

RAD 420

Plain Abdominal Radiographs

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Plain Abdominal Radiography

- ❑ Plain abdominal radiography is the radiographic investigation of the contents of the abdominal cavity **WITHOUT** a contrast agent.
- ❑ The routine projection is the **supine abdominal film** that includes the diaphragms and the symphysis pubis.
- ❑ Other projections may sometimes be useful for diagnosis such as:
 - Erect abdomen
 - Erect CXR
 - Left Lateral Decubitus
 - Supine decubitus
 - Lateral abdomen

Erect abdominal Radiograph

- ❑ This is taken to look for fluid levels and free gas.
- ❑ However, fluid levels are non-specific and free gas (pneumoperitoneum) is better shown on an erect CXR.
- ❑ An erect film is helpful when obstruction is suspected and a diagnosis cannot be made from the supine film.

Erect CXR

- ❑ An erect CXR should be part of a routine abdominal series because:
 - It shows a small pneumoperitoneum more clearly than an erect abdomen. This is because in an erect abdominal film the divergent rays pass obliquely at the level of the diaphragm, which is projected to the top of the film. This part is also often over exposed. In a chest X-ray the top of the diaphragm is almost tangential to the beam.

➤ **An acute abdomen may be complicated by chest pathology:**

For example:

- ❖ Pleural effusions in acute pancreatitis
- ❖ Aspiration pneumonia following prolonged vomiting
- ❖ Basal inflammatory changes with inflammation below the diaphragm
- ❖ Basal atelectasis in post operative patients and following a pulmonary embolus
- ❖ Heart failure especially in elderly patients

Conversely chest pathology may mimic an acute abdomen:

- ❖ Myocardial infarction
- ❖ Pulmonary embolus
- ❖ Pericarditis
- ❖ Lower lobe pneumonia
- ❖ Pneumothorax
- ❖ Dissecting aortic aneurysm
- ❖ Heart failure

Lower lobe pneumonia mimicking abdominal injury

An erect abdominal film in a 12 year old child. He was admitted with abdominal pain several days after falling off a tree. Splenic rupture was suspected but this X-ray shows bilateral consolidation in the lower lobes. Note that there is a silhouette sign of both heart borders and the left diaphragm. The bilateral lower lobe pneumonia was the cause of the abdominal pain.



Pneumonia mimicking abdominal pathology

A child admitted with acute abdominal pain. This erect abdomen included enough of the lungs to show the cause. There is ill-defined alveolar shadowing adjacent to the left diaphragm. The child had acute pneumonia.



Decubitus views

- ❑ X-rays obtained in decubitus position may be useful instead of an erect film if the patient is unfit to stand.
- ❑ A **left lateral decubitus** view is taken with the patient lying on the left side. The film is placed behind the patient and the tube aimed to the centre of the abdomen.
- ❑ **Left lateral decubitus** shows fluid levels and small amounts of free air will be seen between the liver and the diaphragm.
- ❑ If the patient is unable to turn onto the side, a supine decubitus film may (rarely) be necessary. It will show free air but is less useful.

Lateral abdominal radiograph

- ☐ This is seldom necessary but may occasionally be useful for suspected aortic aneurysm (if ultrasound is not immediately available).
- ☐ An abdominal X-ray is seldom helpful in the diagnosis of chronic abdominal pain. It is of no help in the diagnosis of acute appendicitis or certain other acute conditions such as ruptured ectopic pregnancy.
- ☐ A normal abdominal X-ray does not exclude serious pathology and is often unhelpful. Bearing this in mind abdominal X-ray should be reserved for patients in whom it is likely to be helpful in diagnosis.

Indications

□ Plain abdominal X-ray is indicated in:

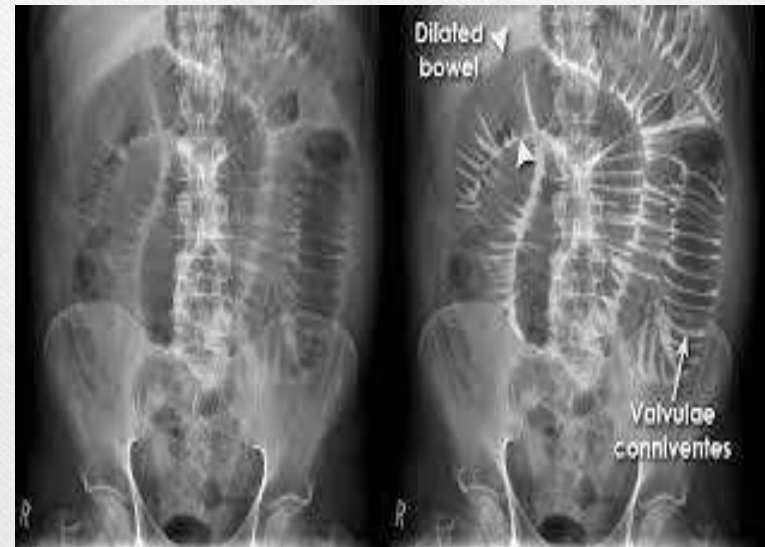
- ❖ Suspected intestinal perforation
- ❖ Suspected intestinal obstruction
- ❖ Renal colic ?calculus
- ❖ Foreign body

□ Plain films are **NOT** indicated for:

- ❖ Non specific abdominal pain
- ❖ Gastro-enteritis
- ❖ Constipation
- ❖ Acute appendicitis
- ❖ Urinary retention
- ❖ Pancreatitis
- ❖ Acute urinary tract infection
- ❖ Diarrhoea
- ❖ Acute peptic ulceration
- ❖ Haematemesis/melaena
- ❖ Biliary disease

Normal Features of a Plain Abdominal Radiograph – Small Bowel

- ❑ The small bowel lies centrally. There should be no more than 3 short fluid levels on an erect film.
- ❑ There should only be small amounts of gas in the small bowel. After being swallowed air reaches the colon within 30 minutes.
- ❑ The jejunum is recognised by **valvulae conniventes** - folds which traverse the full width of the bowel.
- ❑ The distal ileum is smoother in appearance.



Normal Features of a Plain Abdominal Radiograph – Large Bowel

- ❑ The large bowel lies peripherally.
- ❑ There may be longer fluid levels and the maximum diameter is variable.
- ❑ The large bowel often contains faeces & has a speckled appearance due to gas trapped in the faeces.
- ❑ The haustra may be outlined by gas. It is quite common to see gas outlining much of the large bowel normally.
- ❑ The haustra can be recognised by the fact that they do not cross the full width of the bowel & they are not regular.



Normal Features of a Plain Abdominal Radiograph – Urinary Bladder

- ❑ The bladder may be seen as a soft tissue density arising from the pelvic floor.



Normal Features of a Plain Abdominal Radiograph – The stomach

- The stomach is normally outlined with air below the left hemidiaphragm.



Normal Features of a Plain Abdominal Radiograph – Liver

- The liver is seen as a soft tissue density under the right hemidiaphragm



Normal Features of a Plain Abdominal Radiograph – Non significant calcifications

- ☐ **Phleboliths** in the pelvis – these may mimic lower ureteric stones but are more rounded in appearance. Often multiple.
- ☐ **Mesenteric nodes**. These are often confused with renal or ureteric calculi but they are mobile and move with posture.
- ☐ **Costal cartilages**. These may cast confusing shadows in the upper abdomen and may be confused with renal calculi. They can easily be distinguished by taking an oblique film.
- ☐ **Prostate**. Calcification is often seen in the prostate and is a normal finding. It should not be confused with a bladder calculus. It lies below the bladder, centrally.
- ☐ **Seminal Vesicles**. These occasionally calcify. They are serpiginous in appearance, lying behind the bladder.
- ☐ Calcification is commoner in diabetic patients

Normal Features of a Plain Abdominal Radiograph – Fat Lines

- ❑ Fat lines. It is only because of the fat surrounding the internal solid organs that they are visible.
- ❑ The renal outlines can usually be seen, as can the psoas shadows.
- ❑ A fat line lying adjacent to the parietal layer of peritoneum in the flanks can sometimes be seen. This is called the properitoneal fat line



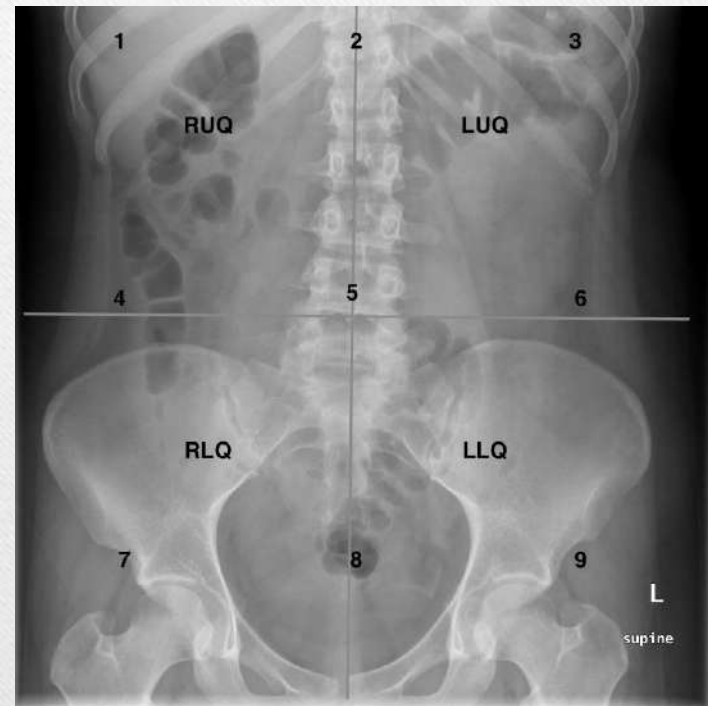
Quadrants and Regions of the Abdomen

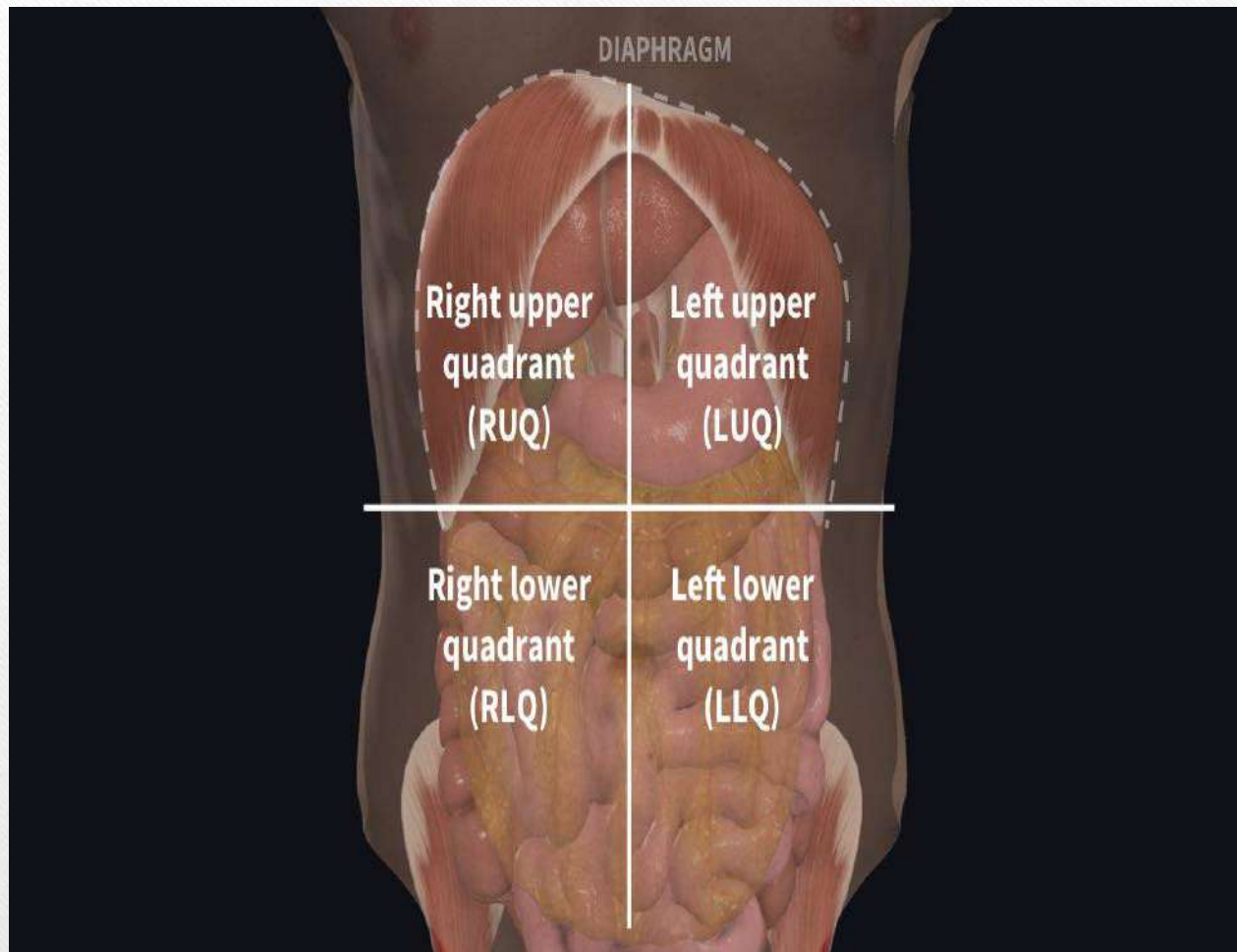
❑ **Quadrants (4)**

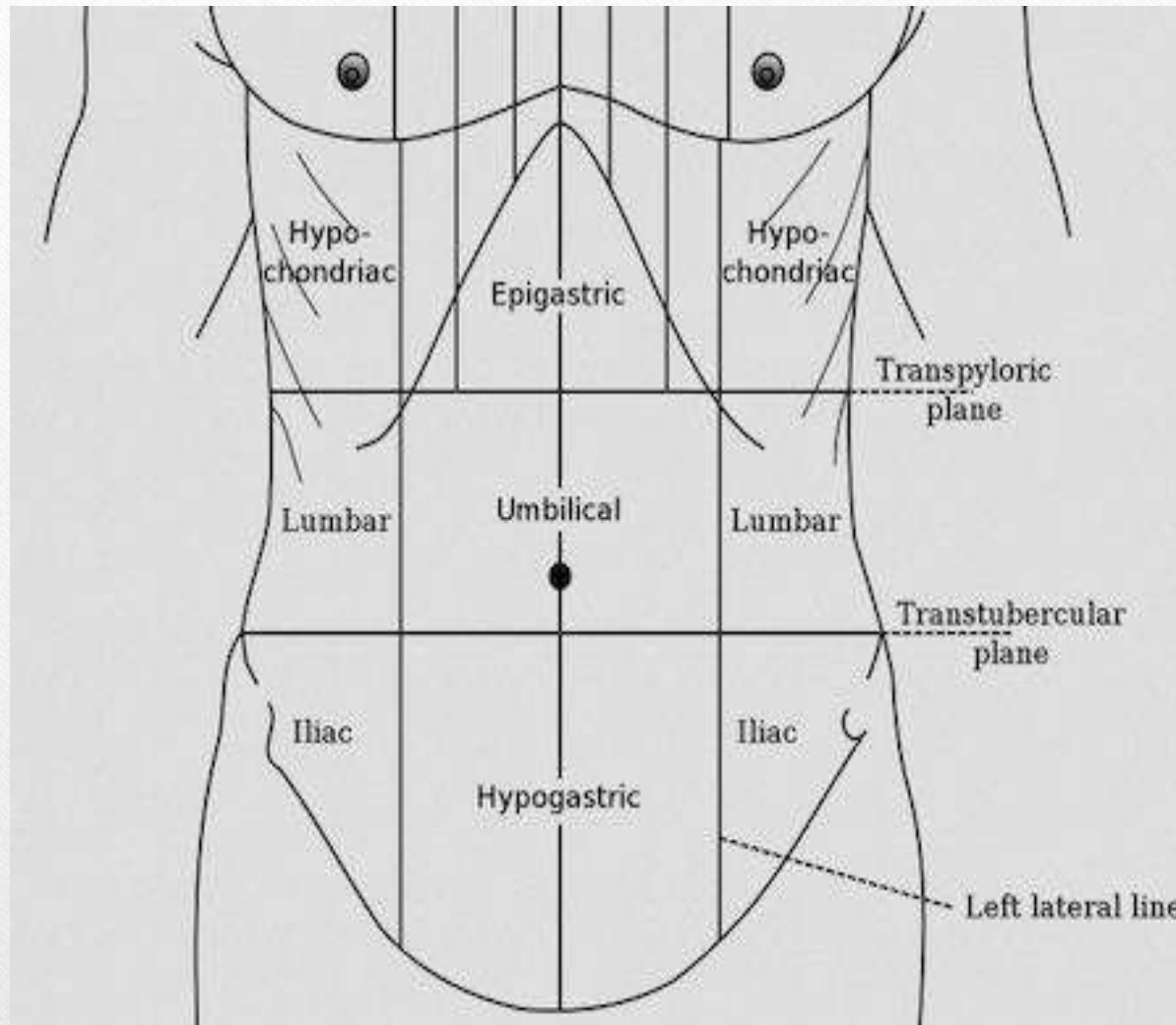
- ❖ **RUQ**
- ❖ **LUQ**
- ❖ **RLQ**
- ❖ **LLQ**

❑ **Regions (9)**

- ❖ **Right hypochondrium (1)**
- ❖ **Epigastrium (2)**
- ❖ **Left hypochondrium (3)**
- ❖ **Right lumbar (4)**
- ❖ **Umbilical (5)**
- ❖ **Left lumbar (6)**
- ❖ **Right iliac (7)**
- ❖ **Suprapubic ((8)**
- ❖ **Left Iliac (9)**





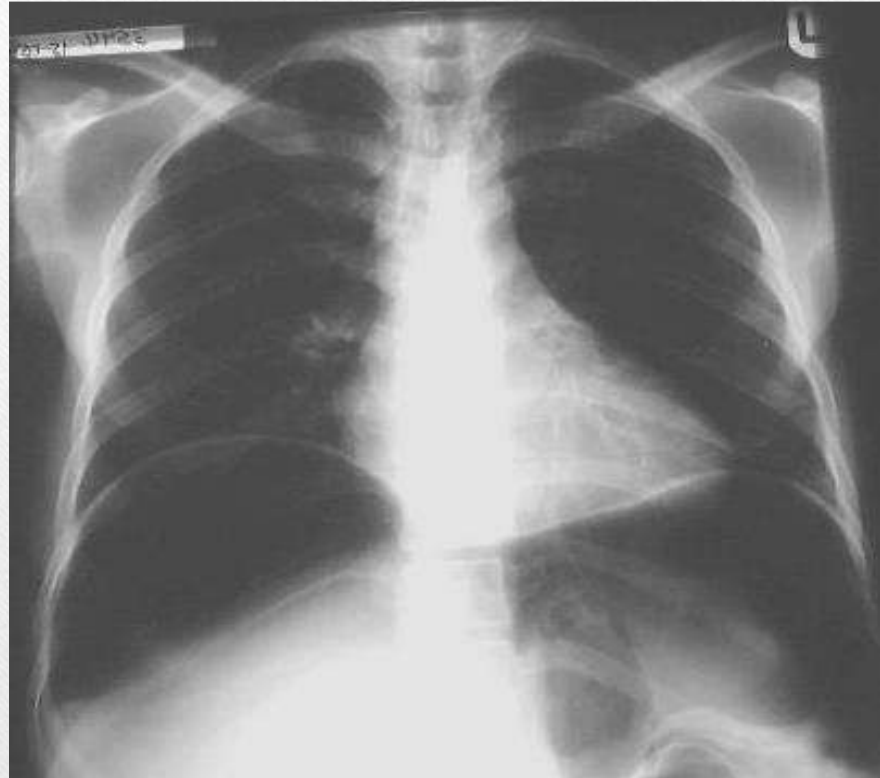


Pneumoperitoneum

- ❑ This is free air within the peritoneal cavity is seen in bowel perforation and post operatively. Air rises to the highest part of the diaphragm on an erect film
- ❑ The stomach is distinguished from free air by the fact that it usually has a fluid level. It should not be mistaken for a pneumoperitoneum, which does not usually show a fluid level unless there is secondary infection (abscess).
- ❑ A pneumoperitoneum is seldom symmetrical and may be unilateral but usually there is a small one visible on the other side.
- ❑ When there is doubt on the erect film or if a perforation is strongly suspected and the film appears normal, a left lateral decubitus film is helpful. Small amounts of free air will rise to lie between the liver and the diaphragm and are more readily seen. It is important to wait for a few minutes after positioning the patient to allow any free air enough time to rise to the highest point.
- ❑ The commonest cause of intestinal perforation in Nigeria is typhoid fever.
- ❑ In the Western world, it is more likely to be either a peptic ulcer or diverticular disease.

Pneumoperitoneum

- ❑ A very large amount of free air within the peritoneal cavity lying beneath both diaphragms.
- ❑ The liver & spleen are pushed downwards and the diaphragms upwards.
- ❑ This patient had a typhoid perforation



Pneumoperitoneum

- ❑ A much smaller pneumoperitoneum is present in this patient. It is larger on the left side, following the curve of the diaphragm & without a fluid level. It is not the stomach.
- ❑ There is just a very small amount of free air visible beneath the highest point of the right diaphragm. Small amounts of free air show best on films centred to the diaphragms and show better on erect chest X-ray than erect abdominal film.
- ❑ A pneumoperitoneum may be suspected on a supine film if gas is seen in areas where the bowel does not normally lie such as overlying the liver. Also, the outer wall of the bowel may be visible in addition to the inner wall. The double wall sign. Normally the outer bowel wall is not seen as it lies against other soft tissues of similar density.



Excessive intestinal gas

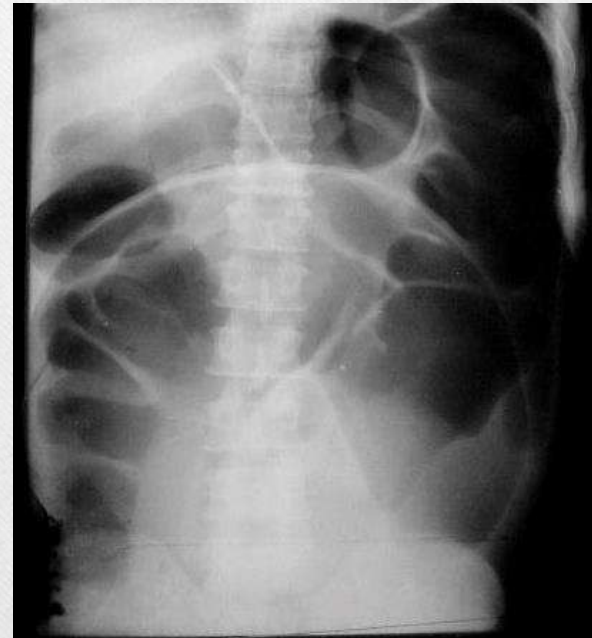
- ❑ This may be physiological - children have more gas in the bowel than adults as a result of air swallowing (aerophagia).
- ❑ Patients with dyspnoea and severe pain swallow more air and if marked the bowel may be full of gas, a condition known as “**meteorism**” which is most commonly seen in renal colic.
- ❑ Bowel gas pattern should be evaluated with particular reference to dilatation. Excessive gas and dilatation occur in **ileus** and **obstruction**.
- ❑ The small bowel is considered to be dilated if the width exceeds 3 cm. The diameter of the colon is more variable but a width of 5.5 cm is definitely abnormal.

Intestinal obstruction

SMALL INTESTINE



LARGE INTESTINE



Differentiation between large and small bowel obstruction: Things to look for

1. Valvulae conniventes are seen in the jejunum.
2. Number of loops; small bowel obstruction usually shows many distended loops, large bowel obstruction few.
3. Distribution; small bowel lies central, large bowel peripheral
4. Haustra : folds which are asymmetrical and not traversing the full width of the bowel indicate large bowel
5. Diameter: large bowel has a greater width. In general if 3 – 5 cm in diameter, it is small bowel. Over 5 cm, it is large bowel.
6. Radius of curvature. Small bowel has a smaller radius of curvature.
7. Solid faeces are seen only in large bowel.

Fluid Levels

- ❑ Fluid levels are seen when there is excess fluid and gas within the bowel. This occurs in **mechanical obstruction** and **paralytic ileus** when the bowel has ceased to function but is not mechanically obstructed.
- ❑ A common cause of obstruction is sigmoid volvulus. It is not always easy to distinguish obstruction from ileus and to distinguish large bowel from small bowel obstruction.
- ❑ Ileus may be generalised or localised.

Causes of ileus

- ☐ Post operative
- ☐ Peritonitis
- ☐ Inflammation of:
 - Pancreas
 - Gallbladder
 - Appendix
 - Fallopian tubes
 - Bowel (gastro-enteritis)
- ☐ Trauma
- ☐ Renal colic
- ☐ Ruptured aortic aneurysm
- ☐ Low serum potassium
- ☐ Drugs e.g. morphia
- ☐ General debility
- ☐ Vascular occlusion
- ☐ Uraemia
- ☐ Meningitis, malaria, any acute severe infection

Differentiating ileus from mechanical obstruction

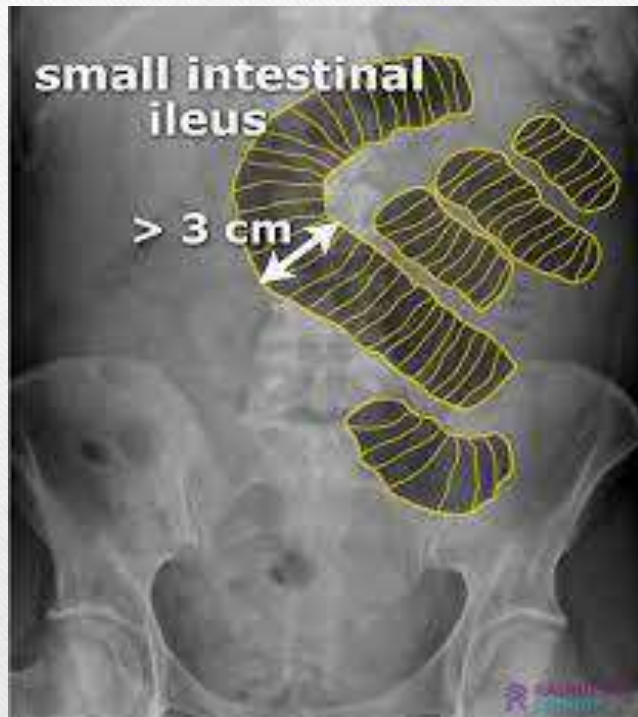
ILEUS

- ☐ Both large and small bowel are dilated.
- ☐ There is more gas than fluid with few fluid levels.
- ☐ Decreased bowel sounds on clinical examination.

MECHANICAL OBSTRUCTION

- ☐ Proximal bowel is dilated with collapsed distal bowel beyond the obstruction.
- ☐ More fluid levels and bowel diameter greater.
- ☐ Increased bowel sounds on clinical examination.

Ileus



End

**Thank you for
listening**