



Radiology
Team 438

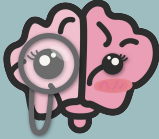
Radiological Anatomy and investigation of the GIT

Lecture 10

Objectives

- ❖ To know various radiological investigations used for GIT.
- ❖ To understand step wise approach in requesting GIT radiology investigations.
- ❖ To be familiar with radiological appearance (anatomy) seen in various imaging modalities.
- ❖ To interpret plain x-ray radiograph of abdomen with common pathologies.

Reviewed By



Noura Alturki
Jehad Alorainy

Color Index:

♦ Important ♦ Doctor's Notes ♦ Extra ♦ Female slides ♦ male slides

Team Leaders



Omar Aldosari



Leena Alnassar



Shahd Alsalamh

Done by:

Abdullah bin Muammar

Notes:

Taif Alotaibi

Introduction

» What is peculiar about GIT? (GIT characteristics):

1- Hollow viscus (Not solid). 2-Usually filled with gas. 3-Motility.

» Radiological Modalities :

Plain X-Ray

Fluoroscopy

Ultrasound

CT

MRI

Nuclear medicine

Angiography

» X-ray (Plain radiography)

- 1- Often used as first imaging modality.
- 2- Cheap
- 3- Fast.
- 4- Can be done bedside (portable).
- 5- Useful for free gas and bowel obstruction.

Common Abdomen Films:

- ❖ AP Supine (KUB)
- ❖ AP Erect
- ❖ Left lateral Decubitus, to see the gas floating and assess if there is any free gas in the abdomen.



» 5 basic densities on x-rays:

Metal

Bone/
calcification

Soft tissue/
Fluid

Fat

Gas

Intensive
white

White

Light
Gray

Dark
Gray

Black

» Fluoroscopy (contrast study)

- 1-Can be used as first imaging modality.
- 2-Cheap.
- 3-Use of contrast .
- 4-Recently replaced by CT & MRI.
- 5-Useful for intraluminal pathology. such as mass in the lumen or mucosal details
- 6-Can give clue about motility (function).



» Ultrasound

- 1- Relatively cheap.
- 2- No radiation.
- 3- Limited use in gas filled structures .such as stomach, small or large bowels. But if there is any mural mass we can detect it by US. so gas prevent us from seeing the whole anatomy.
- 4- Used in pediatrics and pregnant ladies.

Ultrasound studies have a limited role in GIT examinations because of Gas filled bowel

Indications for US is :

- Acute Abdomen
- Appendicitis
- Pyloric stenosis

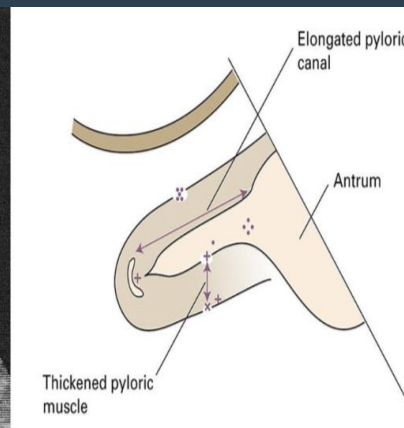


Fig. 6.29 Pyloric stenosis. Ultrasound scan in a neonate showing a thickened, elongated pyloric canal.

Pyloric stenosis. Ultrasound scan in a neonate showing a thickened, elongated pyloric canal. In babies, 4 weeks old, males with swelling in epigastric area and projectile vomiting.



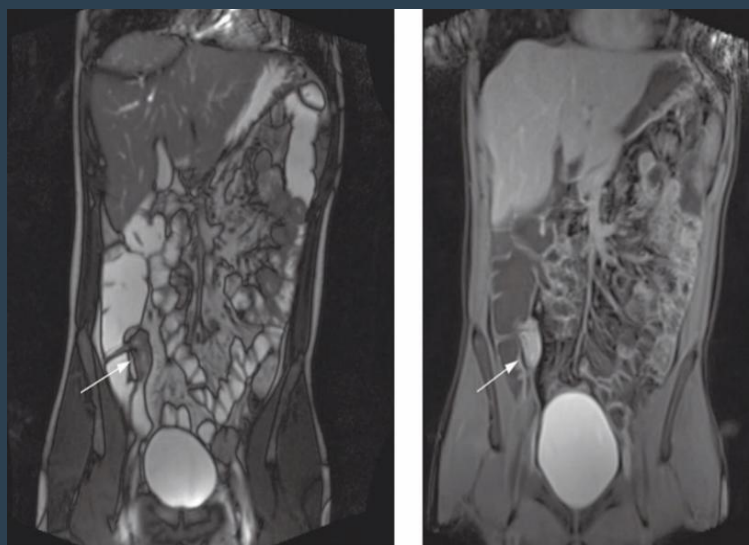
» CT

- 1- Expensive.
- 2- More radiation.
- 3- Fast.
- 4- Contrast (IV to assess all vascular structures, Oral to assess esophagus, stomach, duodenum, small and large bowels, rectal assess the rectum and whole colon) usually used.
- 5- Used in emergency department.



» MRI

- 1- More expensive than CT.
 - 2- No radiation.
 - 3- Slow and affected by artifacts. either respiratory or motion artifacts
 - 4- Excellent for soft tissue.
 - 5- Can't be reformatted.
- Unlike the CT.
We very rarely use it for emergencies.

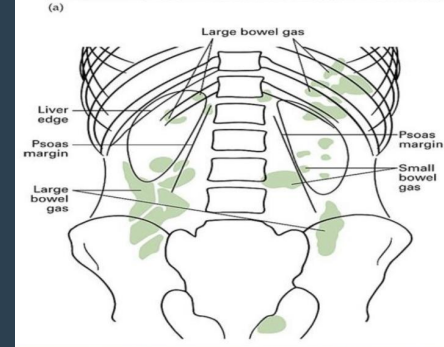
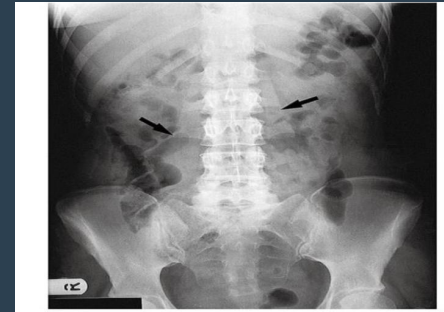


Abdominal X-ray

- 1- Stomach
- 2- Transverse Colon
- 3- Small bowel
- 4- Cecum
- 5- Descending colon

indication:

- bowel perforation
- bowel obstruction
- renal injury
- foreign body
- stones



Diaphragm

How to assess diaphragm?

If there is any raising or flattening of the diaphragmatic cupola, costophrenic angle is it blunted, see if there is any free gas under diaphragm



X-ray erect abdomen reveals **crescentic gas** under diaphragm in keeping with a **visceral perforation**



Lateral decubitus view shows free air between liver, right hemidiaphragm and lateral abdominal wall

Liver

How to assess liver?

If it is enlarged or small, how does it displace adjacent structures, if there any calcification within the parenchyma, or any gas projecting over the parenchyma



X-ray abdomen shows enlarged liver displacing the ascending and transverse colon downward and to the **left side**

Radiological Appearance of the GIT

Spleen

How to assess spleen?

If it is enlarged or small, location usually located in the left upper abdomen, if there is any calcification



X-ray abdomen shows enlarged spleen displacing the adjacent structures

Kidneys

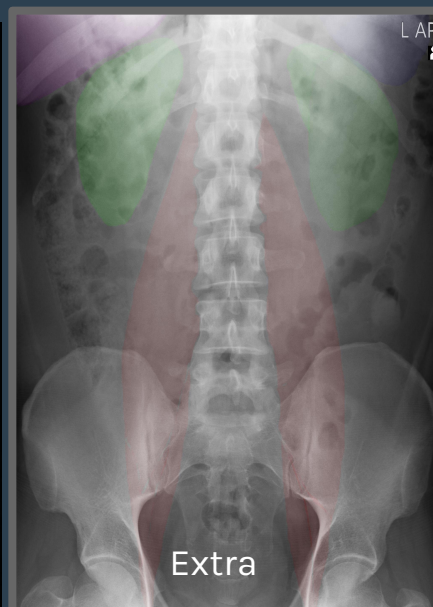
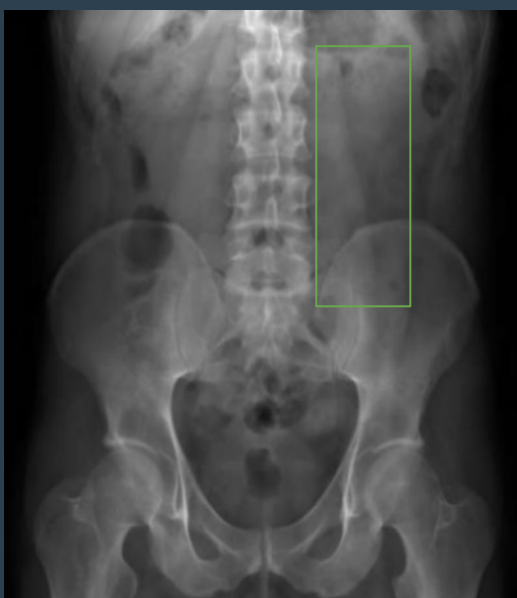
How to assess kidney?

Located between T12 and upper margin of L3, seen parallel to the psoas shadow, any calcification (stones) You can see the outline bc the kidney's outline is covered by the perinephric fat



- X-ray abdomen shows ovale white density to of spine: **stone in left ureter**
- * **right side renal shadow**

Psoas muscle



X-ray abdomen often shows lateral edges of psoas muscles as a near straight line
* left side psoas shadow (straight line)
If cant see the shadow that suggest a mass obscuring the area (usually within the retroperitoneal structures)

Radiological Appearance of the GIT

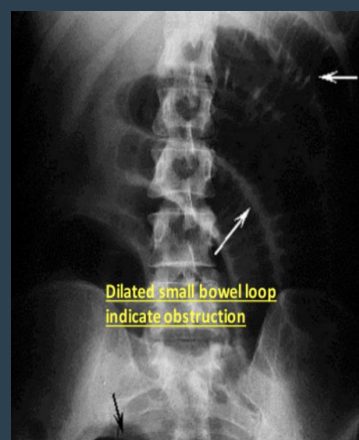
Bowel gas pattern

- ❖ Where are the bowel loops located (central vs. peripheral?)
- ❖ What is the distribution of the gas in the abdomen?
- ❖ What is the caliber of small and large bowel ?
- ❖ Are any dilatation of small +/- large bowel ?
- ❖ Identify any air-fluid levels ?

How to differentiate small from large?

Small: located in the **center** and have **valvulae conniventes**

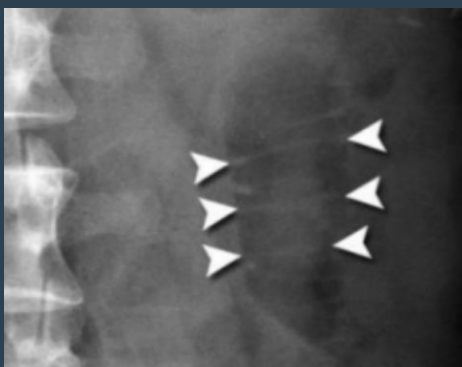
Large: located **peripherally** and contain **haustra**



Valvulae Conniventes
Small Bowel

Haustra
Large Bowel

Erect film showing
multiple air filled level
indicate obstruction



Small bowel
lobe



Small bowel lobe central
location



Large bowel contain
haustra

Usually become visible when the small bowel is more distended (filled with gas)

» Barium Study

Barium Swallow

Barium Meal

Barium Follow through

Barium Enema

» Esophageal Barium Swallow

1- It is a medical imaging procedure used to examine upper GIT, which include the **esophagus** and to a lesser extent the stomach

2- The contrast used is **barium sulfate** **single contrast** to assess anatomy or obstruction or **double contrast** to assess mucosal details



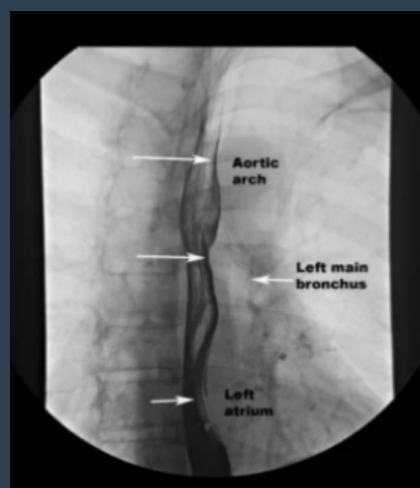
Esophagus starts at lower border of cricoid cartilage



Courses through posterior mediastinum



Ends at GI junction (gastroesophageal)



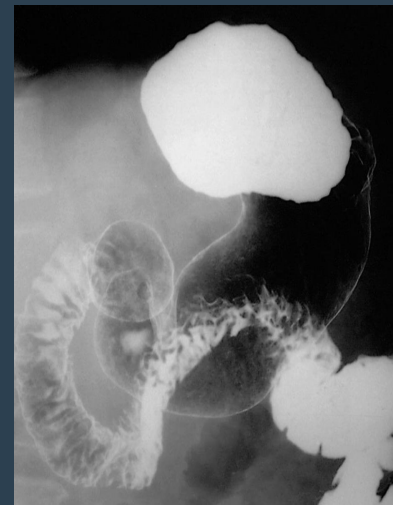
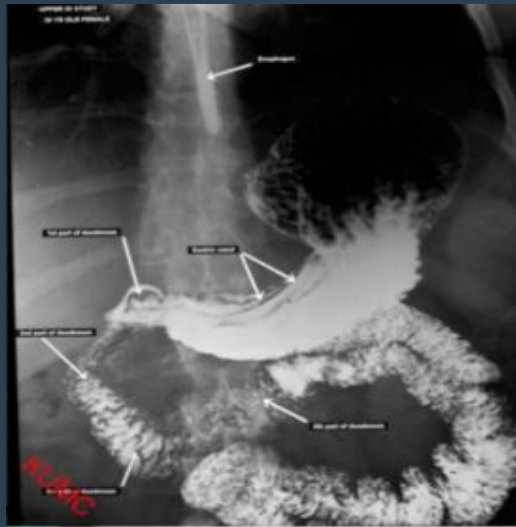
Normal impression in the Esophagus

Aortic arch, left main bronchus, left atrium

narrowings are most likely due to normal peristalsis, unless it was persistent

» Barium Meal

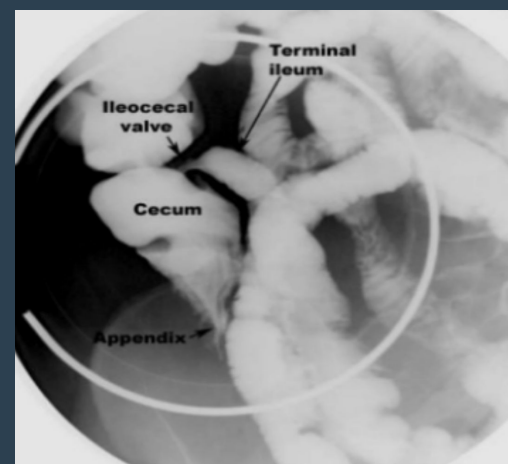
- ❖ In a barium meal test, X-ray images are taken of the **stomach** and the beginning of the **duodenum**.
- ❖ Usually it is assessed by **double contrast**
- ❖ Assess if there is any mucosal abnormality or any mass, assess the duodenum cap if there is any ulceration and the length



» Barium follow through

1

- In a barium meal test, X-ray images are taken for the **small bowel loops**.
- **Pic1:** Small bowel follow through
- **Pic2:** Small bowel enema



» Barium Enema

SINGLE CONTRAST STUDY:

- ❖ The colon is filled with barium which outlines the intestine and showing gross abnormalities.

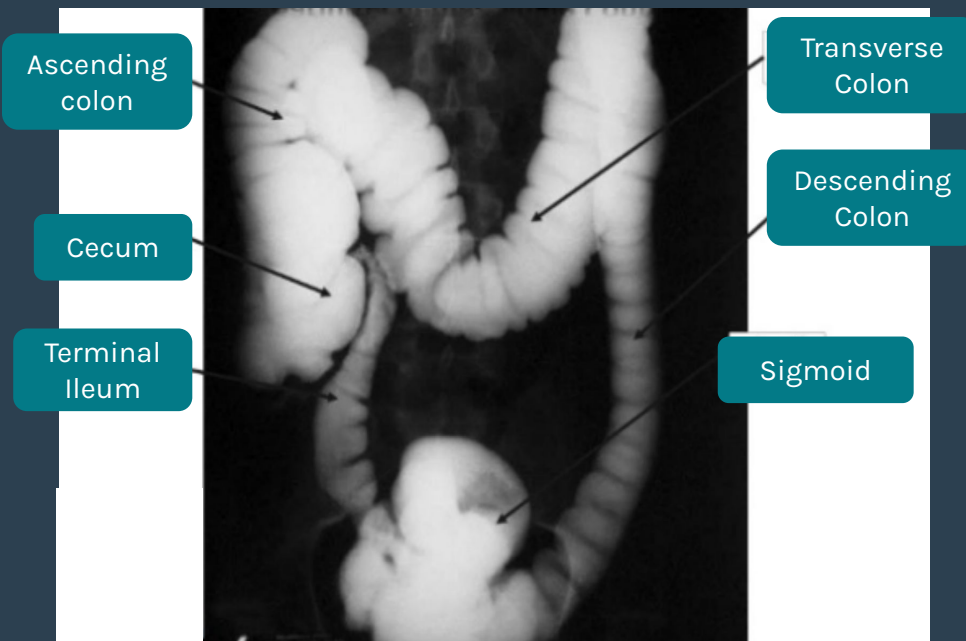
Example any obstruction or mass

DOUBLE CONTRAST with AIR

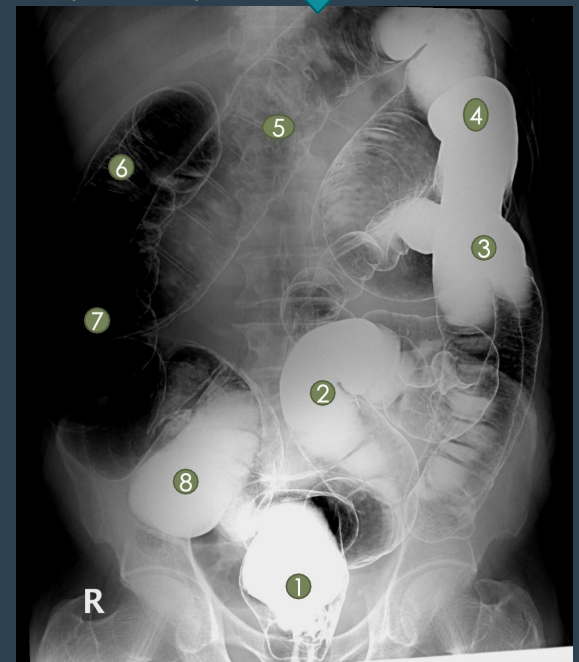
- 1) The colon is first filled with barium
- 2) Then the barium is drained out leaving only a thin layer of barium on the wall of colon
- 3) The colon is then filled with air

- 1- Rectum
- 2- Sigmoid Colon
- 3- Descending Colon
- 4- Splenic Flexure
- 5- Transverse Colon
- 6- Hepatic Flexure
- 7- Ascending Colon
- 8- Cecum

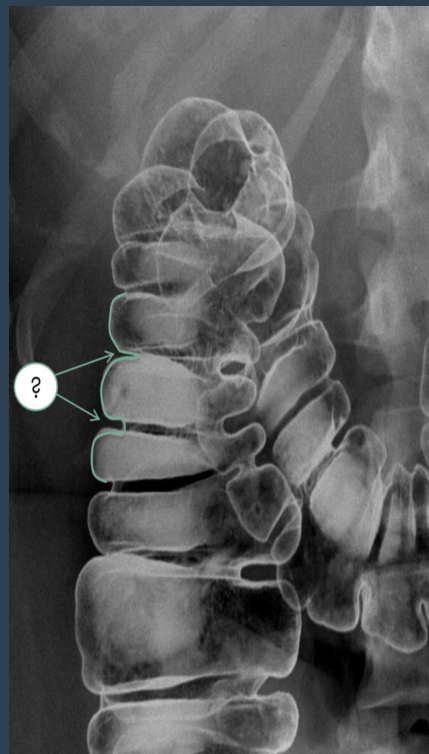
(single)



(double)



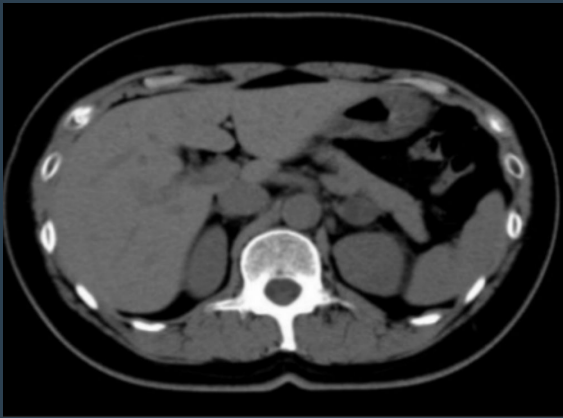
The light green line is the Haustra. This is a double contrast of the large bowel: Haustra can be missing or diminished in the left side of the colon normally. But in right and transverse it MUST be present. Absent haustra in right or transverse is pathological.



Radiological Appearance of the GIT

» CT scan

- ❖ CT provides cross-sectional images of the abdominal organs. Multiple images are taken → Digitized in the computer → Reconstructed → viewed on a monitor.



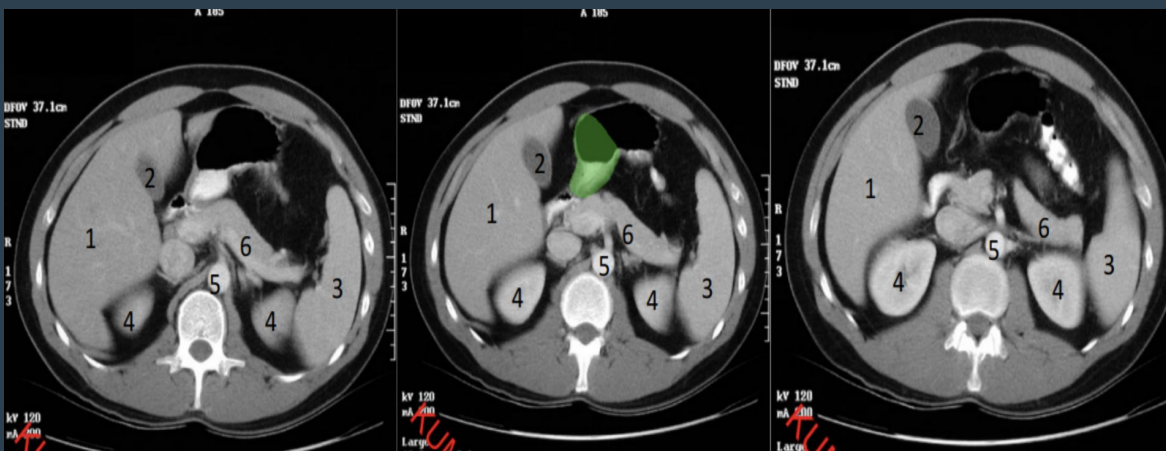
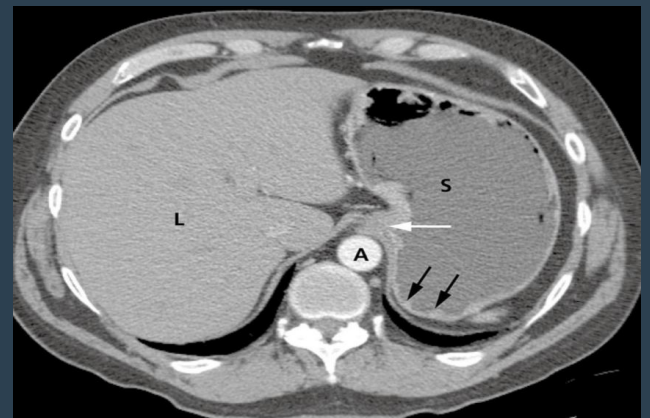
CT without contrast



CT With contrast

L = liver
S= stomach
A= aorta

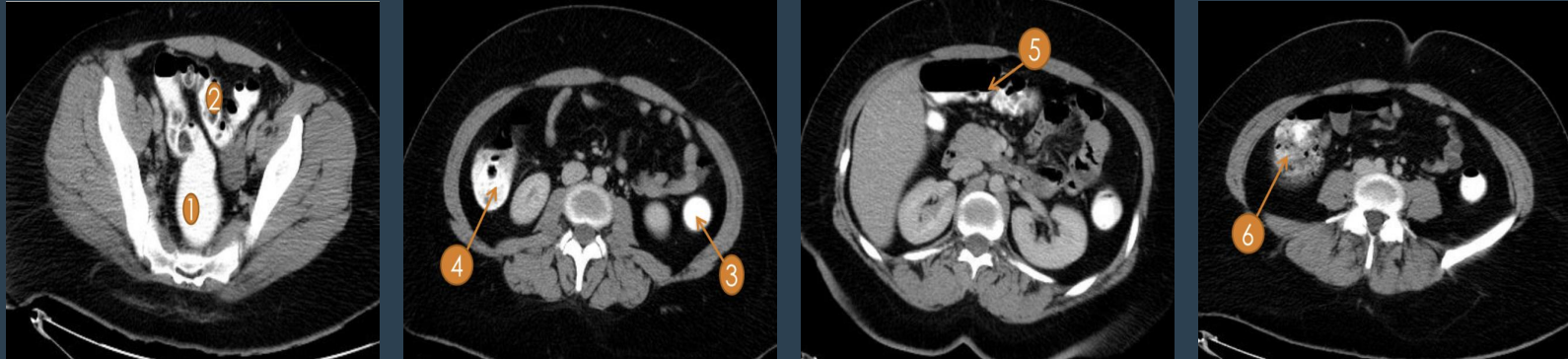
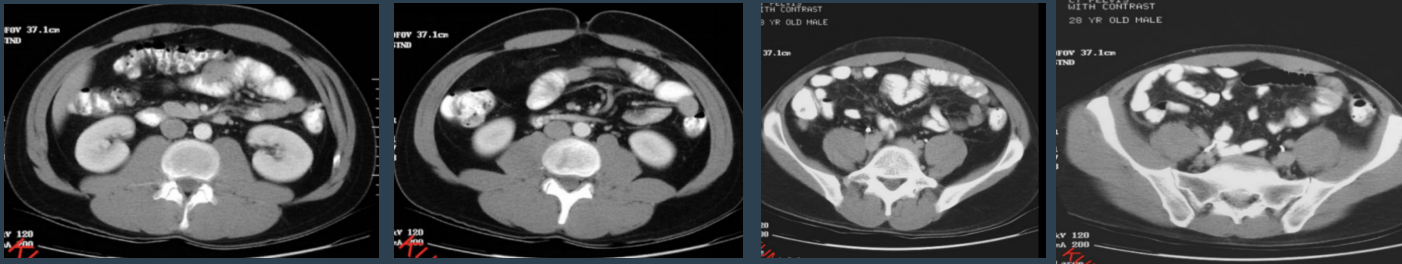
* Assess gastroesophageal area, gastric lumen, gastric wall, abdominal aorta, and liver parenchyma



1- liver 2-Gall bladder 3-spleen 4- kidney 5- Aorta 6- pancreas

Radiological Appearance of the GIT

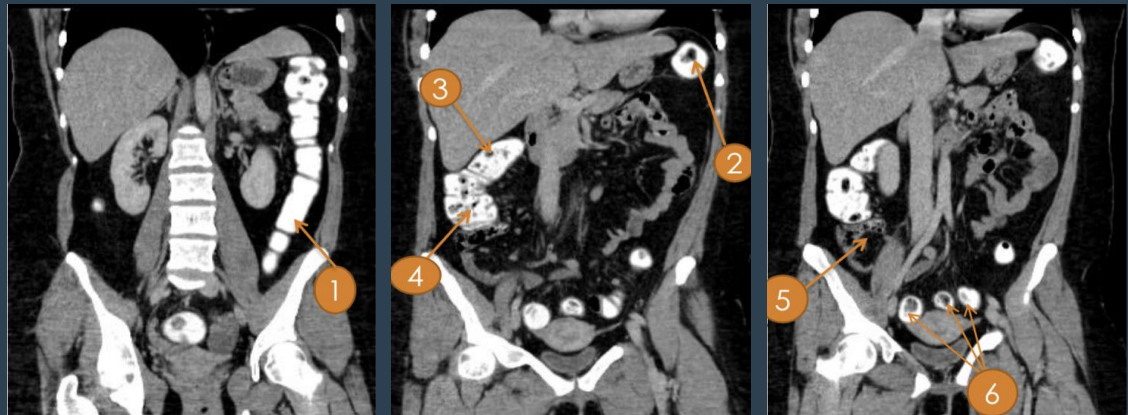
Normal bowel:



1-Rectum 2-Sigmoid colon 3-Descending colon
4-Ascending colon 5-Transverse colon 6-Cecum

➤ Coronal CT scan (reconstructed)

1. Descending colon
2. Splenic flexure
3. Hepatic flexure
4. Ascending colon
5. Cecum
6. Sigmoid colon

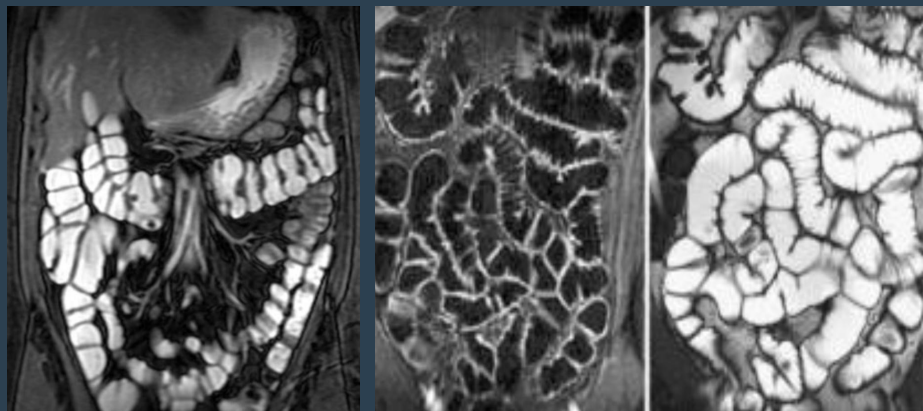


➤ MRI Study

- ❖ MRI is useful in evaluating abdominal soft tissues.
- ❖ MRI is a type of non-invasive test that uses magnets and radio waves to create images of the inside of the body.



MRI Enterography
Used mainly to diagnose IBD (inflammatory bowel disease)
* Assess soft tissue, bowel wall, mucosa, the activity of the disease for example crohn's disease



Radiological Appearance of the GIT

Common plain X-ray abdomen radiograph finding

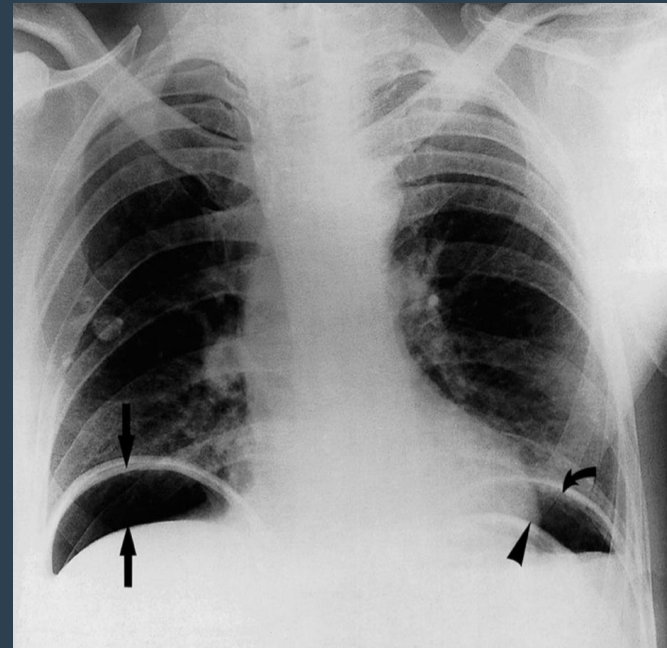
ABNORMAL AIR COLLECTION WITHIN ABDOMEN

Case 1

Crescentic gas shape seen under the right hemidiaphragm as well as the left hemidiaphragm (free gas)

What are the findings?

- 1- Black arrows pointing to the air bubbles.
- 2- If the air bubble was at the site of stomach, it would be normal bubble (left side).
- 3- While if it was on the right side, it indicates the perforation due to peptic ulcer.
- 4- We can see normal air fluid level in the stomach and cecum



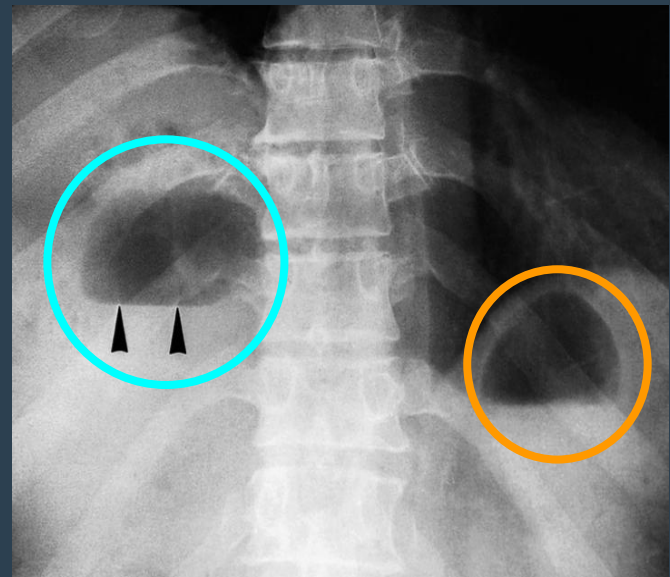
Case 2

Free AIR = Pneumoperitoneum

Blue circle: Air fluid level (cavity filled with gas)

Orange circle: Gas filling structure usually gas within the gastric fundus area (so it appear as air fluid level but in normal location)

**Loculated AIR = Abscess!
(Air-fluid level)**



What is the difference between the 2 cases?

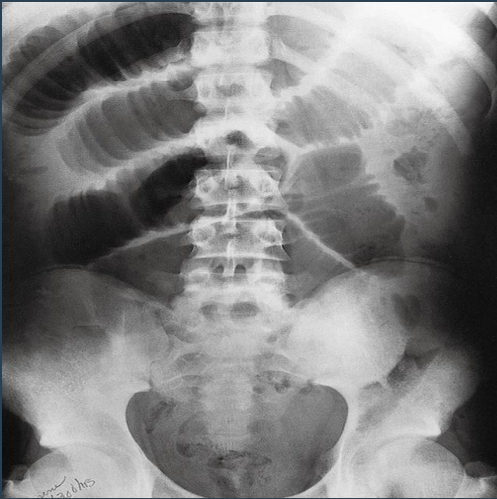
- 1- first case: free gas
- 2- second case: loculated gas in abnormal location (projecting over the liver parenchyma) so can be abscess cavity (air+fluid)

Small bowel

DILATED SMALL BOWEL LOOPS = SMALL BOWEL OBSTRUCTION

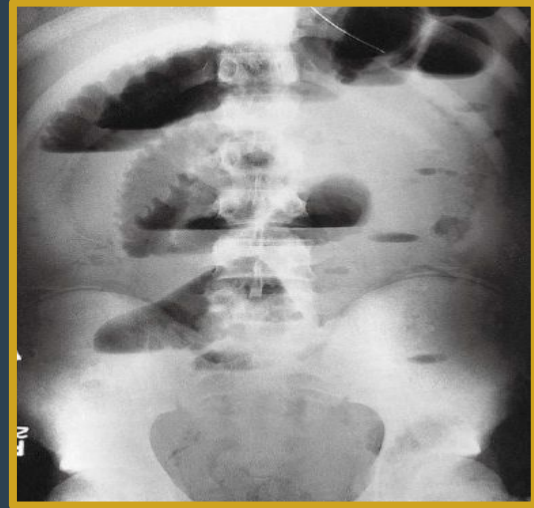
Case 3

Supine position



Dilated small bowel loops in the center with prominent mucosal folds

Erect position



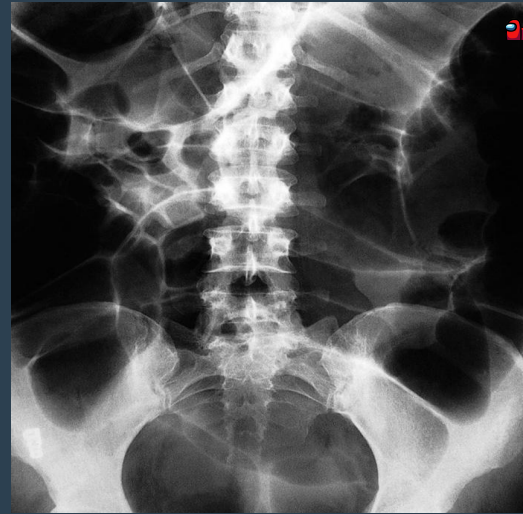
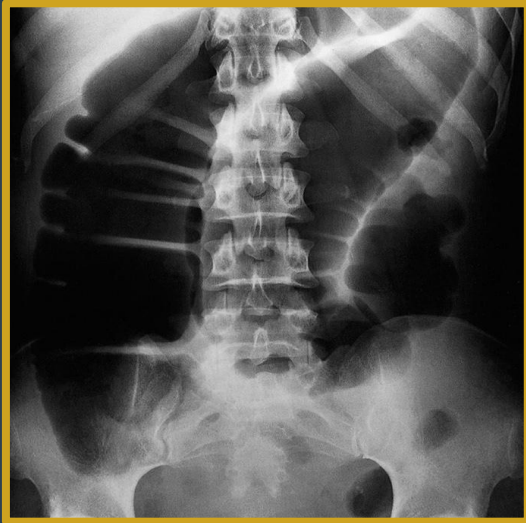
Multiple air fluid levels at multiple location,
Suggestion: obstructed small bowel obstruction (colon is collapsed)

Spine position: you can see the distribution of the bowels
Erect view: you can see the air fluid level

» Large bowel

DILATED LARGE BOWEL LOOPS = LB OBSTRUCTION

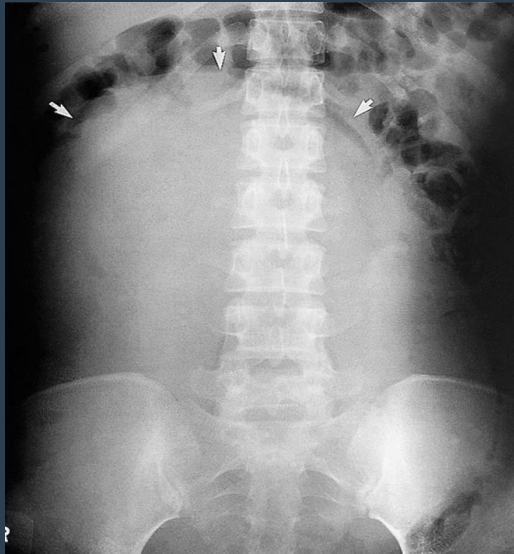
Case 4



dilated large bowel located peripherally (you can see haustra which does not cross the whole length of the bowel)
Collapsed Sigmoid and rectum so we can say it's an obstruction at a distal level either sigmoid or rectal level

DISPLACED BOWEL LOOPS = SOFT TISSUE MASS LESION

Case 5

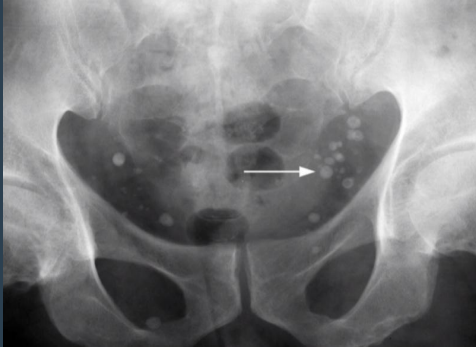


* With x-ray we can't tell if it is fluid or soft tissue
Soft tissue lesion (bc it is gray in color) it can be cystic or solid, projecting from the pelvis to the abdomen
So it is a large pelvic-abdominal mass causing displacement of the adjacent bowel

Will be evaluated properly using another modalities such as CT or US

Examples of calcified lesions in the abdomen

Case 6



(phlebolithes)

rounded calc with lucent center in both side of the pelvis
Usually it is vascular calcification called phlebolithes



(uterine fibroid)

large well defined calcification in addition to the plebolithes in the pelvis.



(Chronic pancreatitis)

viscus calcification seen along the normal anatomy of the pancreatic parenchyma.
So chronic pancreatitis + chronic calcification

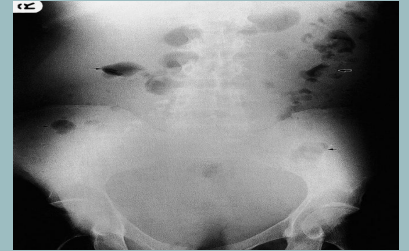
(Mesenteric Mass which get calcified)

calcified lesion located peripherally in the center of the abdomen, it obscured the psoas shadow
Will be evaluated properly by CT or US



1- 44 years old male presented with distended abdomen since 3 months , fatigue , leg swelling and yellowish eye discoloration, what is the most likely diagnosis ?

- a. Ascites
- b. Bowel obstruction
- c. Abdominal calcification
- d. Paralytic ileus



2- What is the finding in this CT scan?

- a. Small bowel obstruction
- b. Large Bowel obstruction
- c. Bowel perforation
- d. Appendicitis



3- A 79-year old male came to the ER complaining of abdominal pain and severe constipation. What's the diagnosis based on the x-ray below?

- a. Small bowel obstruction
- b. Large Bowel obstruction
- c. Bowel perforation
- d. Appendicitis



4- Which of the following modalities is used to assess the esophagus motility, transit time, and any obstruction or strictures?

- a. Barium swallow
- b. Barium enema
- c. Barium follow through
- d. Barium meal

5- :Which of the following represent the radiological study?

- a. Barium follow through
- b. Barium meal
- c. Small bowel enema
- d. Large bowel enema



Answers
1) A
2) A
3) B
4) A
5) A