ASSESSING THE PLAIN ABDOMINAL RADIOGRAPH

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The abdomen (less formally called the belly, stomach, is that part of the body between the thorax (chest) and pelvis, in humans and in other vertebrates.

The region enclosed by the abdomen is termed the abdominal cavity.

Pelvis starts from the sacrum to the coccyx posteriorly and the symphysis pubis anteriorly.

The pelvis is the head quarters for the reproductive organs.

The abdomen together with the pelvis form the abdominopelvic region.
The abdominopelvic region
Contents of the abdomen and pelvis

- **Digestive tract and Accessory organs**: Stomach, small intestine, large intestine with caecum and appendix. Liver, gallbladder and pancreas.

- **Urinary system**: Kidneys and ureters (technically located in retro peritoneum) and the bladder.

- **Other organs**: Spleen

- **Vessels**: Abdominal aorta, inferior vena cava

- Reproductive system.

- Vertebra bodies and muscles
Modalities used

- Plain abdominal x-ray (KUB)
- Ultrasound (USG)
- Computed tomography (CT),
- Magnetic resonance (MR),
- Gastrointestinal radiology (Fluoroscopy)
- Genitourinary radiology (IVU).
Plain abdominal x-ray

- Plain abdominal radiographs are commonly ordered in inpatient and outpatient settings for patients with a variety of abdominal complaints.

- In addition to the gastrointestinal system, a variety of critical and/or incidental findings in the genitourinary, hepatic, biliary, and vascular systems can all be identified on abdominal radiographs.
Indications

- Moderate - severe undifferentiated abdominal pain
- Suspected bowel obstruction,
- Suspected perforations,
- Suspected foreign body,
- Calcifications and renal tract calculi follow-up
Projections

- Supine
- Erect
- Decubitus
- Erect chest
Decubitus

- This demonstrates pneumoperitoneum in a patient who cannot be positioned for an erect chest.

- Gas rises to the upper part of the abdomen and so will be seen on one side of the abdominal X-ray image.

- Decubitus view is usually done with a horizontal beam.

- Can be dorsal or lateral depending on the condition of the patient.
Lateral decubitus

Positioning

AP abdomen left lateral decubitus position.
Image courtesy of Dr. Naveed Ahmad.

Image
Dorsal decubitus

Positioning

Lateral abdomen, left dorsal decubitus position (cross table projection). Image courtesy of Dr. Naveed Ahmad.

Image

A dorsal decubitus (cross table view) projection -- right lateral position. Image courtesy of Dr. Naveed Ahmad.
If perforation of the bowel is suspected then an ERECT chest X-ray must be done in addition to the abdomen.

This is the most sensitive plain radiographic study to detect the presence of free gas in the abdomen.
Free gas under the right diaphragm

- Perforation of an intra-abdominal viscus is a surgical emergency and requires immediate intervention.

- As little as 1ml of free intraperitoneal air can be detected on the erect chest radiograph.
### Erect chest cntd

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<td><img src="image.png" alt="Image" /></td>
<td>• Arrow heads showing a thin film of gas under the diaphragm</td>
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Assessment of the Abdominal Radiograph

- Often anatomical structures are not clearly demonstrated on a plain abdominal radiograph.
- Abnormalities can be obscured by normal anatomical structures.
- A systematic approach to abdominal X-ray assessment is therefore very important.
Stages in assessment

- patient data
- Marker
- image quality
- Outline – i.e. shape and thickness of the wall
Situs inversus, a condition in which the major organs are on the reverse side of what is normal, as seen in an X-ray.

Importance of a marker
Fig. 1.1 - Normal supine adult AP radiograph in a 55-year-old woman. Ideally, the bladder should be emptied immediately prior to an abdominal or pelvic film. This cuts the radiation dose and minimises diagnostic problems.
Assessment cntd

- Bowel gas pattern

- Free air

- Soft tissue structures (outline of solid viscose i.e. liver, spleen, kidneys, prostate, bladder and uterus)

- Foreign body and calcifications

- Bones - Spondylosis, sclerosis, lucency and other changes
Bowel gas pattern

- Any part of the bowel may be visible if it contains gas/air within the lumen.

- Gas/air is of low density and forms a natural contrast against surrounding denser soft tissues.

- It is often difficult to differentiate between normal small and large bowel,

- but this often becomes easier when the bowel is abnormally distended.
Bowel gas pattern

Normal small bowel - Identified by

- Central position in the abdomen
- Valvulae conniventes - mucosal folds that cross the full width of the bowel
- As a general rule, the more visible the small bowel is, the more likely it is to be pathological
Small bowel cntd

Arrow heads showing Valvulae conniventes

The coiled spring appearance only occurs in dilated air-filled small bowel
Normal small bowel not usually visualized

Small bowel obstruction
small bowel obstruction cntd

Mechanical obstruction

image
Small bowel obstruction cntd

- Note the dilated loops of bowel centrally within the abdomen.

- most underlying causes of small bowel obstruction cannot be diagnosed with an abdominal radiograph.
Normal large bowel may be identified by –

- Peripheral position in the abdomen
- Haustra
- May contain faeces
Large bowel cntd

Haustral pattern of the large bowel

Peripheral position of the large bowels
Images of the large bowel

Normal large bowel

Large bowel obstruction
Soft tissue structures

The lung bases

- this passes behind the liver and diaphragm in the posterior sulcus of the thorax, may be visible on some abdominal X-rays.

- It is worth checking the lung bases as some patients with lung pathology present with abdominal symptoms.

- If there is consolidation suspected from the abdominal X-ray then a review of the patient's respiratory system is necessary.

- Costophrenic angles
The lung base

- Arrow heads showing the lung base
Soft tissue structures cntd

Stomach

- The stomach may be visible if it contains gas/air.
- Normally found in the left upper quadrant of the abdomen. The lowest part of the stomach crosses the midline.
- It is not visible if it is either completely empty, or fluid filled.
The stomach cntd

Stomach crossing the mid line

Stomach and kidney
The liver

- The liver lies in the right upper quadrant (RUQ) and is seen as a bland area of grey on an abdominal X-ray.

- The superior edge of the liver forms the right hemi-diaphragm contour (arrowhead).

- The gallbladder is only rarely visible on an abdominal X-ray. Its position is very variable.
Liver cntd

Pneumobilia (air in the biliary tract)

Portal venous gas.
Kidneys on abdominal X-ray

- Natural contrast between the kidneys and the low density retroperitoneal fat that surrounds them means they are often visible on an X-ray of the abdomen.

- They lie at the level of T12-L3 and lateral to the psoas muscles. The right kidney is usually slightly lower than the left due to the position of the liver.
The spleen lies in the left upper quadrant (LUQ) immediately superior to the left kidney.
The bladder has variable appearance depending on how full it is. It has the same density as other soft tissue structures, due to its water content.
Normal bones on abdominal X-ray

- The lower ribs, lumbar vertebrae and sacrum are highlighted.

- Bones can be used as landmarks for invisible soft tissue structures.
Calcification and artifacts

- Added densities may be due to artifact or calcified soft tissue
- Calcification of soft tissues is not always clinically significant
- Differentiating pathological from inconsequential calcification is not always straightforward
calcification

- Calcification and artifact
The psoas muscles (red) arise from the transverse processes of the lumbar vertebrae (arrowheads) and combine with the iliacus muscles.

An abdominal X-ray often demonstrates the lateral edge of the psoas muscles as a near straight line.
Psoas muscle

- Psoas muscles on plain abdominal radiograph
THANK YOU