The Abdominal X-Ray

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Aims:

To identify and interpret significant abnormalities on an abdominal x-ray (AXR) and understand how this investigation relates to the overall management of the patient.

Describe the radiological appearances of common medical and surgical conditions on AXR.

1. Introduction

The abdominal x-ray (AXR) has a much more limited value in diagnosis than a chest x-ray.

The radiation exposure of an AXR compared to a CXR is also considerably higher. One AXR is equivalent to 35 CXRs.

The AXR is of most use in the patient with an acute abdomen. It may guide further imaging (Other Imaging Modalities Lecture)

As with a CXR, an appreciation of normal structures is vital.

Knowledge of the anatomy of the abdomen allows localization of the abnormalities observed on the AXR (see figures 1, 2 and 3a-3d).

Abdominal X-Ray Projections:

- Supine 99%
- Erect
- Lateral decubitus





Figure 2 – Abdominal X-Ray showing anatomical features







Figures 3a, 3b, 3c, 3d - Anatomy of the Abdomen

2. Film Specifics and Technical Factors

The initial assessment of an AXR is the same as for a CXR.

Film Specifics:

- Name of Patient
- Age & Date of Birth
- Location of Patient
- Date Taken
- Film Number (if applicable)

Film Technical factors:

- Type of projection (Supine is standard)
- Markings of any special techniques used



3. Assess the Film in Detail

A simple guide to interpretation is shown below. Working through these headings one covers, '*dark bits*', '*white bits*', '*grey bits*' and '*bright white bits*' in turn.

3.1 'BLACK BITS' = Gas

Intra-luminal Gas:

Intra-luminal gas can be normal. Extra-luminal gas is abnormal. However, intra-luminal gas can be abnormal if it is in the wrong place or if too much is seen.

The maximum normal diameter of the large bowel is 55mm. Small bowel should be no more than 35mm in diameter. The natural presence of gas within the bowel allows assessment of caliber - although the amount varies between individuals. The caecum is not said to be dilated unless wider than 80mm.

Large and small bowel may be distinguished by looking at bowel wall markings, as shown in the box below.

The haustra of the large bowel extend only a third of the way across the bowel from each side, whereas the valvulae conniventes of the small bowel tranverse the complete distance.

It is usual to see small volumes of gas throughout the GI tract and the absence in one region may in itself represent pathology. For example, if gas is seen to the level of the splenic flexure and nothing is seen beyond this, a site of the obstruction at this site – a 'cut off' point is noted.

If bowel obstruction is observed try to look for the cause. For example a hernia as the cause of obstruction



Figure 4 – Small bowel obstruction

Figure 5 – Hernia

Extra-luminal Gas:

When an bowel is obstructed, or any other gas containing structure perforates, its contained gas becomes extraluminal. Extra-luminal gas is never normal, but may be seen following intra-abdominal surgery or endoscopic retrograde cholangio-pancreatography (ERCP).

Causes of Extra-luminal gas:

- Post Abdominal Surgery/ERCP
- Perforation of viscus (eg. bowel, stomach)
- Gallstone ileus
- · Cholangitis (infection with gas forming organisms)
- Abscess



Figure 6 – Air under diaphragm on erect CXR

An erect CXR (not AXR) is the best projection to diagnose a pneumoperitoneum (gas in the peritoneal cavity)

3.2 'WHITE BITS' = Calcification

Calcified structures ('WHITE BITS') are often seen on AXR. The main question is – does its presence have any important implications. Calcification can be broadly divided into 3 types.

- 1. Calcium that is an <u>abnormal structure</u> eg. gallstones and renal calculi
- 2. Calcium that is within a normal structure, but represents pathology eg. nephrocalcinosis,
- 3. Calcium that is within a normal structure, but is harmless eg. lymph node calcification

Bones are normal 'white' structures. On the AXR they comprise mainly those of the thoraco-lumbar spine and pelvis. Findings are largely incidental as direct bone pathology would be investigated with specific views.



Figure 7 - Pancreatic Calcification



Figure 8 - Gallstones

3.3 'GREY BITS' = Soft Tissues

Soft tissues represent most of the contents of the abdomen and feature heavily in the AXR. However, these tissues are poorly seen when compared to other imaging techniques such as ultrasound or CT.

The kidneys, spleen, liver and bladder (if filled) can be seen in addition to psoas muscle shadows and abdominal fat. Rarely would action be taken on the basis of this imaging alone.



Figure 9 - Splenomegaly

3.4 'BRIGHT WHITE BITS' = Foreign Bodies

Foreign Bodies represent an interesting final observation. Objects that may be seen include ingested and rectal foreign bodies, items in the path of the x-ray beam such as belt buckles, dress buttons and jewelry. Other objects may have been deliberately placed for example an aortic stent, an inferior vena cava filter or a suprapubic urinary catheter. Sterilization clips and an intra-uterine device are common findings in women.



Figure 10 - Sterilisation and Surgical Clips



Figure 11 – Foreign body per rectum.

4. Case Presentations:

<u>Case 1</u>: This 67 year-old women presented to the surgical ward with a distended abdomen and vomiting.



Figure 12

Present this x-ray. Give a diagnosis and potential causes.

Radiology Report

Plain abdominal radiograph.

Multiple dilated loops of small bowel within the central abdomen. Gas is not seen in the large bowel. No evidence of hernia or gallstone to suggest potential cause of the dilated loops.

These findings are in keep with a low small bowel obstruction.

I would like to know if the patient has a history of abdominal surgery as the commonest cause is surgical admissions.

Diagnosis: Small bowel obstruction

The three commonest causes of small bowel obstruction are:

- Surgical adhesions
- Herniae
- Intraluminal mass eg, small bowel lymphoma or gallstone (in gallstone ileus)

<u>Case 2</u>: This 71 year-old gentleman visits his GP complaining of blood in his urine. He has had a number of UTI's in recent years.



Figure 13

Present this x-ray. Give a diagnosis and potential causes.

Radiology Report

Plain abdominal radiograph.

Two rounded radio-opacities measuring 4cm within the pelvis. Both opacities are smooth in outline, laminated in nature, have the same density as bone and project over the bladder. No other renal tract calcification.

Does the patient have a history of neurogenic bladder?

Given the size of these stones and history of UTI's these are bladder calculi.

Diagnosis: Bladder calculi

More common in those with a history of:

- UTI's
- A neurogenic bladder
- Bladder diverticulum

<u>Case 3</u>: This patient was admitted with poor renal function.



Figure 14

Present this x-ray. Give a diagnosis and potential causes.

Radiology Report

Plain abdominal radiograph

Multiple areas of punctuate calcification project over the renal outlines bilaterally.

The calcification is within the medulla of the renal parenchyma. The bones are normal in appearance.

These findings are consistent with nephrocalcinosis.

Diagnosis: Nephrocalcinosis

Causes include:

- Hyperparathyroidism
- Medullary sponge kidney

There will be the opportunity during the rest of the day for EVERYONE to present at least one AXR during the small group sessions.