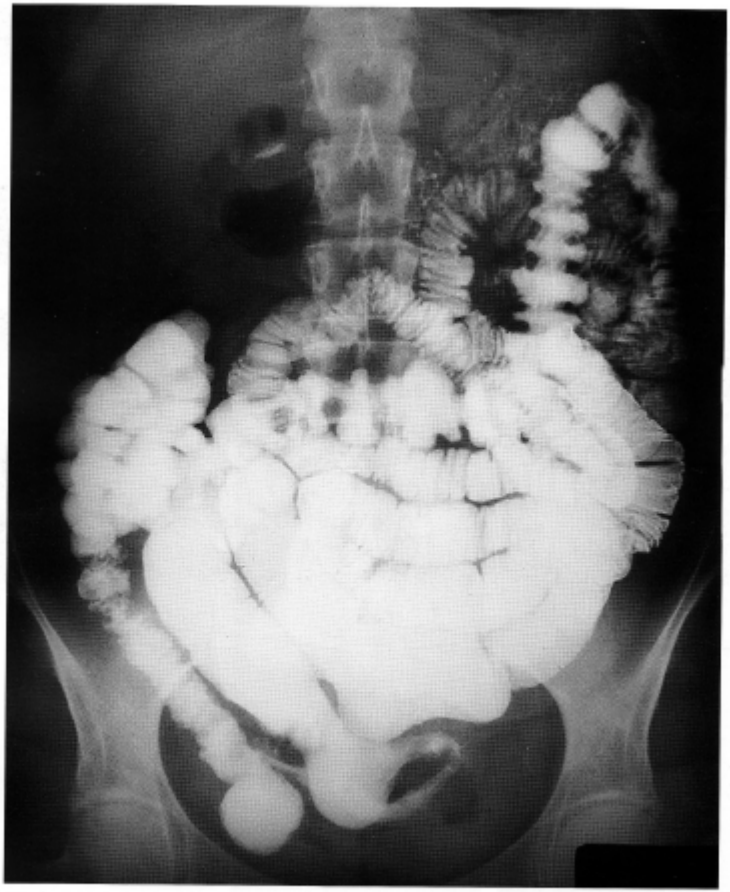
4.1c

4.1d

4.1e

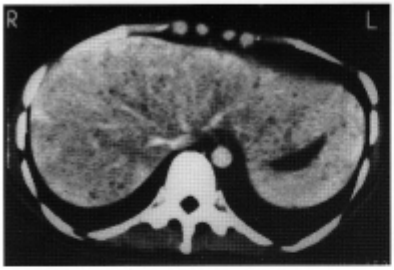
4.1f

Case 4.1 A 65-year-old man with back pain



4.2

Case 4.2 A 23-year-old woman with pyrexia, recurrent lower abdominal pain and diarrhoea



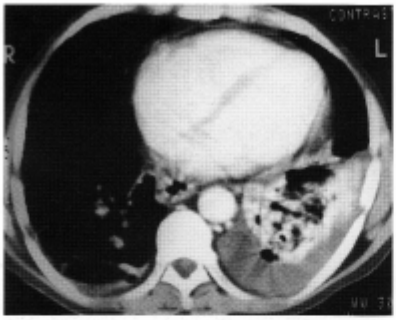
4.3a

4.3b

4.3c

4.3d

Case 4.3 A 20-year-old woman with leukaemia



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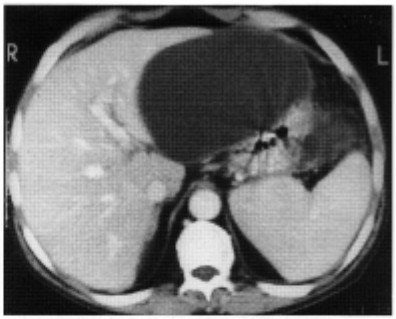

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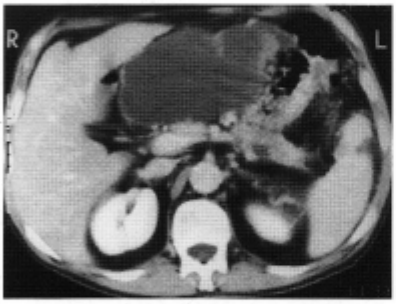

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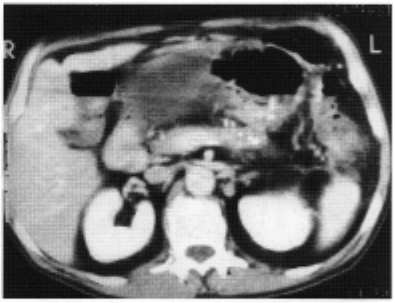
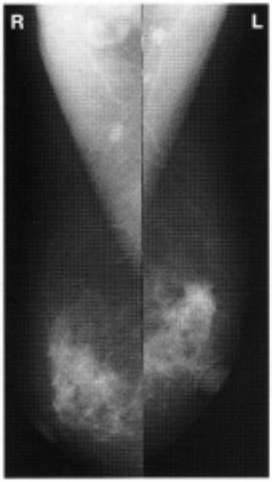


4.4d

Case 4.4 A 65-year-old man with epigastric pain

4.5a



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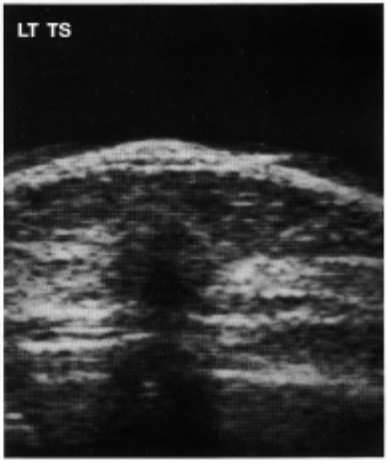
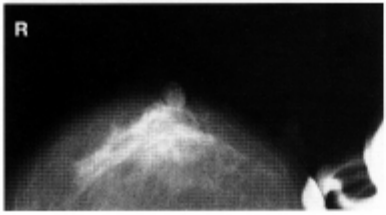




4.5c

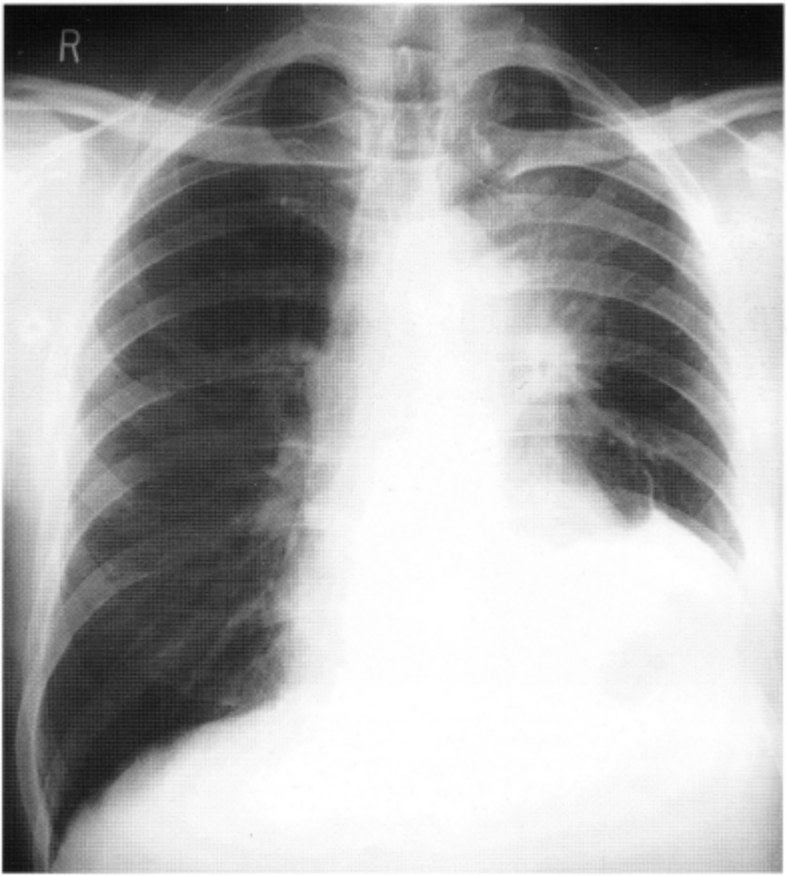
4.5d

Case 4.5 A 55-year-old woman recalled from screening

4.6a

4.6b

Case 4.6 A 32-year-old man presenting to Casualty following an injury



4.7

Case 4.7 A 64-year-old man with chronic cough

4.8

Case 4.8 A 5-year-old girl

ANSWERS TO EXERCISE 4

Case 4.1
A 65-year-old man with back pain

Plain radiograph of the thoracic spine

This shows evidence of osteopenia and a fracture of the upper end-plate of T12. There is a large mass overlying the lower thoracic spine.

Delayed static images from a bone scan

The body of T12 has increased activity extending across the superior end-plate. There is increased uptake in T6.

T_1-weighted sagittal MRI scans of the thoracic and lumbar spine

There is reduced signal involving the whole of the body T12, which has lost height, and a focal area of signal abnormality in T6. There is no extradural extension. The appearances are indicative of metastatic involvement from the possible primary lung lesion, and a chest radiograph should be performed.

Case 4.2
A 23-year-old woman with pyrexia, recurrent lower abdominal pain and diarrhoea

Double contrast small bowel enema

The tube has been removed. The proximal and mid small bowel appear normal. In the distal ileum there is a relatively smooth, tapered stricture approximately 10 cm in length. In this region the mucosa is destroyed and there is evidence of deep ulceration. The bowel just proximal to this is mildly distended and featureless. The terminal ileum is also abnormal, showing nodular thickening of the folds. At the junction of the stricture and the terminal ileum is a contrast-filled diverticulum, possibly representing an abscess. The features are typical of Crohn's disease.

The patient requires CT to look for the presence of a pelvic abscess.

Case 4.3
A 20-year-old woman with leukaemia

Axial CT scans of the upper abdomen following oral and intravenous contrast medium

Multiple, small (< 1 cm), hypodense lesions are seen throughout the liver and in the upper part of the spleen. Because of their small size it is impossible to say if these are cystic or solid due to partial volume averaging. There is no bile duct dilatation, upper abdominal lymphadenopathy or ascites. The gall bladder, pancreas and kidneys are normal.

The appearances are characteristic of hepatosplenic candidiasis, but other fungal or granulomatous infections could be considered.

The differential diagnosis includes multiple metastases, lymphoma and leukaemia. It is likely that the patient is immuno-compromised due to therapy or underlying disease.

Although it is technically possible to confirm the diagnosis by aspiration under ultrasound guidance, these patients are often pancytopenic and caution should be exercised.

Case 4.4
A 65-year-old man with epigastric pain

CT of the upper abdomen following both intravenous and oral contrast enhancement

There is a moderately large left pleural effusion with underlying collapse of the left lower lobe and a small right pleural effusion. A well-defined hypodense mass is seen between the stomach and left lobe of the liver. This extends caudally where it is intimately related to the anterior body of the pancreas. Calcification is seen in the tail of the pancreas and there are non-enhancing areas in the distal body. Little tissue is identified in the head of the pancreas. The spleen contains a wedge-shaped peripheral non-enhancing lesion. The splenic and portal veins are patent and no abnormality is seen in the liver or kidneys. The gall bladder is not identified. There is no free fluid.

The features are those of acute on chronic pancreatitis (probably alcohol-related) complicated by pseudocyst formation and splenic infarction. US-guided percutaneous drainage of the cyst would be possible if clinically indicated.

Case 4.5
A 55-year-old woman recalled from screening

Bilateral mammograms with lateral oblique and craniocaudal views.

There has been partial fatty involution of the stoma in both breasts. The right breast appears normal. On the left, above and just lateral to the nipple, there is a stellate density. Tethering and thickening of the overlying skin is noted. Patchy areas of benign macrocalcification are scattered through both breasts, but no suspicious microcalcification is seen. Overall, the appearances are those of a carcinoma.

Ultrasound of left breast

This is confirmed by the ultrasound, where an irregular hypoechoic mass casts an acoustic shadow.

The malignant nature of the lesion can readily be confirmed by ultrasound-guided fine needle aspiration.

Case 4.6
A 32-year-old man presenting to Casualty following an injury

OF and horizontal beam lateral view of the skull and facial bones

The frontal view shows left-sided orbital emphysema and diffuse opacification of the left maxillary antrum. The lateral view shows this to be due to an air-fluid level within the maxillary sinus. The features are those of an orbital 'blow-out' fracture involving the floor of the orbit. A coronal CT scan may help to characterise the nature of the fracture further and to identify whether there is trapping of the inferior rectus muscle.

Case 4.7
A 64-year-old man with chronic cough

PA chest radiograph

The left hemidiaphragm is raised and there is opacification adjacent to the left hilum and aortic arch which fades away peripherally. Some crowding of the left ribs is also noted. The features are those of left upper lobe collapse. There is also suspicion of a left hilar mass. The right lung is clear.

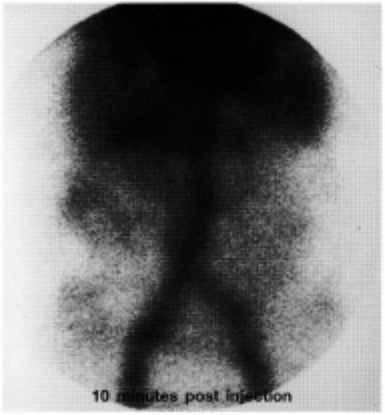
The most likely diagnosis is of a bronchial carcinoma. The patient needs a bronchoscopy and thoracic CT which should extend to involve the liver and adrenal glands.

Case 4.8
A 5-year-old girl

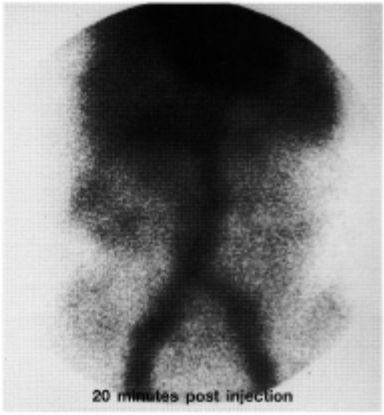
DP plain films of both hands

There is a generalised disorder affecting the majority of the long bones that are seen, which are all expanded with areas of ground-glass abnormality. In addition, the bone age is markedly advanced. These are the appearances of polyostotic fibrous dysplasia with Albright-McCune syndrome, leading to precocious puberty.

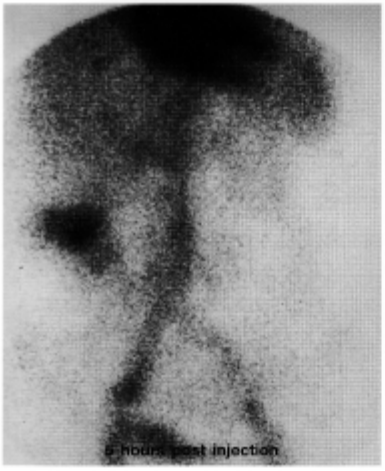
EXERCISE 5



5.1a



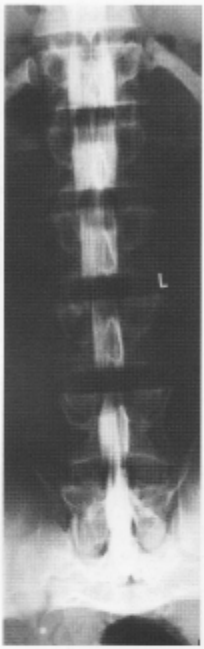
5.1b



5.1c

5.1d

Case 5.1 An 82-year-old woman with anaemia



5.2a

5.2b

Case 5.2 A 35-year-old man with progressive difficulty in walking

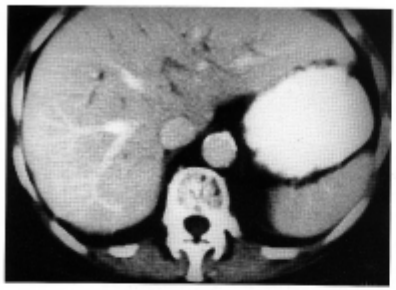
5.3a

5.3b

5.3c

5.3d

Case 5.3 A 70-year-old lady with abdominal pain



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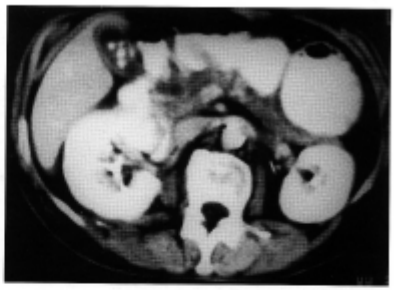
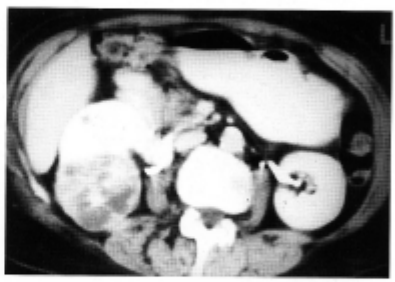


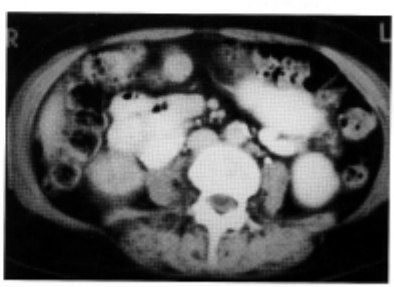
5.4b

5.4c



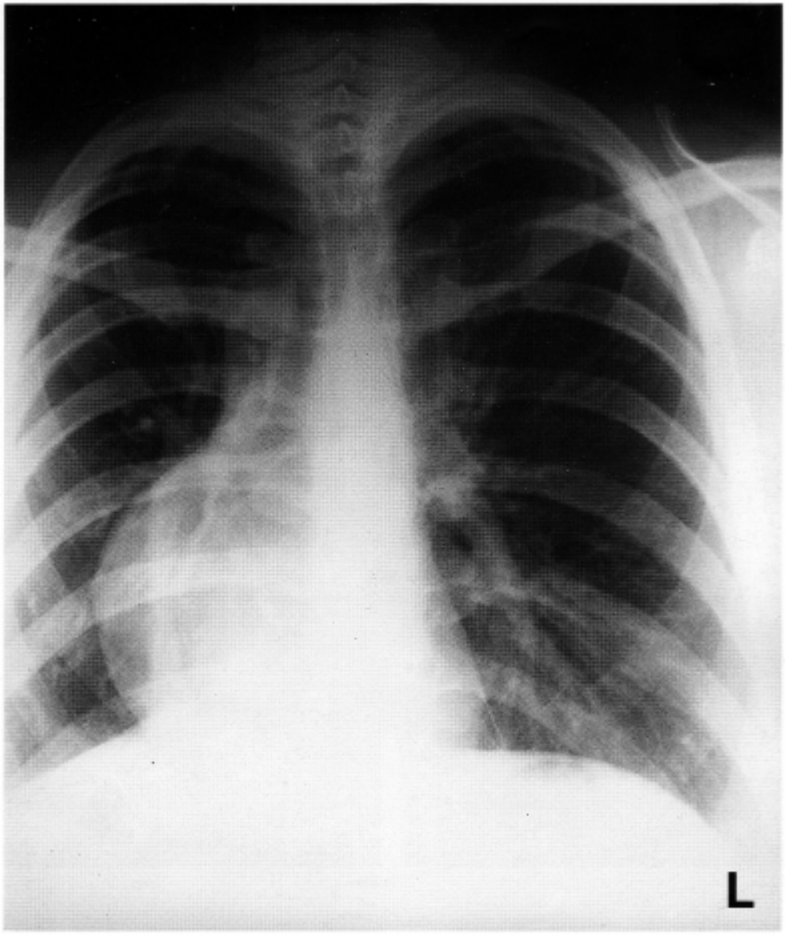
5.4d

5.4e



5.4f

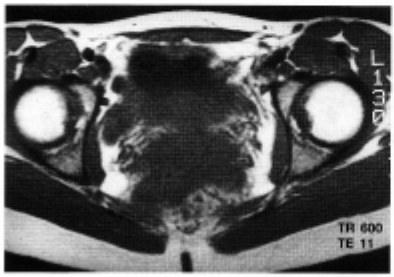
Case 5.4 A 57-year-old woman with a history of recurrent RUQ pain



Case 5.5 A 17-year-old girl with breathlessness

5.6a

5.6b



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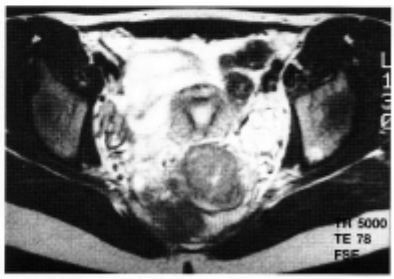
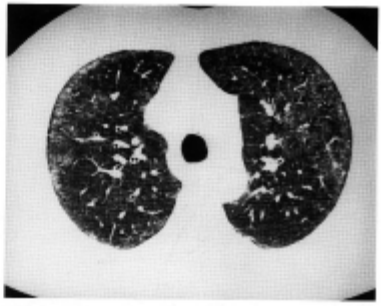


5.6d

Case 5.6 A 37-year-old woman with an abnormality detected at routine examination

Case 5.7 A young man with back pain

5.8a



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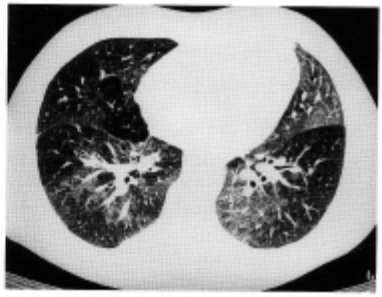
5.8c



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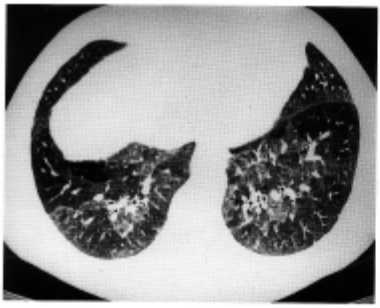

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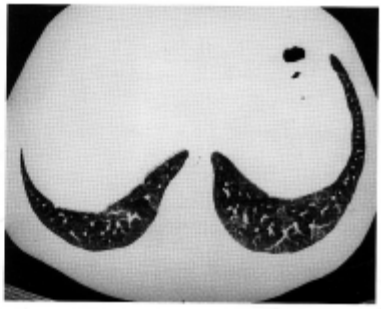


5.8f

Case 5.8 A 40-year-old man with breathlessness

ANSWERS TO EXERCISE 5

Case 5.1
An 82-year-old woman with anaemia

Technetium sulphur colloid scan

The initial images show an area of increased uptake in the right flank. On the later images, as the bladder begins to fill, a more clearly defined area of tracer activity is present. The right lateral image provided suggests that the area of increased tracer activity lies anteriorly.

This is likely to represent chronic bleeding from caecal angiodysplasia, the precise location of which could be demonstrated by angiography.

Case 5.2
A 35-year-old man with progressive difficulty in walking

AP and oblique views from lumbar myelogram

The spine is abnormal, showing reduction of the interpediculate distance from L1 to L5. The L5 vertebral body is set low between the iliac wings and the sacrum is relatively horizontal. There is underfilling of all the lumbar nerve root sheaths and the contrast column extends well into the lower thoracic spinal canal. All these features are consistent with spinal stenosis and the underlying bony abnormality is classical of achondroplasia. No abnormality is demonstrated within the conus or cauda equina.

Case 5.3
A 70-year-old lady with abdominal pain

Upper abdominal ultrasound

There is an approximately 7 cm solid mass in the right upper quadrant. This is seen to be separate from the upper pole of the right kidney and pushes the IVC forward, indicating that it is retroperitoneal and likely to be adrenal in origin. Apparent acoustic enhancement is probably due to the lower impedance of the lesion than surrounding tissues. The left adrenal cannot be identified and is therefore probably normal. The remainder of the scan is normal.

The differential diagnosis for an adrenal mass of this size is between phaeochromocytoma, metastasis and adrenal carcinoma; other adrenal pathologies would be unlikely to produce such a large mass.

Further investigations would be a chest X-ray and measurement of urinary catecholamines, followed by enhanced upper abdominal CT and biopsy under imaging guidance.

The lesion is extremely unlikely to account for her symptoms.

Case 5.4
A 57-year-old woman with a history of recurrent RUQ pain

CT scan of the abdomen with both oral and intravenous enhancement

A large mass of heterogeneous attenuation is present in the mid and lower poles of the right kidney. Without unenhanced scans it is impossible to exclude the presence of calcification. A small non-enhancing lesion in the anterior part of the right kidney most likely represents a simple cyst. There is no evidence of involvement of the renal vein or inferior vena cava. The left kidney, pancreas and spleen are normal.

The most likely diagnosis is that of renal cell carcinoma.

Incidental note is made of a thick-walled gall bladder with stones and mild intrahepatic bile duct dilatation.

Case 5.5
A 17-year-old girl with breathlessness

PA chest radiograph

The heart is displaced to the right. No focal lung lesion is identified. Behind the cardiac shadow in the right lung is a tubular structure extending down below the diaphragm. This is consistent with an anomalous pulmonary vein and the features are those of the Scimitar syndrome.

Echocardiography and cardiac MRI could be of value in precisely defining the vascular anomaly.

Case 5.6
A 37-year-old woman with an abnormality detected at routine examination

T_1-weighted axial and T_2-weighted axial and sagittal MRI scans of the pelvis

There is a mass in the region of the cervix which returns intermediate signal on T_1-weighted scans and slightly increased signal on T_2-weighted scans. The uterine cavity is distended and fluid-filled. Both ovaries are seen and contain multiple cysts which are likely to be physiological. No obvious lymphadenopathy is identified.

On the sagittal images the mass has effaced the normal tissue planes between the cervix and rectum and is therefore likely to be invading the rectum. There is no evidence of extension into the bladder.

The appearances are consistent with a carcinoma of the cervix which is invading the rectum.

Case 5.7
A young man with back pain

AP view of thoracolumbar spine

There is a right convex scoliosis centred at T9/10. There is no underlying vertebral abnormality; in particular, all the pedicles are present and of normal shape and density. There is no paravertebral mass.

Two-phase bone scan

The blood pool images show a small focal area of increased uptake adjacent to the cardiac border in the lower thoracic spine, indicating that this is a vascular lesion. Static images show an area of intense uptake in the left neural arch of T10. The remainder of the scan is normal.

The appearances are classical for an osteoid osteoma or osteoblastoma.

A thin section CT scan would be the investigation of choice to locate the nidus.

Case 5.8
A 40-year-old man with breathlessness

A fine-section CT scan through the chest viewed on lung settings

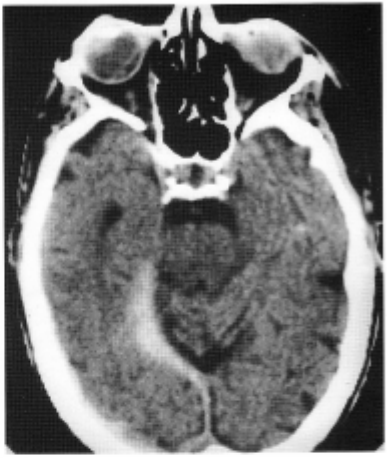
'Ground-glass' opacification affects both lungs, predominantly in the mid zones, and largely in a segmental distribution. There is some evidence of subpleural crescent formation. Focal emphysema is identified in the right mid and lower zones, but no bronchiectasis or pleural effusion is seen. The hila are normal.

The appearances are most likely to represent an acute inflammatory condition, such as sarcoidosis, extrinsic allergic alveolitis or fibrosing alveolitis in an unusual distribution.

The diagnosis may be evident from the history, bronchoalveolar lavage or transbronchial biopsy.

EXERCISE 6

6.1a



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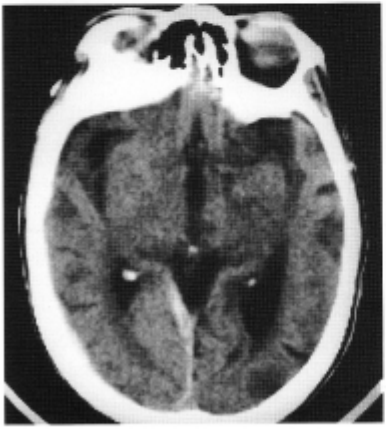

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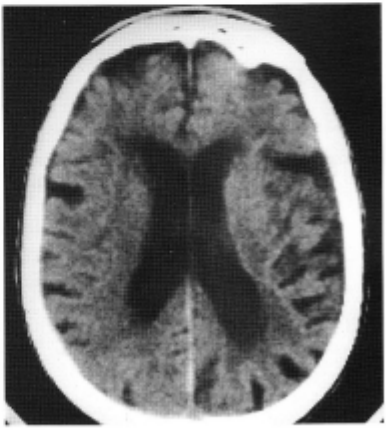


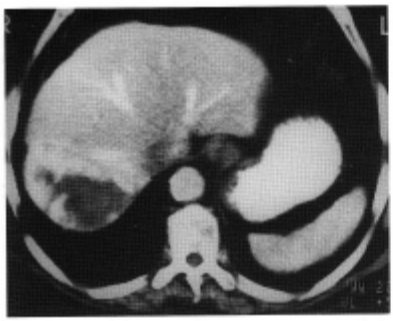
6.1d

Case 6.1 A 76-year-old lady with sudden onset of headache

6.2a

6.2b

Case 6.2 A 43-year-old woman with abdominal discomfort



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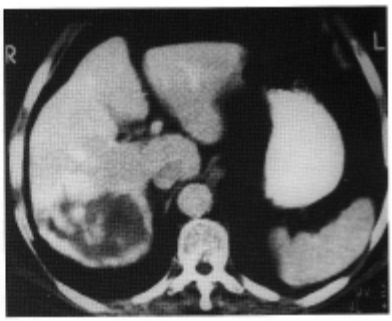

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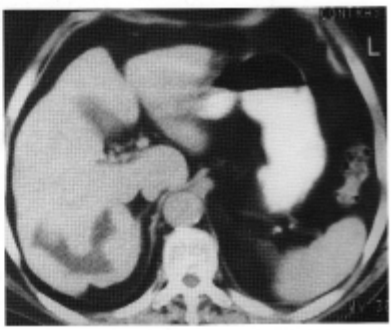
6.3c



6.3d

Case 6.3 A 63-year-old man with right upper quadrant pain

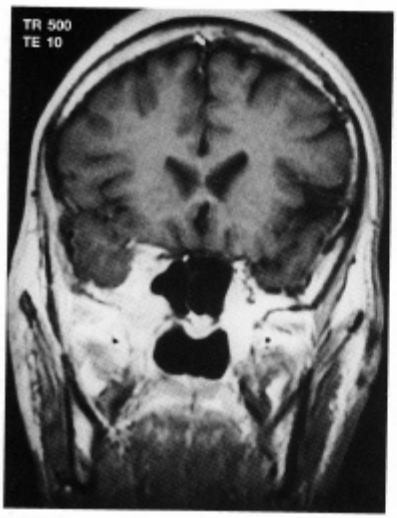
6.4a

6.4b

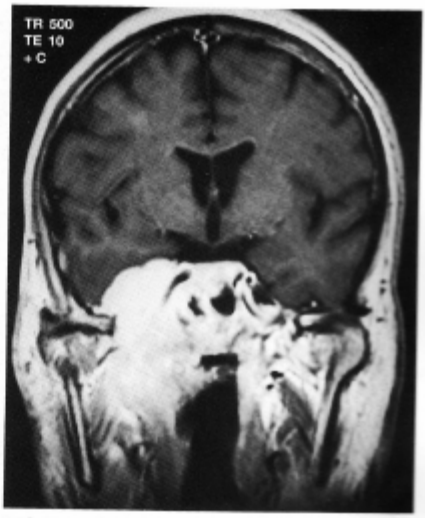
6.4c

6.4d

Case 6.4 A 25-year-old with right upper quadrant pain



6.5a



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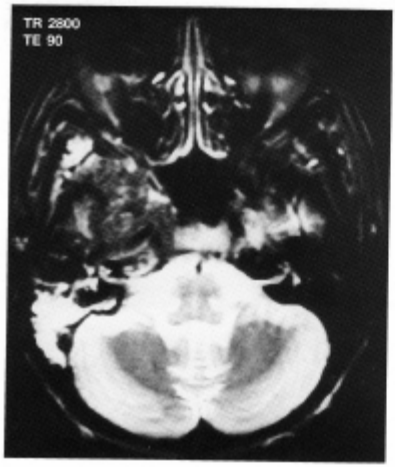
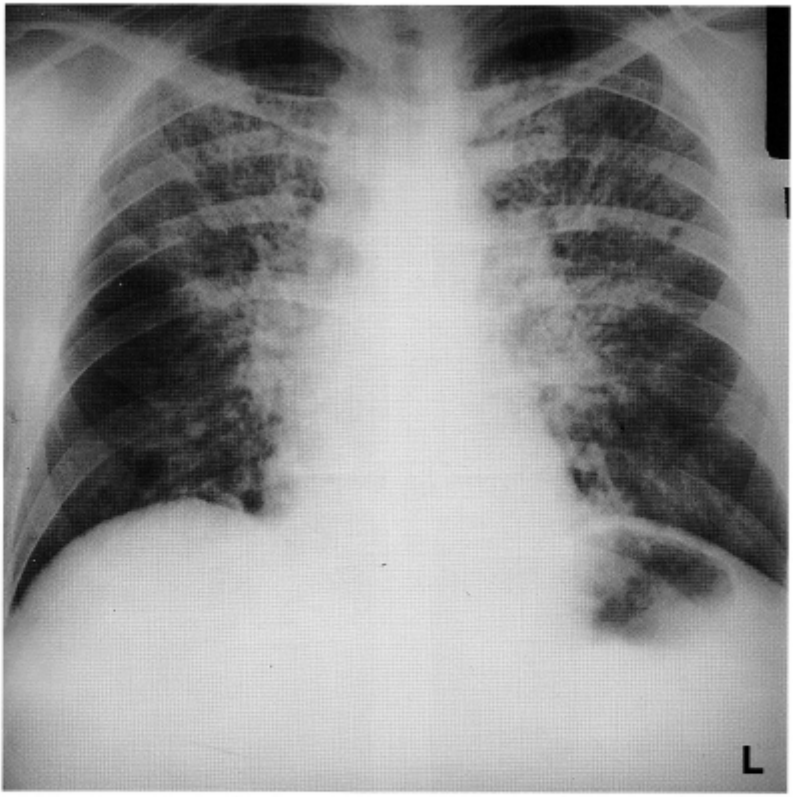


6.5c

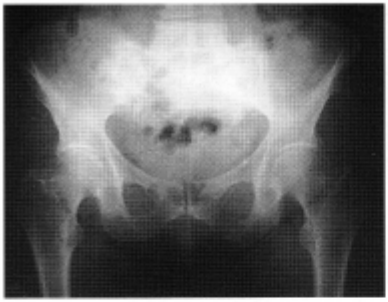
6.5d

Case 6.5 A 36-year-old man with a history of progressively worsening (right) facial pain



6.6

Case 6.6 A 32-year-old woman with a dry cough



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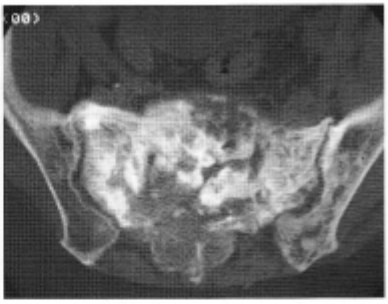

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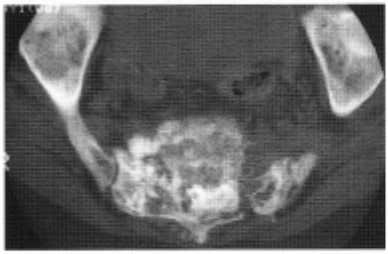

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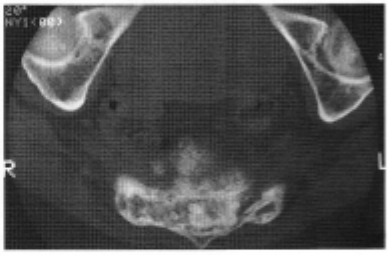


6.7d

Case 6.7 A 78-year-old woman with low back pain

6.8

Case 6.8 A 40-year-old man with chronic disease

ANSWERS TO EXERCISE 6

Case 6.1
A 76-year-old lady with sudden onset of headache

Unenhanced CT of the brain

There is a region of hyperdensity in the right posterior fossa paralleling the right tentorium cerebelli which is not producing any mass effect. The ventricular system is generally dilated and there is also a moderately severe degree of involutional change. The features would be consistent with an acute paratentorial subdural haematoma.

Case 6.2
A 43-year-old woman with abdominal discomfort

Films from a barium follow-through series

The stomach and what can be seen of the large bowel appear normal. In the proximal jejunum there is an area of bowel dilatation with effacement of the normal mucosal pattern and thickening of the valvulae conniventes. There is a suggestion that this is associated with a mass outside the bowel displacing the other loops from this area. The rest of the small bowel is normal.

The appearances are most likely to be due to either lymphoma or metastases, although other diagnoses, such as endometriosis, are a possibility. Abdominal CT is recommended.

Case 6.3
A 63-year-old man with right upper quadrant pain

CT of the upper abdomen following both oral and intravenous contrast medium. Single delayed image through the liver at the level of the porta hepatis

There is a single focal lesion in the posterior aspect of the right lobe of the liver. In its inferior aspect, the lesion extends beyond the liver margin and shows a nodular peripheral enhancement pattern. The delayed image shows some 'filling-in' of the peripheral aspect of the lesion, which becomes isodense to the remaining liver parenchyma; the central area remains hypodense. The features are characteristic of a pedunculated giant cavernous haemangioma.

The remainder of the liver, the stomach, spleen and gall bladder are normal.

Case 6.4
A 25-year-old with right upper quadrant pain

Abdominal ultrasound with longitudinal and transverse views of both kidneys

There are multiple hyperechoic masses within both kidneys. These do not produce any acoustic shadowing, indicating that they are not calcified. The overall renal size is normal and there is no hydronephrosis. The most likely diagnosis is of bilateral renal angiolipomata in a patient with tuberous sclerosis. The fatty nature of the masses can be confirmed with CT or MRI.

Case 6.5
A 36-year-old man with a history of progressively worsening (right) facial pain

MRI with axial T_2-weighted spin echo scans and post-gadolinium T_1-weighted spin echo scans through the base of the skull. Coronal T_1-weighted spin echo scans following gadolinium

There is an enhancing mass lesion in the right side of the nasopharynx which is extending superiorly into the middle cranial fossa, where it is related intimately to the carotid syphon on the right side, and may in fact be surrounding the carotid artery. There is no extension into the adjacent sphenoid sinus or anteriorly into the orbit. There is also extension inferomedially into the nasopharynx with obliteration of the right Eustachian tube resulting in obstruction to the right mastoid air cells, which are filled with fluid. No extension into the maxillary antrum is identified. Laterally, the tumour does not reach the ramus of the mandible.

The features are most in keeping with an aggressive tumour of the right nasopharyngeal space, with a nasopharyngeal carcinoma being the most likely diagnosis.

Case 6.6
A 32-year-old woman with a dry cough

PA chest X-ray

There is extensive perihilar reticular shadowing, worse in the left lung. The heart size is normal and no other significant abnormality can be identified.

The differential diagnosis is wide. Given the patient's age and symptoms, the most likely diagnosis is *Pneumocystis carinii* pneumonia, and risk factors should be considered.

Confirmation could be obtained from transbronchial biopsy or broncho-alveolar lavage.

Case 6.7
A 78-year-old woman with low back pain

Plain film of the pelvis

An area of increased sclerosis occupies the upper part of the sacrum. The lower part of the sacrum is ill-defined and cannot be clearly seen, but this may be due to overlying bowel loops. The L5 vertebra is also somewhat dense and enlarged and, in a patient of this age, the appearances are likely due to Paget's disease.

CT scan of the sacrum

A mixed pattern of sclerosis and lysis is identified throughout the sacrum, which is expanded and shows trabecular thickening consistent with Paget's disease. A poorly defined bone-forming lesion is seen.

The appearances are of osteosarcomatous change and this could be confirmed by needle biopsy under CT control.

Case 6.8
A 40-year-old man with chronic disease

PA radiograph of the right hand

Extensive soft tissue calcification is identified, related mainly to the soft tissues of the metacarpophalangeal joints but also around the carpus and generally within the soft tissues adjacent to the ring finger and middle phalanx. Parallel linear calcification is also seen adjacent to the first metacarpal, and this is consistent with vascular calcification. The cortices on the radial side of the index to ring middle phalanges are thinned, with evidence of subperiosteal bone resorption. The cortical outline to the terminal tufts of the same fingers is also lost, indicating a degree of acro-osteolysis.

The features are those of secondary hyperparathyroidism in association with chronic renal failure.

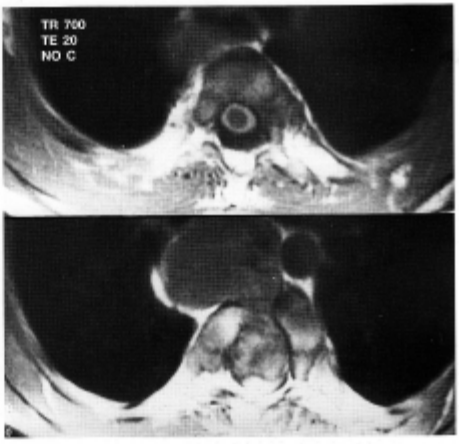
EXERCISE 7

7.1a

7.1b

7.1c

7.1d



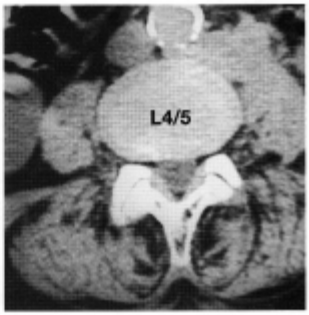
7.1e

Case 7.1 A child with abnormal lower limb neurology

7.2

Case 7.2 A 24-year-old immune-compromised patient with abdominal discomfort

7.3a



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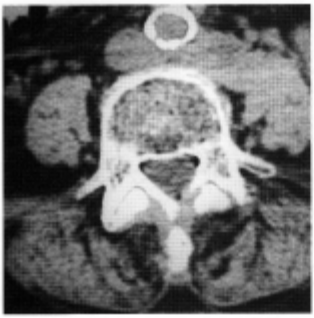

7.3c

7.3d

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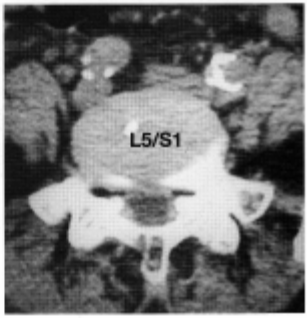
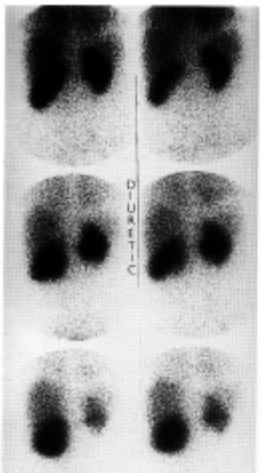


7.3f

Case 7.3 A 79-year-old lady with back pain



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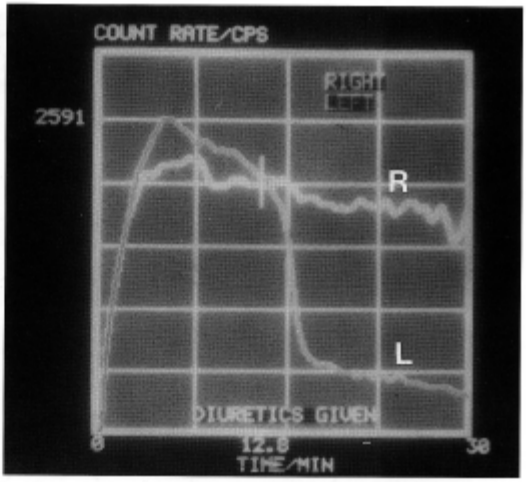
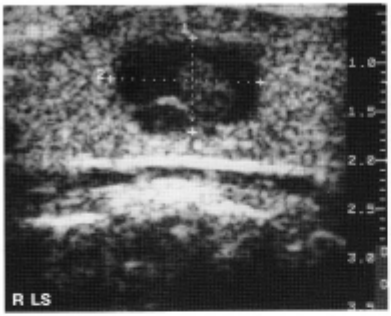


7.4b

Case 7.4 A 17-year-old girl with recurrent right loin pain



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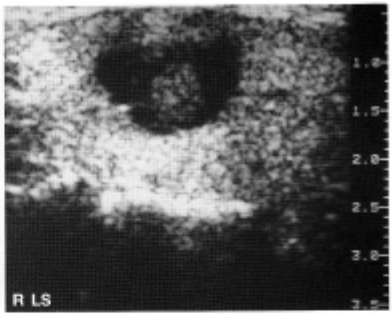

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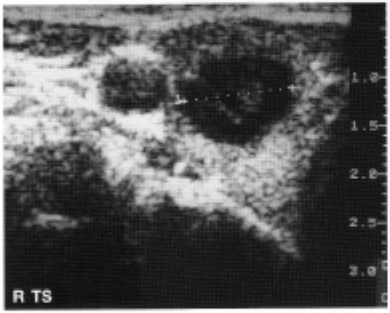

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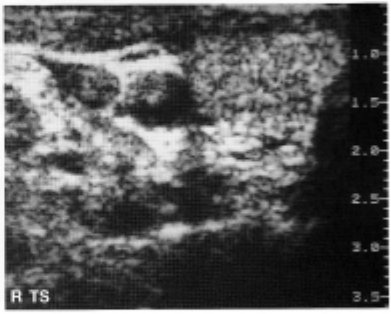
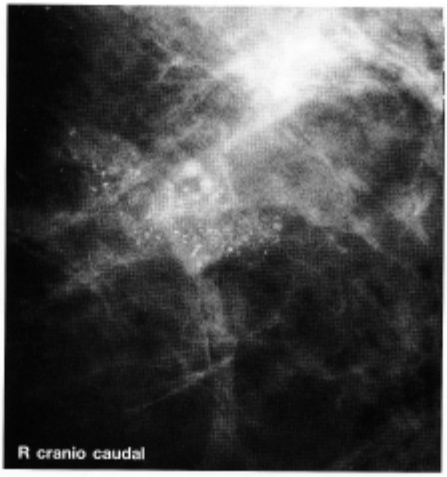


7.5d

Case 7.5 A 47-year-old lady who had noticed a lump in the right side of the neck



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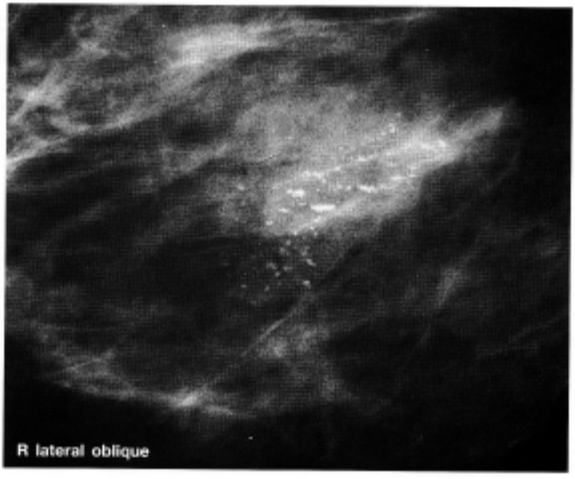


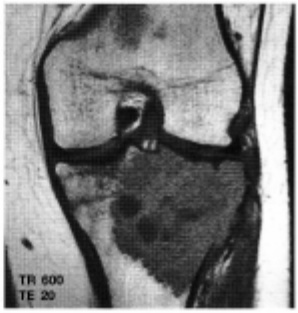
7.6b

Case 7.6 A 62-year-old woman recalled from a Forrest screening

7.7a

7.7b

7.7c



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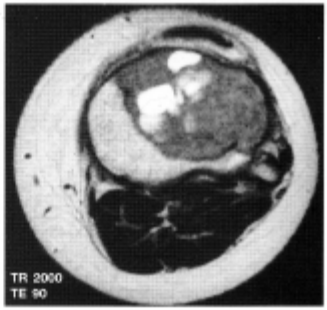
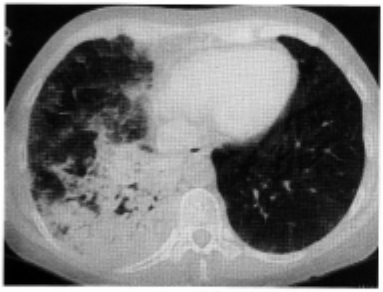


7.7f

Case 7.7 A 30-year-old lady with several months history of increasing pain in the left knee

7.8a

7.8b



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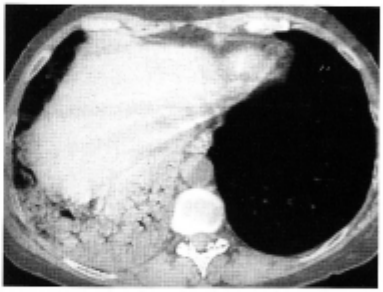


7.8d

Case 7.8 A 55-year-old lady with chronic cough

ANSWERS TO EXERCISE 7

Case 7.1
A child with abnormal lower limb neurology

AP and lateral views of the thoracic spine

There is a complex congenital kyphoscoliosis in the mid thoracic spine. On the lateral radiograph, a posterior mediastinal mass is present, causing anterior displacement of the trachea.

T_1-weighted sagittal and axial MRI scans through the cervical and upper thoracic spine.

The cervical spine is within normal limits. In the upper thoracic spine there is a sharp, localised kyphosis at the T3-4 level with associated vertebral abnormality. The thoracic cord is expanded above this level with several areas of low signal intensity within it, indicating a multiloculated syrinx. Below this, the spinal cord appears normal.

There is, in continuity with the dura, a low signal intensity mass anterior to the thoracic spine. The appearances are those of an anterior thoracic meningocoele.

Overall, the appearances are highly likely to be due to neurofibromatosis.

Case 7.2
A 24-year-old immune-compromised patient with abdominal discomfort

Single film from a double-contrast barium meal

The body and antrum of the stomach are outlined. The stomach folds appear slightly thickened, but this may be due to underdistension. In addition, there are multiple rounded filling defects within the stomach. Some of these appear to have a small ulcer crater within them.

The differential diagnosis for this appearance would include Kaposi's sarcoma, lymphoma or metastasis, a florid gastritis or infective lesions.

Endoscopy and biopsy would provide a histological diagnosis.

Case 7.3
A 79-year-old lady with back pain

Plain CT of the lumbar spine through the L4/5 and L5/S1 discs

The distal aorta and iliac arteries are pushed away from the vertebral bodies by a mass of soft tissue density extending to involve the left psoas muscle. No calcification is identified within the mass. The

abnormal tissue extends to the level of the L5/S1 disc. The canal dimensions are normal with no evidence of disc hernia or significant disc bulge at the L4/5 or L5/S1 levels. Multilevel bilateral facet degenerative changes are seen. No destructive bony lesion is identified.

The features are those of metastatic disease to the paravertebral lymph nodes. Diagnostic possibilities include lymphoma or metastatic carcinoma. Examination of the pelvis is indicated. The tissue could be biopsied with CT guidance.

Case 7.4
A 17-year-old girl with recurrent right loin pain

MAG-3 renogram

Both kidneys appear of normal shape and size. There is delayed clearance of isotope from both kidneys but, following intravenous diuretic, there is rapid clearance from the left kidney, excluding the presence of obstruction. However, on the right side, there is a very poor response to diuretic, indicating obstruction. On the post-diuretic images, the activity on the right side appears globular, consistent with a dilated renal pelvis. The features are characteristic of a right-sided pelvi-ureteric junction obstruction, but a plain film should be performed to exclude a stone at the PUJ.

Case 7.5
A 47-year-old lady who had noticed a lump in the right side of the neck

Ultrasound of the thyroid

In the right lobe of the thyroid there is an approximately $2 \times 2 \times 3$ cm mixed echogenicity mass. This is largely hypoechoic but has a complex central solid nodule. No other abnormalities can be seen within the thyroid. A careful search should be made for other masses as this is likely to represent a nodule in a multinodular goitre. In a solitary mass, however, malignancy cannot be excluded and therefore fine needle aspiration of the mass under ultrasound control is recommended.

Case 7.6
A 62-year-old woman recalled from a Forrest screening

Magnified views from lateral oblique and craniocaudal mammogram of the right breast

There is a localised collection of microcalcifications in an otherwise normal-appearing area of stroma. The calcification is clustered and variable but, on the lateral oblique view, shows the characteristic layering or 'tea-cup' phenomenon indicative of benign microcalcification in microcysts. Although this is certainly benign calcification, it may be advisable to repeat the mammogram in a year's time to ensure that there has been no change.

Case 7.7
A 30-year-old lady with several months history of increasing pain in the left knee

AP and lateral plain radiographs of the left knee

The plain films show a lytic lesion in the proximal metaphysis of the tibia, predominantly on the lateral side. The lesion reaches the articular surface. It shows no evidence of matrix calcification and has a relatively poorly defined non-sclerotic margin. There is no definite evidence of cortical destruction. No other lesion is identified on the plain film and there is no evidence of a joint effusion.

Bone scintigraphy, frontal views of both knees

There is extensive uptake in the left proximal tibial metaphysis corresponding to the region on the plain films, with a central area of lower activity and increased uptake in the left distal femoral epiphysis and patella.

The increased activity in the patella and distal femur are likely to be related to increased blood flow to the leg rather than other sites of disease.

MRI scan of left knee: coronal T_1-weighted, axial T_2-weighted and coronal fat suppression sequences

There is a well-defined area of signal abnormality in the lateral and central aspects of the proximal tibial metaphysis. The lesion has predominantly intermediate to low signal on T_1-weighted scans and T_2-weighted scans, but is hyperintense on the fat suppression sequence. Within the lesion are areas of lower signal on T_1- and higher signal on T_2-weighting, which would be consistent with necrosis. The cortex is destroyed on the lateral tibial margin and tibial condyle, and a small joint effusion is present.

On the T_1-weighted scan there is a poorly defined area of reduced signal in the distal femoral metaphysis, but this shows no abnormality on the STIR sequence and has the features of residual red marrow.

The plain radiographic features in a patient of this age are classical for a giant-cell tumour. This should be confirmed by a percutaneous needle biopsy.

Case 7.8
A 55-year-old lady with chronic cough

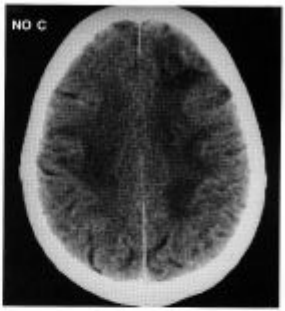
Thin-section CT of the chest viewed at lung and soft tissue windows

Extensive consolidation is present within the right lower lobe. Smaller patches of consolidation are also seen in the right lower lobe apex and in the left midzone. No mass lesion is seen within the lungs. On the views shown, there is no evidence of hilar or mediastinal lymphadenopathy.

Considering the history of chronic cough, the features would be consistent with a condition such as alveolar cell carcinoma. Lymphoma also has to be considered but this is unlikely in the absence of intrathoracic lymphadenopathy. The diagnosis can be obtained by cytology of sputum specimens or alveolar lavage.

EXERCISE 8

8.1a



8.1b

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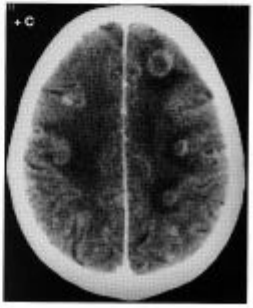
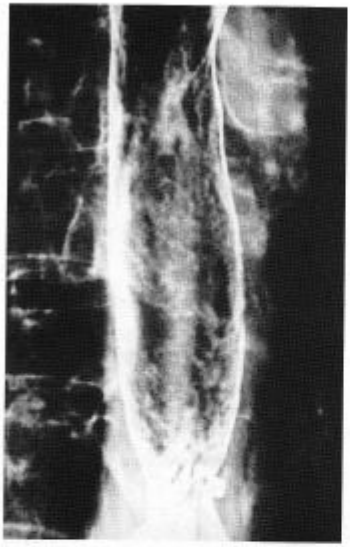


8.1f

Case 8.1 A 34-year-old man with headaches and confusion



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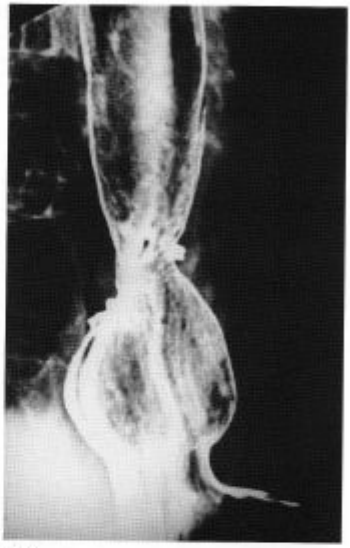

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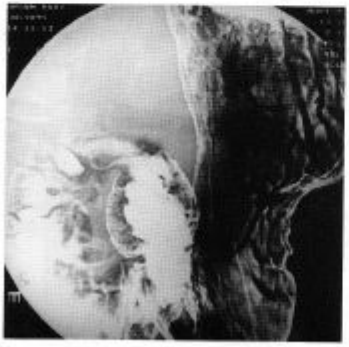

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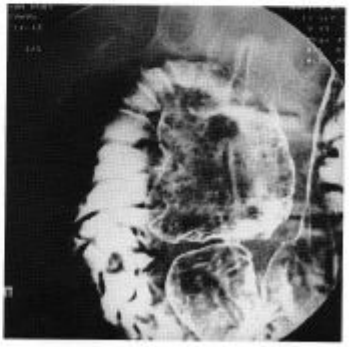
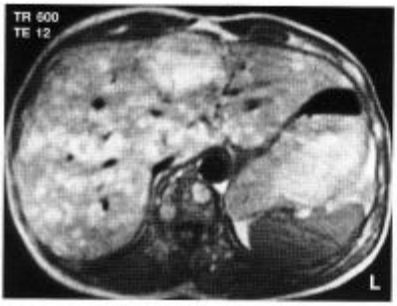


8.2d

Case 8.2 An 80-year-old woman with difficulty in swallowing



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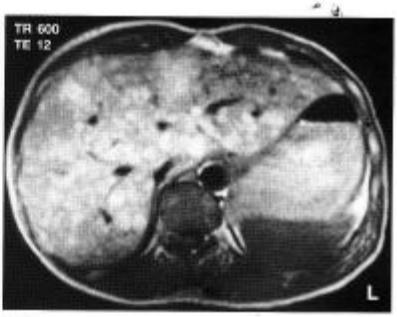

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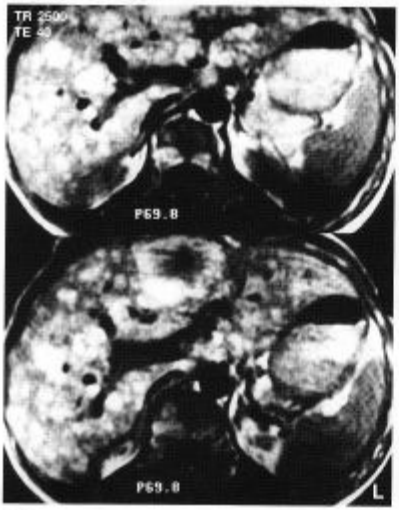

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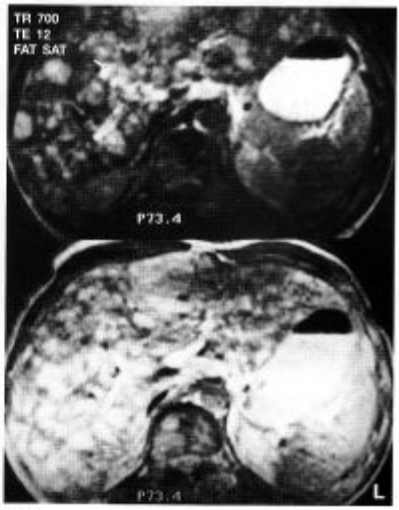
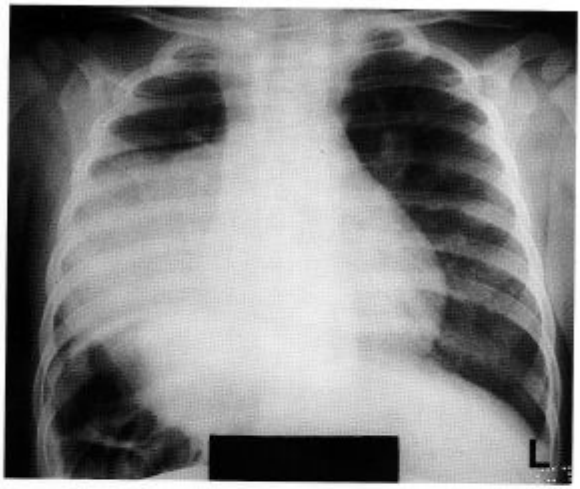


8.3d

Case 8.3 A 40-year-old woman with profound weight loss

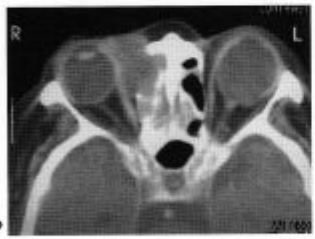


8.4a

8.4b

Case 8.4 A 2-year-old girl with a history of vomiting

8.5a



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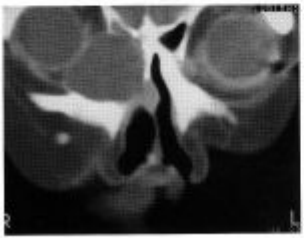

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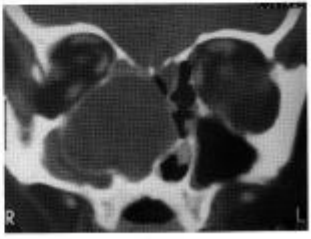


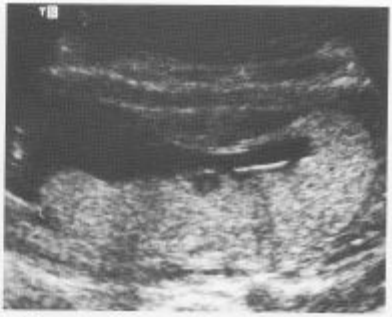
8.5e

Case 8.5 A 79-year-old man with a history of a slowly developing right facial mass

8.6a

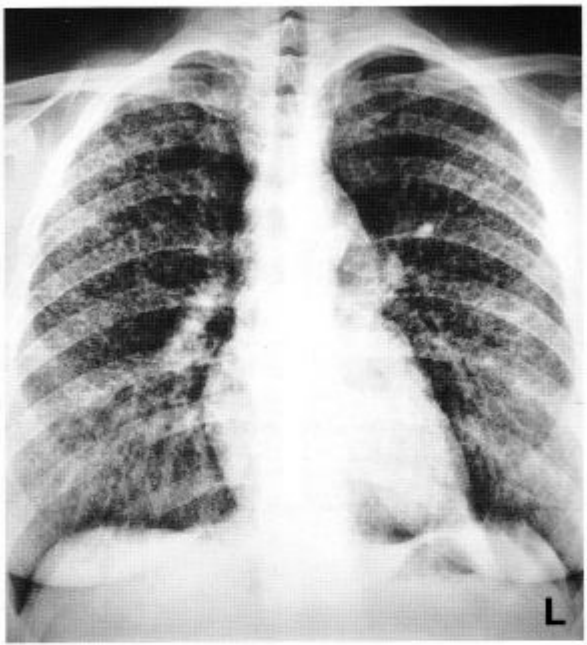
8.6b

8.6c



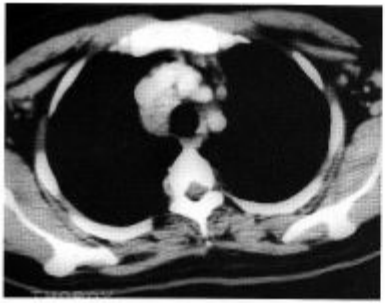
8.6d

Case 8.6 A 27-year-old woman with bleeding during pregnancy

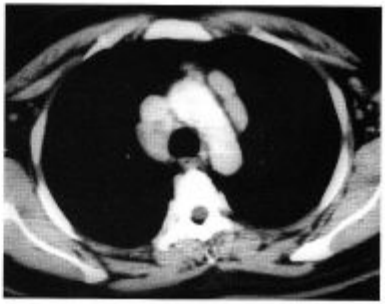


8.7

Case 8.7 A 24-year-old woman with breathlessness



8.8a



8.8b

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8.8d

Case 8.8 A 40-year-old man with a dry cough

ANSWERS TO EXERCISE 8

Case 8.1
A 34-year-old man with headaches and confusion

Cranial CT before and after intravenous contrast enhancement

On the pre-contrast study, there is the suggestion of several small hyperdense nodules in the posterior fossa. The fourth ventricle is not compressed or displaced. There is white matter oedema, particularly in the left frontal region, with the suggestion of several 'ring' lesions at the grey-white matter junction. There is no hydrocephalus, midline shift or extra-axial collection.

On the post-contrast scans, multiple enhancing lesions are demonstrated throughout the brain, many of which show 'ring' enhancement. There is fluid in both maxillary antra and in the nasopharynx.

The most likely diagnosis is of AIDS-related toxoplasmosis, although other granulomatous diseases or lymphoma must be considered.

Case 8.2
An 80-year-old woman with difficulty in swallowing

Series of images from a double-contrast barium meal

Double-contrast images of the oesophagus show a short area of stricturing above a hiatus hernia and at least two ulcers. No other abnormality is seen on the images provided.

Although this is a short stricture, the most likely diagnosis remains an inflammatory stricture due to reflux oesophagitis. Endoscopy and biopsies are however indicated to exclude carcinoma and to look for evidence of dysplasia.

Case 8.3
A 40-year-old woman with profound weight loss

T_1 and T_2-weighted MRI scans performed through the liver

Multiple nodules are scattered throughout the liver and several deposits are also noted in the vertebrae. On T_1-weighted scans the liver nodules are only moderately higher signal than the liver parenchyma. On the T_2-weighted scans the nodules are also of high signal intensity.

Given the signal characteristics, the likely diagnosis is multiple metastatic deposits from melanoma.

Case 8.4
A 2-year-old girl with a history of vomiting

PA and lateral chest radiographs

There is a large, well-defined mass in the right posterior lower chest which obscures the right hemidiaphragm. There is no evidence of calcification in the mass and the adjacent ribs appear normal. The remaining visible right lung, the left lung and cardiac contour are normal. Bowel gas is seen in the right upper quadrant. The features are consistent with a right-sided diaphragmatic hernia or eventration, with the mass being the liver. This should be confirmed using ultrasound.

Case 8.5
A 79-year-old man with a history of a slowly developing right intraorbital mass

AP radiograph and contrast-enhanced coronal and axial CT of the facial bones

The plain radiograph demonstrates opacification of the right maxillary antrum. The medial wall of the antrum and the floor of the right orbit are indistinct. There is a soft tissue mass just inferomedial to the right orbit and a fluid level in the left maxillary antrum.

The CT scan shows that the right sphenoid and maxillary antra are filled with material of soft-tissue density. The ethmoid sinus is expanded and its walls are thinned but intact, suggesting that this is a slow process. The right globe is displaced superolaterally, but the intraorbital fat is not infiltrated. The sphenoid sinus is normal. The features are more in keeping with a non-aggressive process such as an ethmoid mucocoele rather than a neoplastic lesion.

Case 8.6
A 27-year-old woman with bleeding during pregnancy

Obstetric ultrasound

A well-formed singleton pregnancy is present, lying in a transverse presentation. The amount of liquor appears normal. The placenta is lying predominantly posteriorly. At its anterior margin, there is an ellipitical area of reduced echogenicity lying deep to, and lifting, the free edge.

The appearances are those of a retroplacental haemorrhage.

Case 8.7
A 24-year-old woman with breathlessness

PA film of the chest

The cardiomediastinal contour is normal. The lungs are of preserved volume but show a diffuse

reticulo-nodular pattern throughout. There is a narrow differential diagnosis for this appearance, being (1) Langerhan's cell histiocytosis; (2) the lung changes of tuberous sclerosis; (3) lymphangioleiomyomatosis and (4) neurofibromatosis.

A thin-section CT scan would be of value to differentiate between the causes. There are no clues on the film to suggest the underlying cause.

Case 8.8
A 40-year-old man with a dry cough

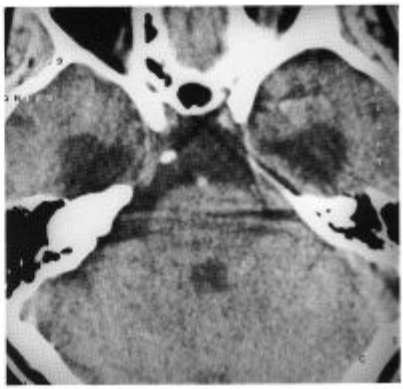
CT of the thorax performed with intravenous contrast enhancement (mediastinal windows only available)

Lymphadenopathy is present in the mediastinum. Enlarged nodes are seen in the right paratracheal region, the aortopulmonary window, azygo-oesophageal recess and at both hila, more marked on the right. There is no evidence of axillary lymphadenopathy or parenchymal lung mass.

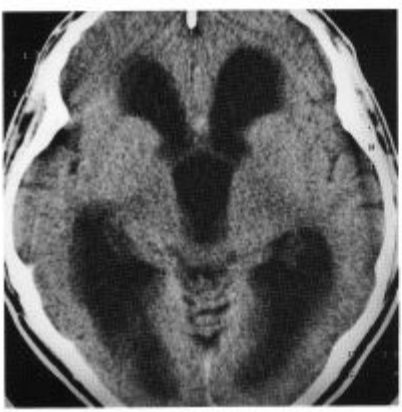
The differential diagnosis would include lymphoma, metastases, sarcoidosis, tuberculosis or a small-cell carcinoma of the lung.

EXERCISE 9

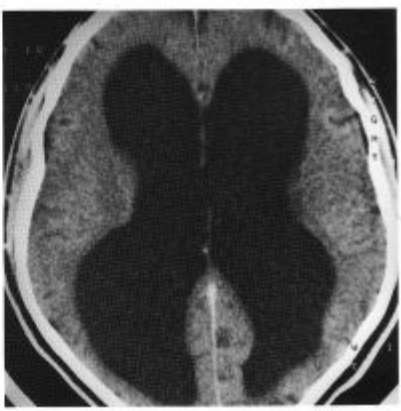
9.1a



9.1b



9.1c

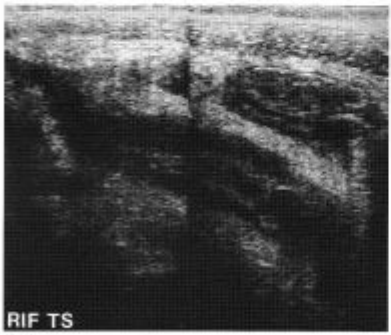


9.1d

Case 9.1 A 24-year-old man with a long history of gradually worsening headache

9.2a

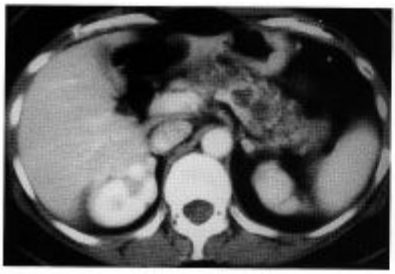
9.2b



9.2c

9.2d

Case 9.2 A 21-year-old woman with right iliac fossa pain



9.3a

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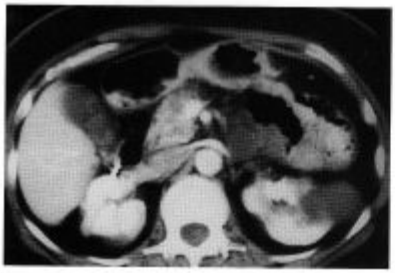
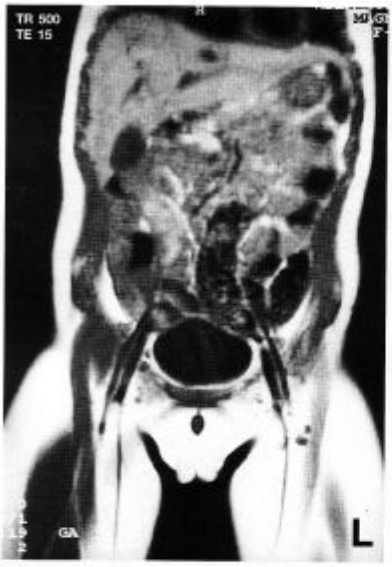


9.3e

9.3f

Case 9.3 A 37-year-old woman with abdominal pain



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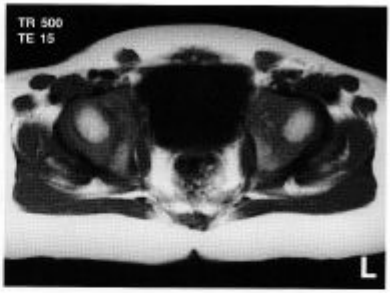

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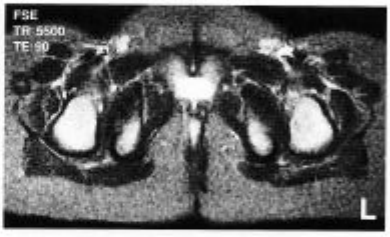
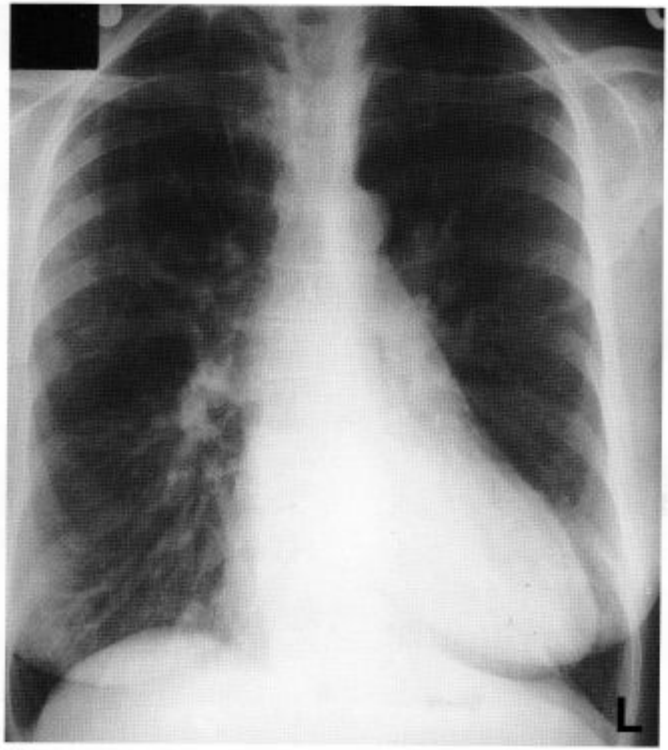


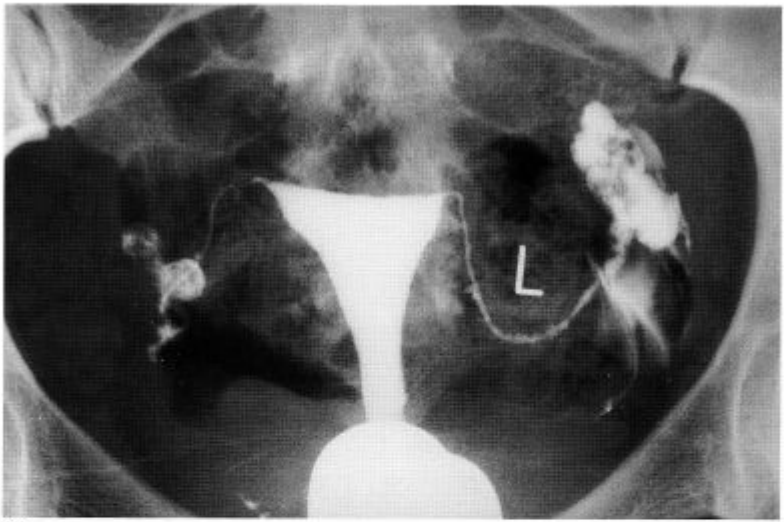
9.4c

Case 9.4 A 2-year-old boy with a developmental abnormality



9.5

Case 9.5 A 40-year-old woman with breathlessness on exertion

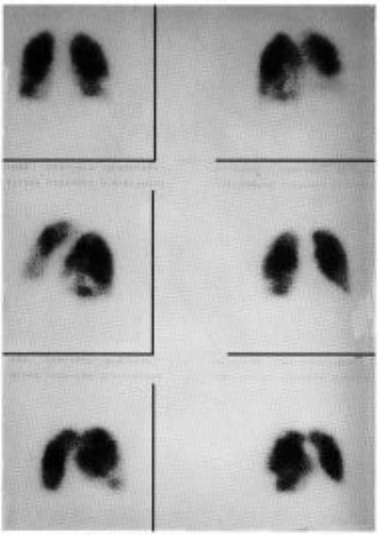


9.6

Case 9.6 A 26-year-old woman being investigated for infertility

9.7

Case 9.7 A 40-year-old man with chronic pain in the right wrist



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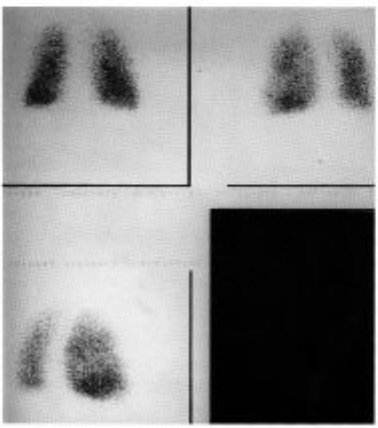


9.8b

Case 9.8 A 50-year-old man with chest pain

ANSWERS TO EXERCISE 9

Case 9.1
A 24-year-old man with a long history of gradually worsening headache

Unenhanced cranial CT

The third and lateral ventricles show a severe degree of dilatation. The fourth ventricle is normal in appearance with no evidence of any mass in the posterior fossa. There is no midline shift, focal lesion or extra-axial collection.

The features are consistent with congenital aqueduct stenosis. This could be better visualised with cranial MRI to confirm the absence of a mass lesion in the brain stem.

Case 9.2
A 21-year-old woman with right iliac fossa pain

AP and lateral decubitus radiographs of the abdomen

There is a dilated gas-filled loop of small bowel in the right iliac fossa. This contains several air-fluid levels on the decubitus view. The features are those of a localised ileus (sentinel loop), suggesting the presence of a localised inflammatory process. The remaining bowel gas pattern is unremarkable and there is no evidence of free intra-abdominal air or abdominal calcification.

Ultrasound of the right iliac fossa

There is a small amount of free fluid adjacent to a tubular structure lying in the transverse plane which has the features of thickened bowel.

The combined features of the plain film and ultrasound are strongly suggestive of acute appendicitis.

Case 9.3
A 37-year-old woman with abdominal pain

Axial CT through the upper abdomen following intravenous contrast enhancement

Multiple cysts are demonstrated within the body and tail of the pancreas and in the left kidney. The liver and spleen are normal. Several stones are identified within the gall bladder but there is no intrahepatic or extrahepatic bile duct dilatation. There is normal enhancement of the splenic vein, IVC and aorta. The major abnormality therefore is the presence of multiple cysts in the pancreas and kidney, the most likely diagnosis being von Hippel Lindau disease.

Case 9.4
A 2-year-old boy with a developmental abnormality

T_1-weighted spin echo coronal and axial MRI scans with a STIR axial scan through the abdomen and pelvis

The scrotal sac is empty and axial scans show bilateral structures in the subcutaneous fat anteromedial to the femoral vessels that are of intermediate signal on T_1-weighting and of increased signal on STIR sequences. These are undescended testes.

Case 9.5
A 40-year-old woman with breathlessness on exertion

PA chest radiograph

There is cardiomegaly with rounding of the cardiac apex, in keeping with right venticular hypertrophy/enlargement. The proximal pulmonary arteries are enlarged. There is no evidence of left atrial enlargement and the aortic arch is small. An azygous lobe is noted. Otherwise the lungs are normal. No rib notching is identified.

The features are those of an intracardiac left to right shunt and presentation at this age would be in favour an ASD. This could be confirmed with echocardiography.

Case 9.6
A 26-year-old woman being investigated for infertility

Single film from a hysterosalpingogram

The outline of the uterine cavity is normal. The left fallopian tube has a very irregular, 'beaded' appearance, although there is no tubal dilatation. There is free spill of contrast medium on the left side, indicating that the tube is patent. The right fallopian tube appears essentially normal and also shows free spill of a small amount of contrast medium. The features are most in keeping with previous inflammation such as tuberculous salpingitis.

Case 9.7
A 40-year-old man with chronic pain in the right wrist

DP and lateral radiographs of the right wrist

There is increased distance between the scaphoid and the lunate, indicating scapholunate dissociation due to rupture of the scapholunate ligament. On the DP radiograph, the scaphoid appears foreshortened

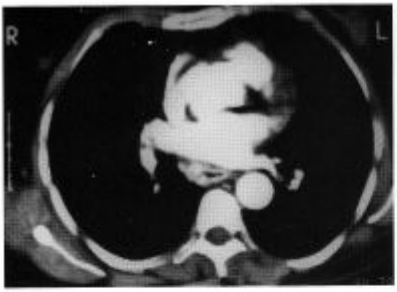
and, on the lateral radiograph, is lying in a horizontal position. The relationship of the remaining carpal bones is maintained and no fracture is identified. The features are those of rotatory subluxation of the scaphoid.

Case 9.8
A 50-year-old man with chest pain

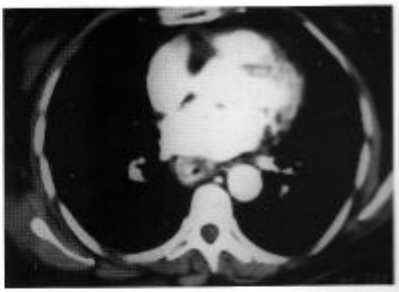
Ventilation and perfusion scan of the lungs

There are multiple segmental defects on the perfusion scan scattered throughout both lungs. Although the ventilation scan shows a suggestion of the defect in the right lung only, there is a high degree of mismatch and therefore the appearances have a high probability of representing multiple pulmonary emboli.

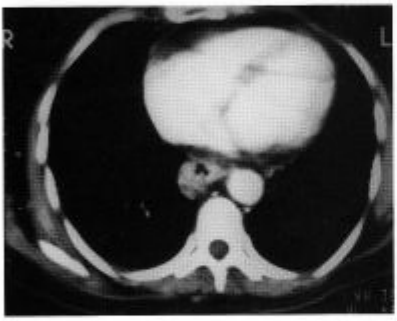
EXERCISE 10



10.1a



10.1b

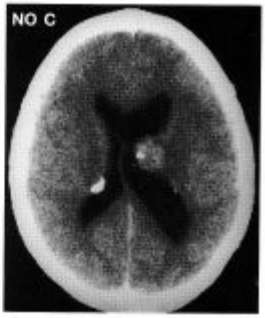


10.1c

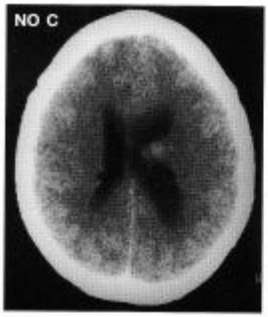
10.1d

Case 10.1 A 50-year-old woman with a history of progressive dysphagia

10.2a



10.2b



10.2c

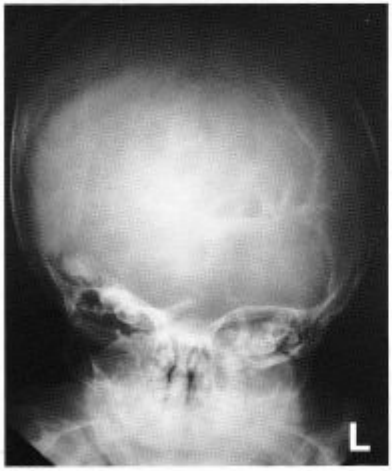
10.2d

10.2e

Case 10.2 A 20-year-old male with fits

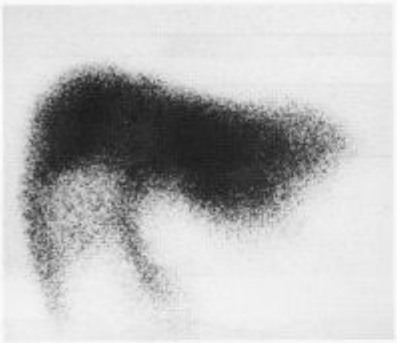
10.3a

10.3b



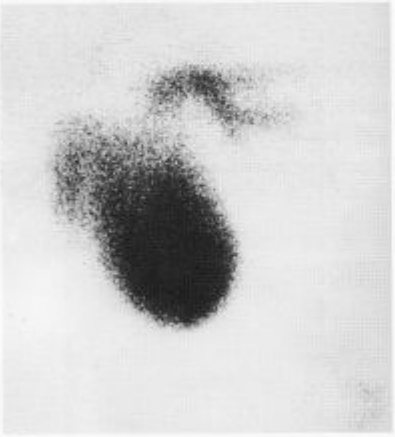
10.3c

Case 10.3 A 5-month-old girl with developmental delay



10.4a

10.4b



10.4c

10.4d

Case 10.4 A 2-year-old girl with intermittent jaundice and abdominal pain, with an abnormal upper abdominal ultrasound

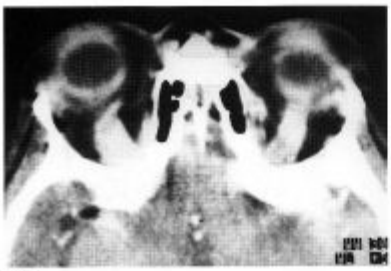
10.5a

10.5b

10.5c

10.5d

Case 10.5 A 20-year-old woman with bleeding eight weeks after her LMP



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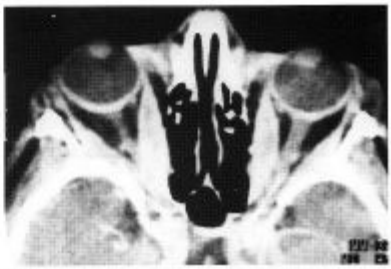
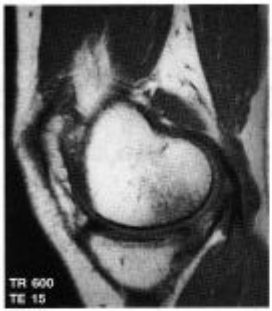


10.6b

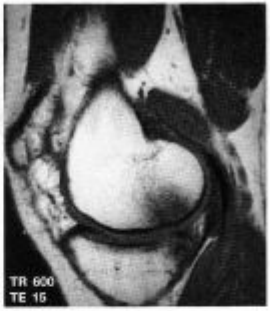
10.6c

10.6d

Case 10.6 A 76-year-old lady presenting with bilateral exophthalmos



10.7a



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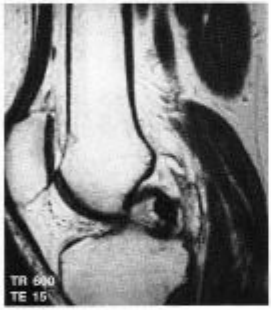
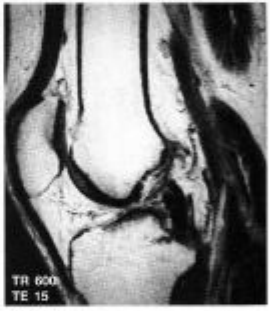


10.7c



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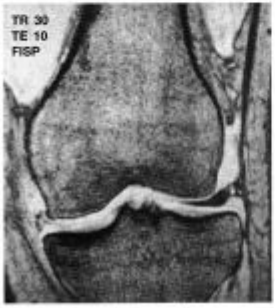
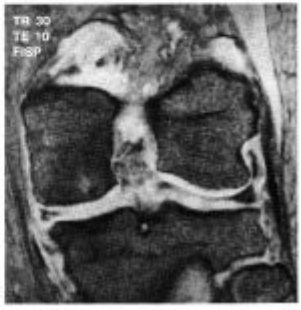
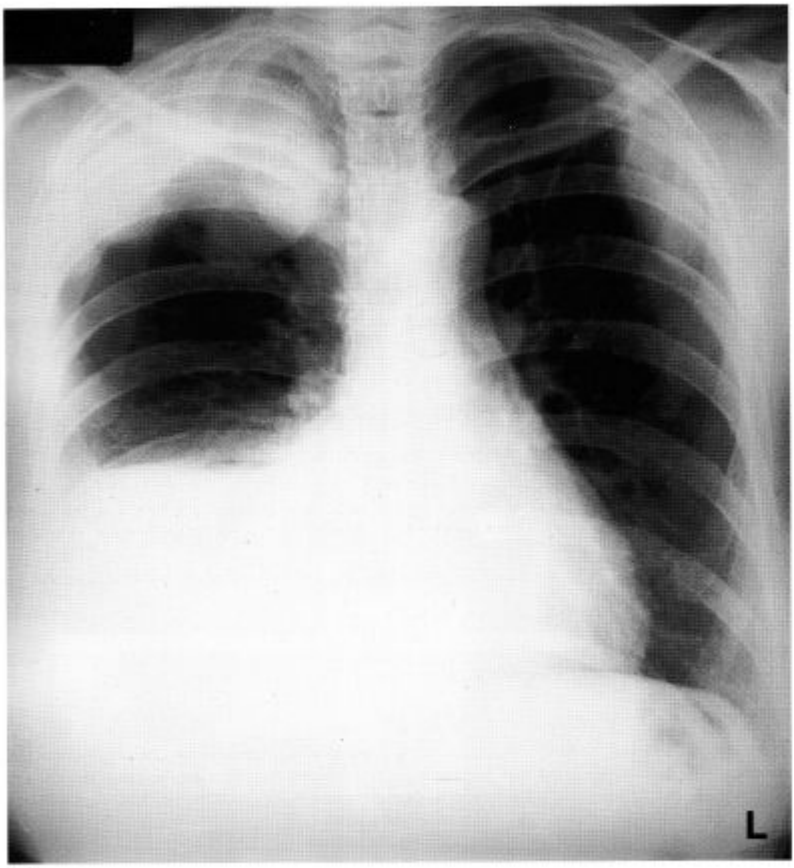


10.7e



10.7f

Case 10.7 A 20-year-old man with pain in the knee



10.8

Case 10.8 A 33-year-old woman with right-sided chest pain

ANSWERS TO EXERCISE 10

Case 10.1
A 50-year-old woman with a history of progressive dysphagia

CT through the lower thorax and upper abdomen with intravenous and oral contrast medium

There is eccentric thickening of the wall of the distal oesophagus and narrowing of the oesophageal lumen. A clear fat plane is identified between the oesophagus and the adjacent left atrium and distal thoracic aorta. In the upper abdomen is a mass anterior to the aorta which shows some rim enhancement. The liver and spleen appear normal. The features are those of an oesophageal carcinoma with spread to the coeliac nodes, but no evidence of local invasion.

Case 10.2
A 20-year-old male with fits

CT scan of the head before and after intravenous contrast enhancement

Multiple nodules are identified bilaterally in a periventricular distribution. The smaller of these lesions are calcified. Deep to the left-sided basal ganglia, there is an area of slightly increased attenuation on the pre-contrast scan which shows dense enhancement following contrast. There is no midline shift or hydrocephalus.

These lesions represent the calcified tubers and angiomatous lesions of tuberous sclerosis.

Case 10.3
A 5-month-old girl with developmental delay

AP, occipitofrontal and lateral views of the skull

There are accentuated cranial markings in the left occipital region with an associated degree of plagiocephaly, the left side of the skull vault being slightly smaller than the right. No other abnormality is identified. The features are consistent with craniosynostosis involving the left lambdoid suture.

Head CT is required prior to surgical intervention.

Case 10.4
A 2-year-old girl with intermittent jaundice and abdominal pain, with an abnormal upper abdominal ultrasound

Early and delayed images from a HIDA scan

On the early view, the liver parenchyma appears normal but there is a relatively photopenic region in the right lower aspect of the liver.

The next view shows clearance of the radio-isotope from the liver parenchyma into dilated intrahepatic bile ducts. There are two oval regions in the right lower quadrant corresponding to the initial photopenic areas on the early scan. The smaller of these to the right is consistent with a normal gall bladder and the larger with a choledocal cyst.

On the last image there is evidence of gradual clearance from the intrahepatic ducts and activity is identified within the small bowel, indicating that there is no biliary obstruction.

The features are typical for a Type IV choledocal cyst with both intra- and extrahepatic bile duct dilatation.

Case 10.5
A 20-year-old woman with bleeding eight weeks after her LMP

Transvaginal scan of the uterus

This shows an abnormal gestation sac which has an irregular outline with a poor trophoblastic response. It measures only 19.4 mm, which is small for an 8-week gestation. No yolk sac or fetal pole is identified, although there is a small amount of tissue within the sac. There is no blood or fluid around the sac. The remainder of the uterus appears normal.

The appearances are those of a non-viable pregnancy.

Case 10.6
A 76-year-old lady presenting with bilateral exophthalmos

Contrast-enhanced axial CT through the orbits

The rectus muscles are hypertrophied, this being maximal in the belly of the muscles. The medial rectus and inferior rectus are maximally involved. Bilateral exophthalmos is noted but there is no evidence of any retro-orbital mass. The optic nerves are normal.

The features are typical of thyroid eye disease and thyroid function texts should be performed.

Case 10.7
A 20-year-old man with pain in the knee

MRI of the knee with T_1-weighted sagittal scans and T_2-weighted gradient echo coronal scans

No normal tissue is identified in the region of the anterior cruciate ligament and there is slight forward displacement of the tibia, with bowing of the intact posterior cruciate ligament, indicating a complete rupture of the anterior cruciate ligament.

The posterior third of the medial meniscus is small and, on the gradient echo scans, a high signal area can be seen to contact the undersurface, indicating a complete tear. On the sagittal scans, there is an area of reduced signal within the medulla of the medial femoral condyle which represents a bone bruise. The lateral collateral ligament is normal, but there is a complete tear of the medial collateral ligament.

Case 10.8
A 33-year-old woman with right-sided chest pain

PA chest radiograph

There is a lobulated mass in the right upper zone with a well-defined inner margin, indicating that it is extrapulmonary. No erosion or deformity of the ribs is seen, but there is an associated pleural effusion. The right lower zone is opacified; the superior border of this is straight and slants laterally. No lung markings are seen through this area. The features are in keeping with a subpulmonary effusion rather than a raised hemidiaphragm. This may be confirmed by a right decubitus radiograph or ultrasound.

The left lung is clear and what is seen of the heart and mediastinal contour is normal.

The differential diagnosis includes a primary localised fibrous tumour of the pleura, and other tumours such as neurofibroma, metastatic adenocarcinoma or invasive thymoma. Further assessment with CT and CT-guided needle biopsy is advised.

DIAGNOSES

EXERCISE 1

1.1 Inflammatory bowel disease related arthropathy
1.2 Acoustic neuroma
1.3 Acute cholecystitis
1.4 Retroperitoneal liposarcoma
1.5 Complex adrenal mass
1.6 Necrotising enterocolitis
1.7 Unilateral facet joint fracture subluxation
1.8 Invasive thymoma

EXERCISE 2

2.1 Ischaemic colitis
2.2 Dermoid
2.3 Testicular tumour
2.4 Cirrhosis with portal hypertension
2.5 Aortic dissection
2.6 Meconium aspiration
2.7 Tear of the triangular fibrocartilage complex
2.8 Transient osteoporosis

EXERCISE 3

3.1 Crohn's disease
3.2 Posterior fossa mass
3.3 Bilateral adrenal adenomata
3.4 Adenomyomatosis
3.5 Ovarian carcinoma
3.6 Non-accidental injury
3.7 Unstable shoulder with partial rotator cuff tear
3.8 Bronchial carcinoid

EXERCISE 4

4.1 Metastasis
4.2 Crohn's disease
4.3 Hepatosplenic candidiasis
4.4 Pancreatic pseudocyst
4.5 Breast carcinoma
4.6 Orbital blow-out fracture

4.7 Left upper lobe collapse due to carcinoma
4.8 Polyostotic fibrous dysplasia in Albright-McCune syndrome

EXERCISE 5

5.1 Caecal angiodysplasia
5.2 Spinal stenosis in achondroplasia
5.3 Adrenal metastasis
5.4 Renal carcinoma
5.5 Scimitar syndrome
5.6 Cervical carcinoma
5.7 Osteoid osteoma
5.8 Cryptogenic fibrosing alveolitis

EXERCISE 6

6.1 Paratentorial subdural haematoma
6.2 Small bowel lymphoma
6.3 Giant pedunculated cavernous haemangioma
6.4 Renal angiomyolipomata
6.5 Nasopharyngeal carcinoma
6.6 Pneumocystis carinii pneumonia
6.7 Osteosarcoma in Paget's disease
6.8 Renal osteodystrophy

EXERCISE 7

7.1 Anterior thoracic meningocoele
7.2 Kaposi's sarcoma
7.3 Metastatic carcinoma
7.4 Right pelvi-ureteric junction obstruction
7.5 Multinodular goitre
7.6 Benign microcalcification
7.7 Giant-cell tumour
7.8 Alveolar cell carcinoma

EXERCISE 8

8.1 Toxoplasmosis
8.2 Benign oesophageal stricture

8.3 Metastases from malignant melanoma
8.4 Diaphragmatic hernia
8.5 Ethmoid mucocoele
8.6 Retroplacental haemorrhage
8.7 Langerhan's cell histiocytosis
8.8 Mediastinal lymphadenopathy

EXERCISE 9

9.1 Aqueduct stenosis
9.2 Acute appendicitis
9.3 Von Hippel Lindau syndrome
9.4 Undescended testes
9.5 Atrio-septal defect
9.6 Salpingitis — organism unknown
9.7 Carpal instability
9.8 Multiple pulmonary emboli

EXERCISE 10

10.1 Oesophageal carcinoma
10.2 Tuberous sclerosis
10.3 Craniostenosis
10.4 Choledochal cyst
10.5 Non-viable pregnancy
10.6 Thyroid eye disease
10.7 Anterior cruciate rupture, medial meniscal and medial collateral ligament tears ('O'Donohue's triad')
10.8 Plexiform neurofibroma of the right pleural space

Exercises in Diagnostic Imaging

Sarah Burnett and Asif Saifuddin

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