Radiology
Team 438

Radiological of GI system diseases

Lecture 11

Objectives

- To know the common GIT pathologies presentation.
- To understand step wise approach in requesting GIT
- radiology investigations.
- To know common radiologic pathologies in GIT.

Color Index: -Main text -Males slides -Female slides -Dr's notes -Important -Golden note -Extra

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Esophagus

Clinical Signs and symptoms

- Dysphagia
- Odynophagia (pain oropharynx).
- Regurgitations or obstruction (chest pain) , it is complicated sometimes with esophagitis or esophageal ulcer Note38
- Vomiting.
- Age is also important (some diseases are common in specific age, a young patient will most likely have achalasia, but old one most likely have cancer).
- Constitutional symptoms (Fever, Night Sweat " signs of infection", Weight Loss " malignancy ").

Age and constitutional symptoms are important for diagnosis,
for example: 75 y/o => think about malignancy , 15 y/o => think about achalasia

- Recurrent chest infection (TOF). Some patients present with tracheoesophageal fistula and they are susceptible to recurrent infections, also during reflux some food regurge into the pulmonary system (particularly pediatric age group) **Note38**

Imaging Modalities

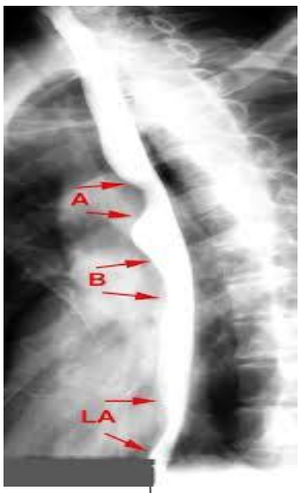
• X-ray.limited role
(Helps in esophageal perforation secondary to trauma or foreign body. Also in cases of distal esophageal obstruction e.g. achalasia, or esophageal tumor in lower esophagu, the esophagus proximally become dilated, showing air-fluid level or fluid-fluid level → significant widening of the mediastinum.) **Note38**
• Fluoroscopy (contrast-dynamic study - barium swallow) play a role "1st choice" (Barium swallow = shows us the lumen and mucosal lining) we do not use it if we suspect perforation.
• Ultrasound limited role(we use the endoscopic US. Helps to see the extent of the disease (locally staging of the tumor).)Note38
• CT plays a role (helps in diagnosis, staging, and metastasis. but it's not the study of choice.)
• MRI plays a role (helps in characterization of the lesion (limited role).)
• Nuclear Medicine > Of limited use.
• Angiography > of limited use.

*The most important thing in this lecture is to differentiate benign from malignant conditions Note38

The doctor comments' here just if it is play a role in the diagnosis or not, the extra are from 38 notes

Esophagus (Barium swallow)

Normal study in 38 slides

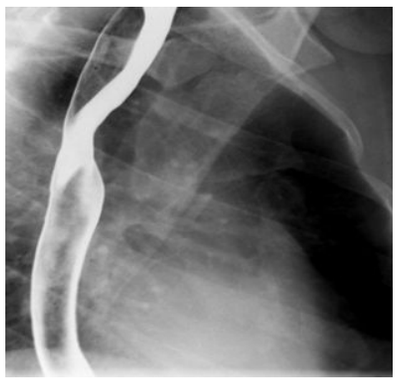


extra picture
-Aortic arch
-Left main bronchus
-Left atrium

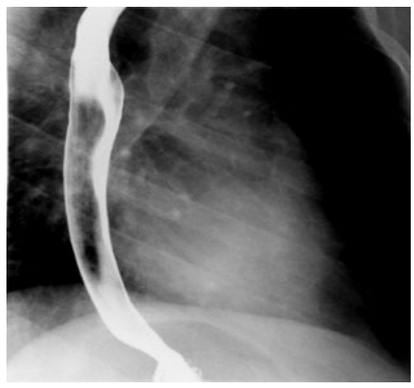
Normal Study-Double contrast

Double contrast (helps in mucosal details)
- upper esophagus

single contrast
(helps in gross pathology and anatomy)
- upper esophagus



Mid esophagus



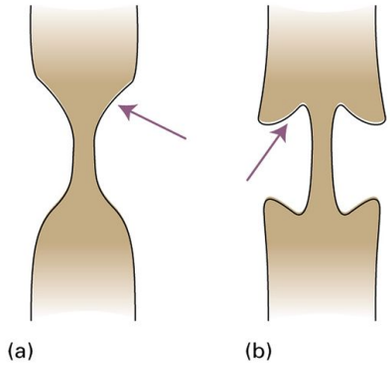
Lower esophagus
- Yellow: gastroesophageal junction

Dysphagia, Esophageal stricture (Barium swallow)

Benign stricture
- corrosive esophageal stricture
- peptic esophagitis stricture
- Achalasia

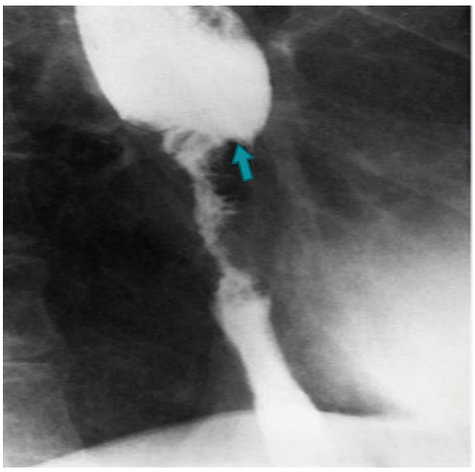
malignant stricture
- esophageal carcinoma stricture

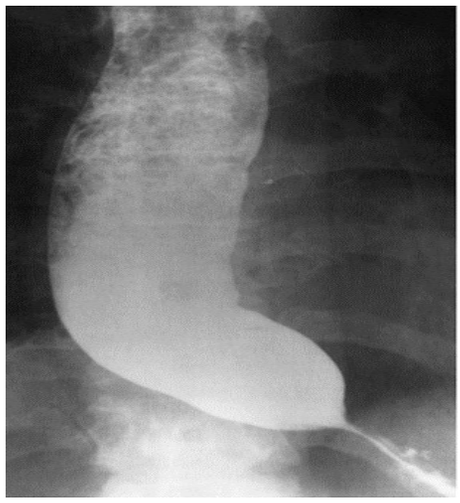
Esophageal Stricture
a) Tapering ends with smooth outlines → benign peptic stricture
b) Overhanging edges or shouldering with irregular outlines→ malignant
- (shouldering indicates overgrowth of the wall "mass" so we can not see the wall clearly on barium swallow).
- Short segment of strictures with luminal narrowing. Irregular outline. Deep ulceration. Shouldering proximally. All of these manifestations are of **malignant** strictures



Dysphagia, Esophageal stricture

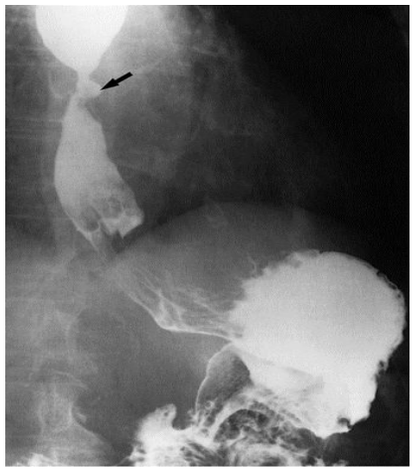
Barium swallow





Esophageal Carcinoma
Irregular stricture with shouldering (arrow) at the upper end
Short segment of strictures with luminal narrowing **Due to a mass invading the esophageal wall**.
Irregular outline. Deep ulceration.
Shouldering proximally.
there is always dilatation before any stricture.
All of these manifestations are of malignant strictures.

Achalasia Most of esophagus is dilated with food residuals and smooth narrowing at the lower End. **Rat tail** and bird beak sign with
no shouldering > benign.
Significant esophageal dilation proximally, some food particles and barium is pooling in the lower esophagus. Beak bird appearance of the distal esophagus with Smooth tapering.

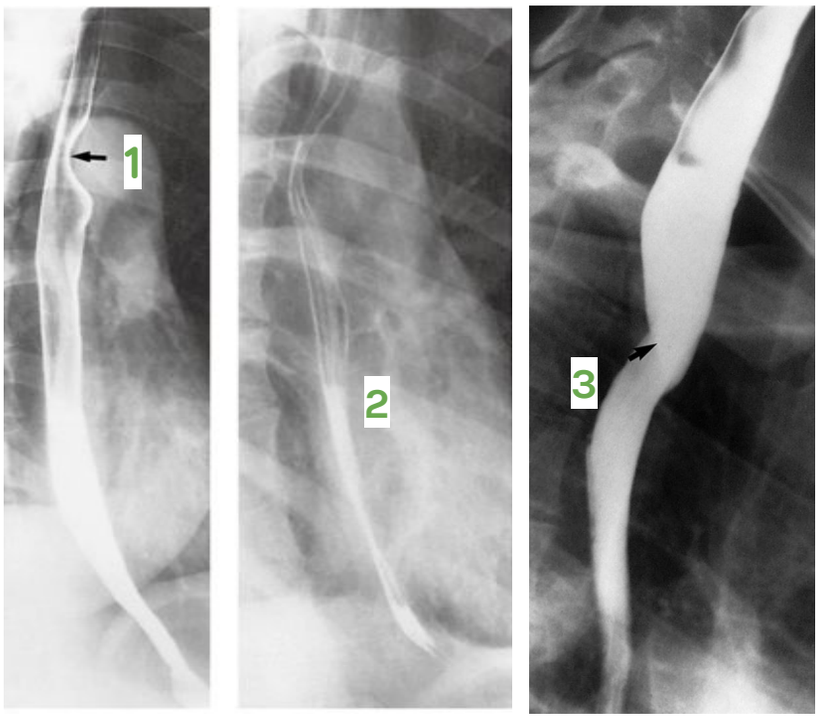


Corrosive Stricture
Irregular narrowing in the whole esophagus with dilated inflow. **no shouldering** > benign
*Corrosive are chemicals like acids or bases.
(long segment of esophageal stricture and narrowing with lobulated outline involving the mid and lower esophagus) this occur due to Acid intake

Peptic stricture:
due to GERD in a patient with hiatus hernia. There is smooth narrowing of the mid esophagus we see it in gastroesophageal junction with an ulcer within the stricture (arrow).
Short segment of stricture and narrowing and Tapering with peptic ulcer (arrow) and smooth outline

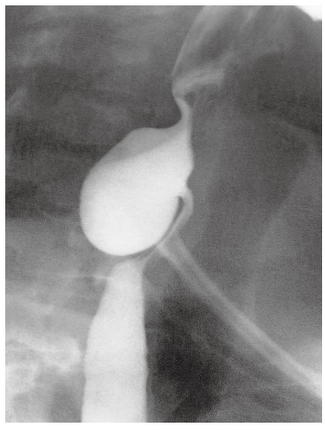
Esophageal impressions (normal)

Physiological impressions (indentation):
1- related to aortic arch
2- related to atrial enlargement
3- left main bronchus[1]

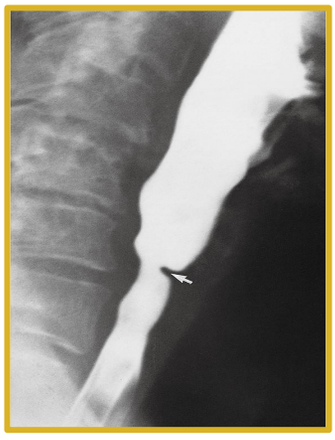


Dysphagia, Esophageal web/Diverticulum in 38 slide

Barium swallow



Esophageal diverticulum (mucosa bulging outside and filled with contrast), no dilation proximally and normal esophagus



Esophageal web.
Shelf-like indentation (arrow)
from the anterior wall of esophagus, no shouldering

External posterior compression causes narrowing of esophagus due to apparent subclavian artery[1] as it passes behind the esophagus (arrow) anomalous right subclavian artery.

[1]In the reference as well as the golden notes this was said to be a pathology caused by the subclavian artery, but the doctor mentioned it as a normal physiological narrowing caused by the left main bronchus

Stomach

Clinical signs and symptoms

- Epigastric pain.
- Vomiting.
- Hematemesis.
- Age is also important (some diseases are common in specific age).
- Constitutional symptoms (Fever, Night Sweat, Weight Loss).

Age and constitutional symptoms are imp for the diagnosis

Imaging Modalities

• X-ray. Limited role we can see Obstruction or when there's a perforation
• Fluoroscopy, contrast study (Barium meal).
(used to visualize stomach mucosa).
• Ultrasound >
Limited role in GI, used in pediatric for pyloric stenosis, and pregnant women and pancreatitis

• CT.
(For staging and characterization of the disease and **differential diagnosis**)
The Best 99% sensitive
• MRI.
• Nuclear Medicine not used.
• Angiography not used

Fluoroscopy, US , X-ray -> to detect abnormalities
CT-> to stage and give Differential diagnosis

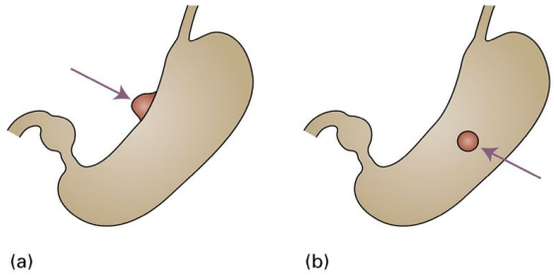
Barium meal

Normal

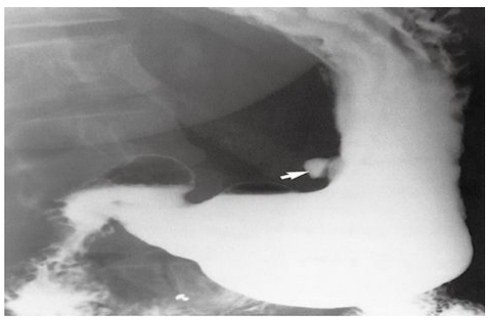
Normal Stomach and Duodenum **on double contrast barium meal.** On this supine view, barium collects in the fundus of the stomach. The body and the antrum of the stomach together with the duodenal cap and loop are coated with barium and distended with gas. Note how the fourth part of the duodenum and duodenojejunal flexure are superimposed on the body of the stomach.

peptic ulcer disease (Epigastric pain)

a) In profile the ulcer is seen as an outward projection
b) En face (facing forward, out profile) the ulcer appears rounded.



Barium meal:

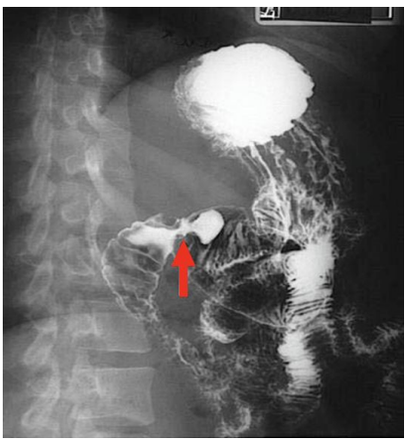


Benign ulcer due to its regular lining
White arrow: In profile ulcer, **outpouching filled with contrast** in the lesser curve of the stomach (arrow).
Black arrow: En face of an ulcer (arrow) is seen as rounded collection of barium, زي الحفر تدخل فيها الصبغة.and edematous mucosa adjacent to it and directed towards the ulcer

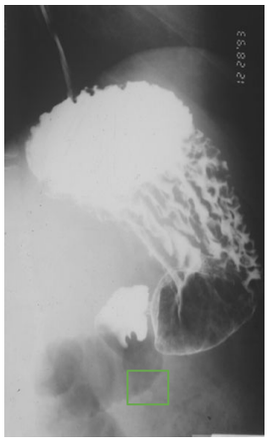
Ulcers -> benign
-> malignant(rare) with irregular edges

Duodenal ulcer in 38 slides involving the duodenal cap

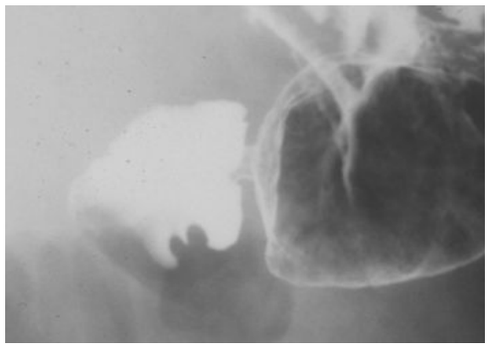
Barium meal



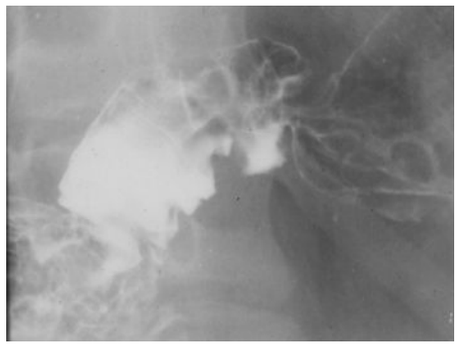
Narrowing, area of contrast pool, mucosal edema (distal gastric antral ulceration)
No proximal obstruction



A filling defect within the inferior aspect of the duodenal wall



Single contrast study - filling defect



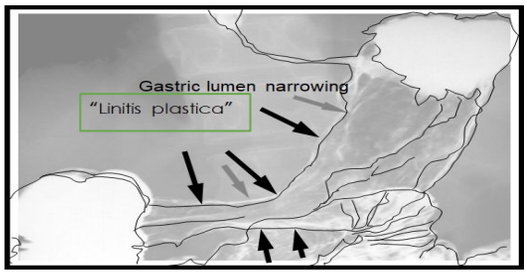
Double contrast study (thickened edematous mucosal fold directed toward the ulceration)

(Epigastric pain) Gastric carcinoma Barium meal

Gastric Carcinoma on baruim study there are a number of large filling defects in the antrum and body of the stomach

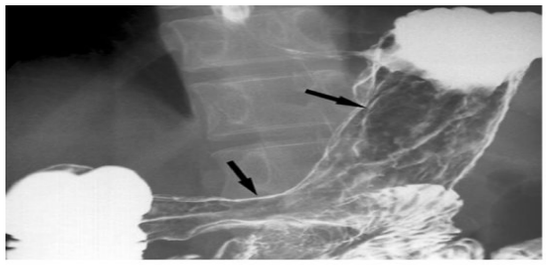
Thickened mucosal fold and Swelling of the wall That led to filling Defect **Cloud like appearance**, narrowing of gastric lumen with lobulation in the outline (seen in diffuse infiltrative process involving the gastric wall
e.g. infiltration by malignancy)
' lumen with black color indicates **filling defect**-> due to food or foreign body or thickening in the wall
Causes of this **wall infiltration**:
1-cancer in wall 2-malignant metastasis 3-lymphoma ¿

Extra pic.



Linitis plastica related to the diffuse gastric luminal narrowing

Extra pic.



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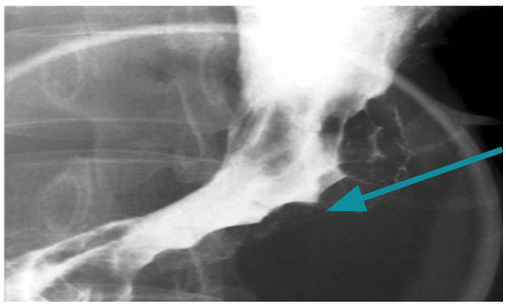
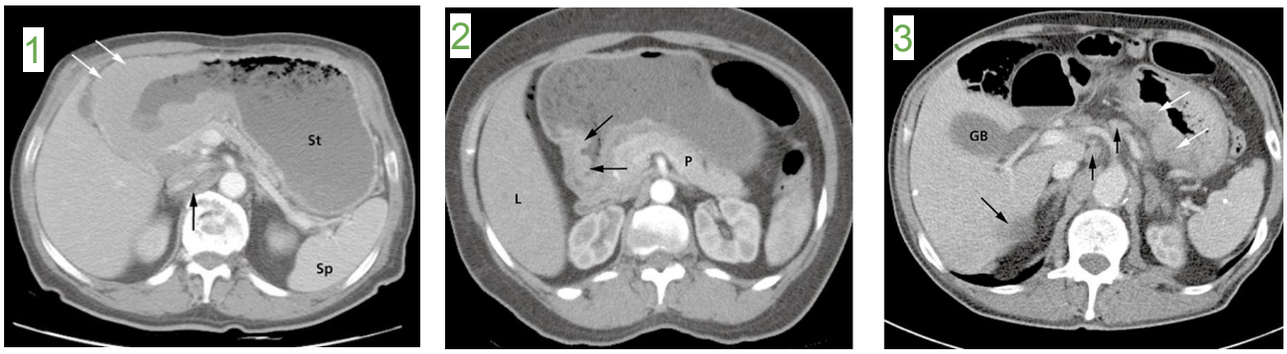


Gastric Carcinoma on Barium study
Black areas (black clouds) are large filling defects in the antrum and body of stomach which indicates mucosal abnormality (infiltration). The difference between gastric masses and ulcer is that the ulcer will accumulate the contrast in ulcer site which will appear as dense but in case of mass, the mass will clear the contrast and will appear black.

wow, such empty



Gastric Carcinoma on CT

1- In the first picture (white arrows) indicate wall thickening, and it's what appeared in the barium study as filling defects. **Mass in the gastric antrum**

2- focal ulcer is seeing arising in the antrum (arrows)

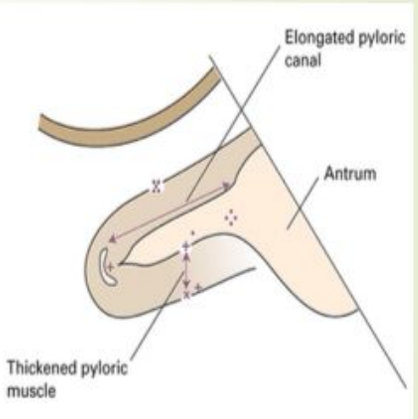
3- In **the third picture,** there is diffuse thickening of the wall of the stomach (white arrows), several lymph nodes (short black arrows in the middle) and a liver metastasis (long black arrow) are also seen. These thickened walls could be: 1.Primary Gastric Cancer 2.Infiltration 3.Metastasis 4.Lymphoma. (it is Gastric Carcinoma here) thickened walls and narrowed lumen with different axial levels.

Pyloric stenosis

Ultrasound scan in a neonate showing a thickened, elongated pyloric canal

Typical presentation: boy 6 month with projectile vomiting

Pyloric stenosis Is one of limited role of US in the GIT



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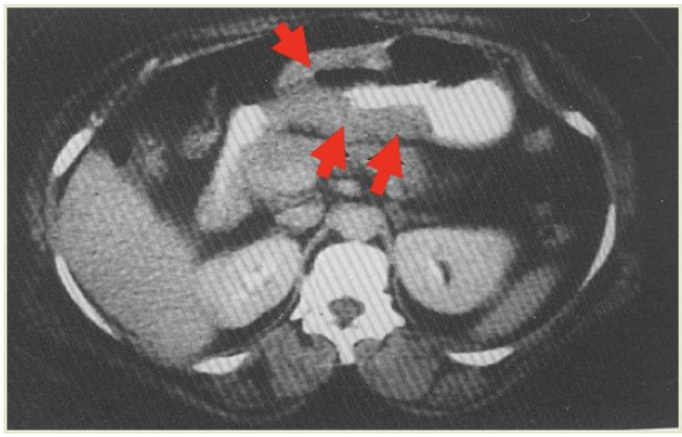
Gastric lymphoma

Barium meal

Shouldering of the stomach

Diffuse luminal narrowing of stomach, with irregular outline, without significant obstruction proximally



Thickening of the gastric wall

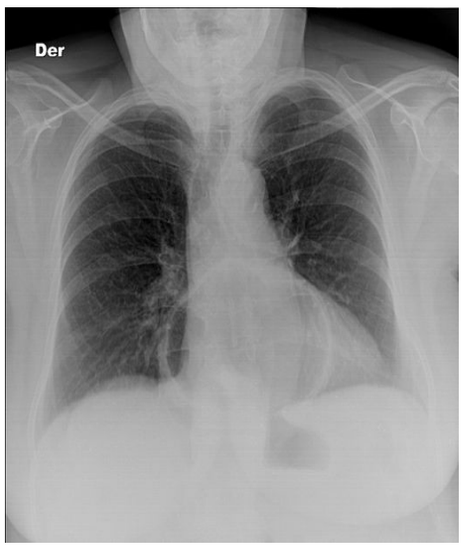
Diffuse thickening involving the gastric antrum without proximal obstruction

Sliding hiatal hernia

Barium meal

Two types of hernia:
1- sliding hiatus hernia: the gastroesophageal junction is above the level of the diaphragmatic crus

2- paraesophageal hernia: gastroesophageal junction is below



Gas filled cavity projecting over the cardiac shadow

What is the next step after x-ray? Barium meal and swallow

Small bowel

Clinical signs and symptoms

- Malabsorption.
- Vomiting.
- Diarrhea.

- Age is also important (some diseases related to specific age).
- Constitutional symptoms (Fever, sweating and weight loss).

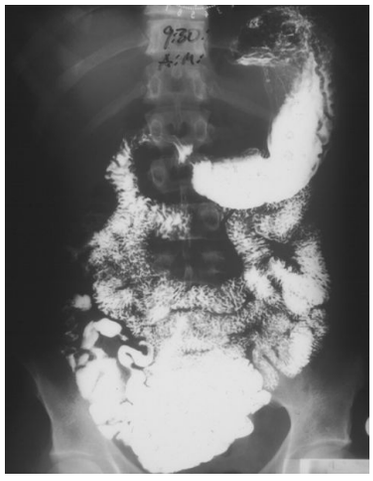
Age and constitutional symptoms are imp for the diagnosis

Imaging modalities

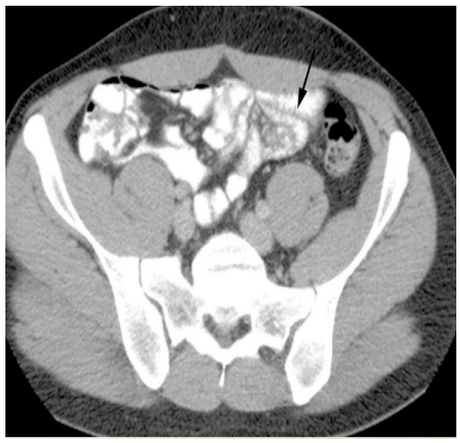
- **X-ray** (Bowel obstruction and perforation) best initially.(limited role)
- **Fluoroscopy** (Barium follow through/Small bowel enema). (play a major role)
- Ultrasound (we don't use it because small bowel is filled with gas and US can't read gas).
- **CT** replacing the fluoroscopy these days. (Play a role)
- **MRI** replacing the Fluoroscopy and CT.
- **Nuclear medicine >** not used.
- **Angiography >** not used.

Normal

small bowel enema



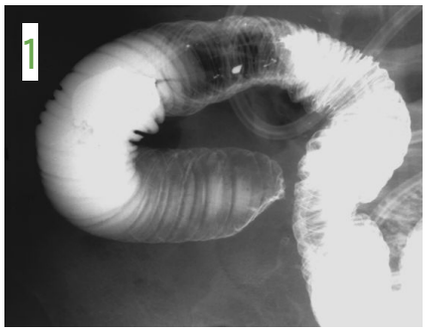
barium meal- follow through



CT scan

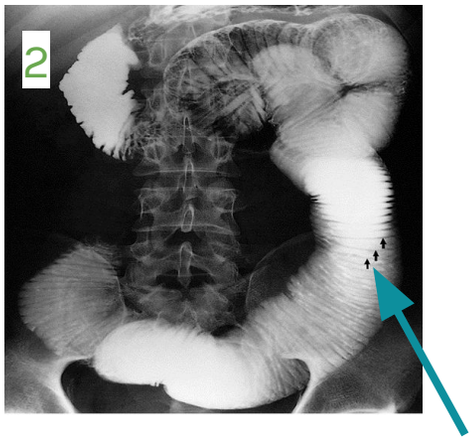
Small Bowel obstruction

Patient presenting with abdominal pain and distension



Small bowel enema :

- Significant dilation of the small bowel obstruction. The diameter of the wall is greatly increased. The feathery mucosal pattern is lost and the folds appear as thin lines traversing the bowel, known as valvulae conniventes (arrows).
- Picture 2: The signs of small bowel obstruction secondary to adhesion :
  1- Dilated small bowel loops proximally
  2- Thickened mucosa (valvulae conniventes)
  3- Cutoff sign distally
- The diameter of the bowel is greatly increased.
  - (Keep in mind that The upper limit of normal diameter of the bowel is generally accepted as 3cm).



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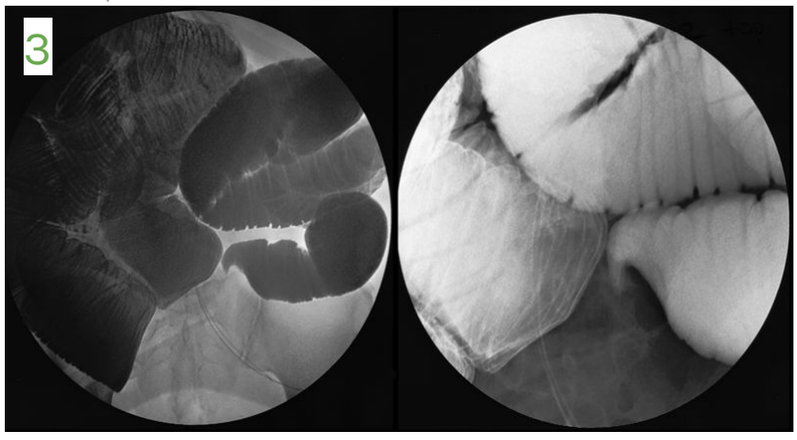

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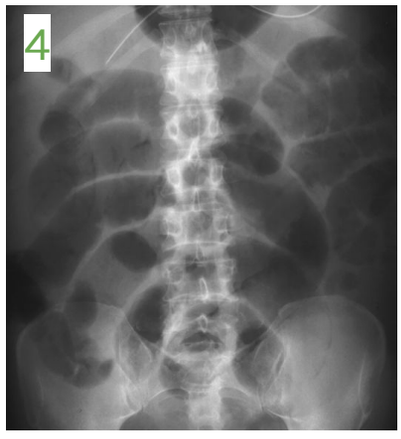
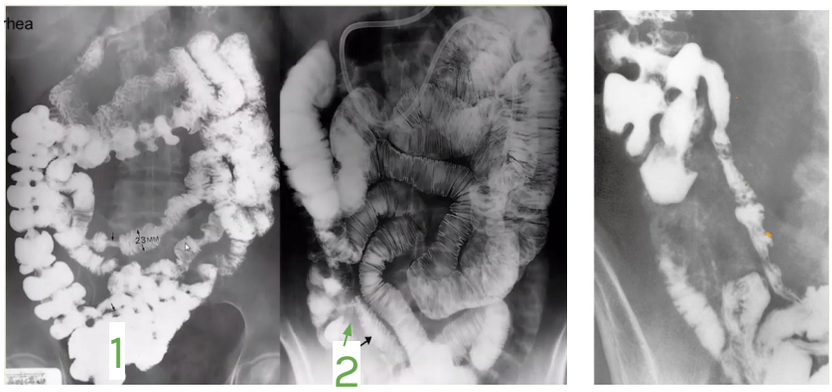
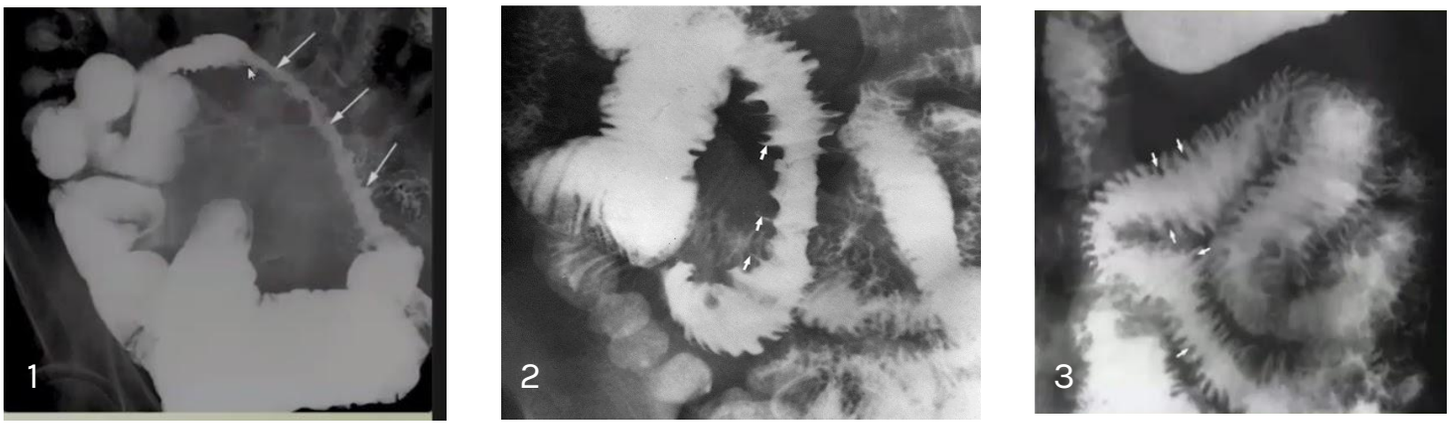


Picture 4: This is a plain x-ray. We see significantly dilated small bowel loops which centered in the mid-abdomen. Also there is Cutoff sign distally, thickened, mucosal folds, edema and complete cutoff distally and smooth tapering

Crohn's disease

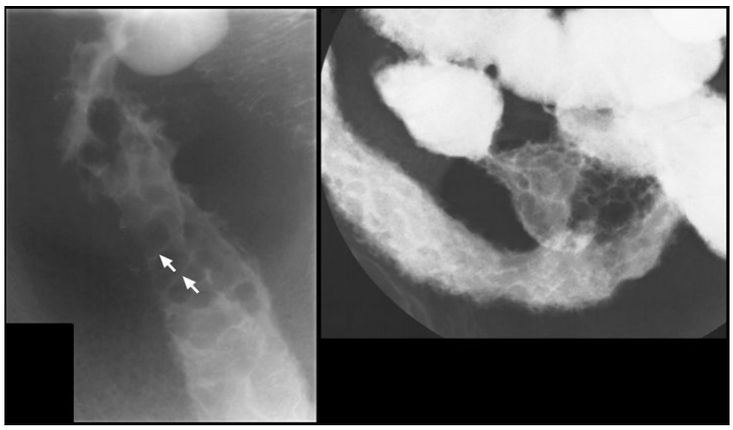
A patient presenting with Abdominal pain & weight loss and diarrhea
1-normal barium swallow
2-ileocecal narrowing on enema
small bowel inflammatory process





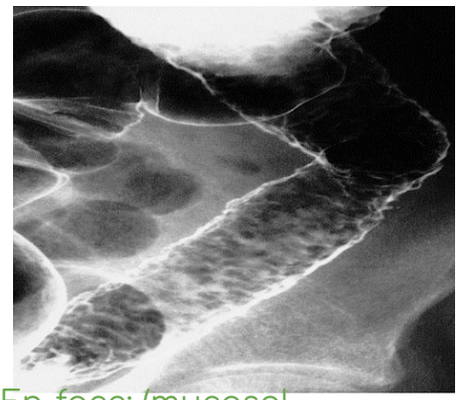
Picture 1: There is a long stricture (arrows) in the ileum due to crohn's and an abdominal mucosal pattern + separation of abnormal segment from other loops of the bowel (loops separation due to fibrofatty proliferation) with thorns rose
picture 2: **Deep Ulceration** abnormal loops of bowel in crohn's disease showing the ulcers as outward projections (arrows). If the erosion extends to submucosa we will see the contrast filling the submucosa (thorns rose) Streak of contrast filing the wall both of these changes are seen in the crohn's disease (cobblestone sing & thorns rose)
picture 3: mucosal abnormalities with infiltration of the bowel, **thickening of the mucosal folds** Due to infiltration

Extra pics



Cobblestone appearance due to edema of the mucosa

Fibrofatty proliferation with separation of the bowel loops



En-face: (mucosal ulceration the black spots in the picture) small erosions of the mucosal lining (cobblestone sign)
سطح القمر المبقع

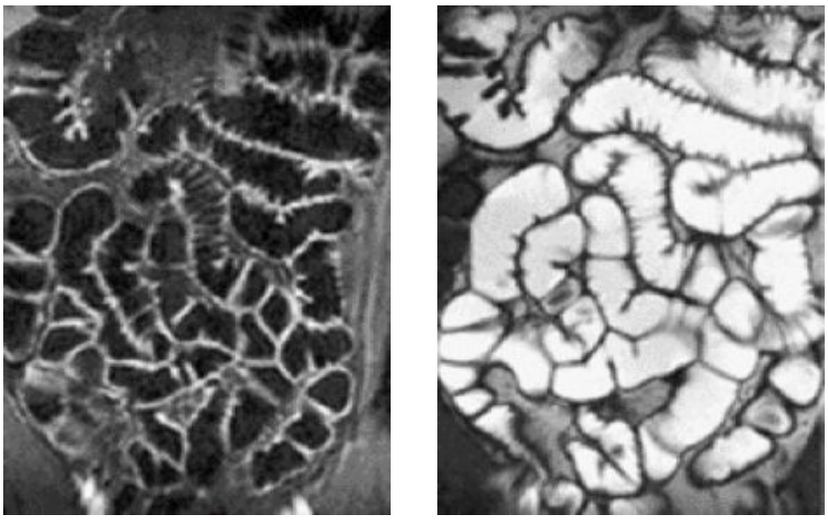
FINDINGS:

1. Lumen narrowing & multiple stenotic segments (skip lesion)
2. Deep Ulceration with mucosal edema in between → Cobblestone Appearance
3. Bowel loop separation (fibrofatty proliferation)

Crohn's disease

CT in the same patient demonstrating **marked Non-uniform thickening with mucosal enhancement** of the abnormal loop of small bowel, with a narrowed lumen due to increased wall thickness (white arrows). Several dilated loops of small bowel are also seen (black arrows) due to some obstruction at the level of the stricture

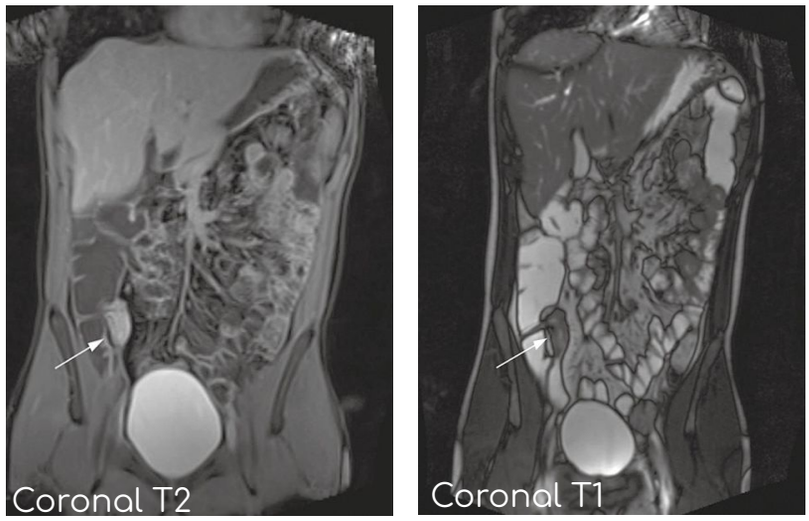
CT scan of the small bowel
White arrow: significant thickening of the wall this might be seen in Hypoalbuminemia or lymphoma



MRI enterography - normal.

MRI can show the bowl while it is moving so if there is a part that does not move It Means It Is dead

- Mucosal thickening and enhancement involving the l lliocecal junction (arrows), characteristic of Crohn's disease.
- Narrowing of the lumen and thickening in the wall of ileocecal junction are seen by MRI enterography.



MRI enterography - CD

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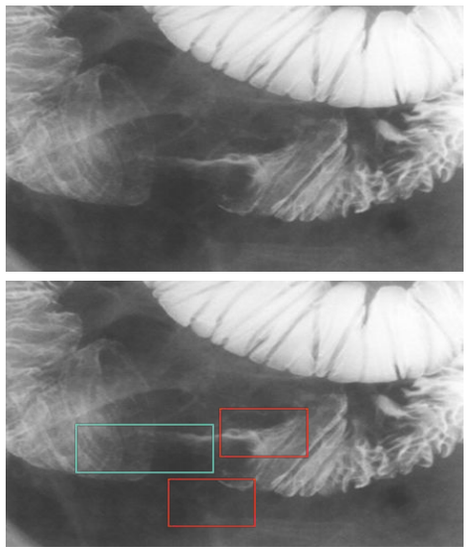
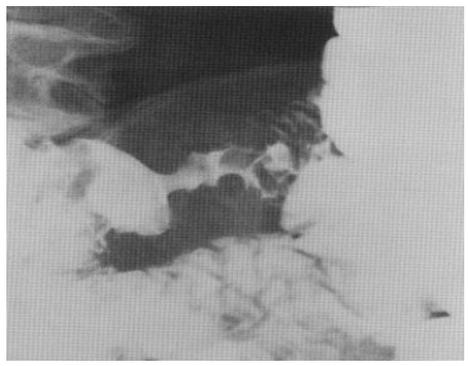
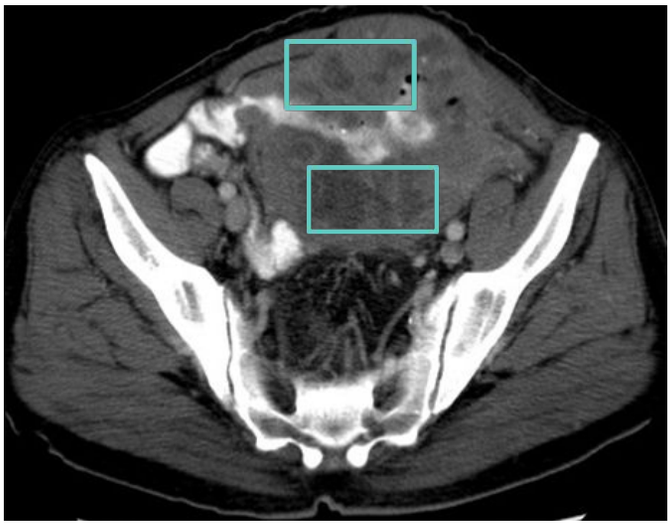
Small bowel Carcinoma

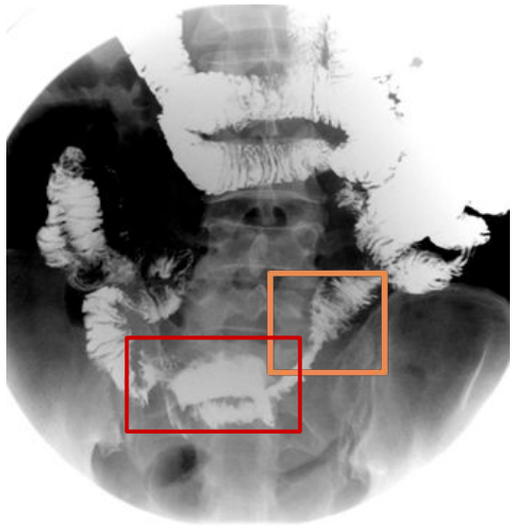
same here, add The patient presented with Gi bleeding and weight loss
FINDINGS in small bowel enema:
Lumen narrowing irregular with ulceration & shouldering margins.
Focal luminal narrowing, irregular outline, shouldering





Small bowel lymphoma





FINDINGS:
Lumen narrowing irregular
Mural wall thickening & bowel separation
Aneurysmal dilatation
no bowel obstruction

Large bowel

Clinical signs and symptoms

- Abdominal Pain.
- Diarrhea.
- Hematochezia.
- Vomiting (not always).
- Anal pain and Discharge.
- Age (some diseases related to specific age).
- Constitutional symptoms (Fever, sweating and weight loss).

Age and constitutional symptoms are important for diagnosis,

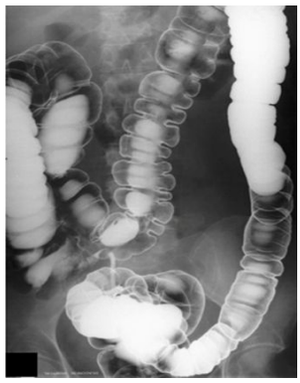
Imaging Modalities

- X-ray. >limited role for obstruction
- Fluoroscopy - Barium enema (Contrast study)
- Ultrasound (we don't use it because large bowel is filled with gas but we can use it to detect colonic mass). In pediatric for there appendix
- CT.
- MRI.
- Nuclear medicine > not used.
- Angiography > not used.

Normal large bowel

Normal appearance of double contrast in the colon and it has normal mucosal lining and Haus
Normally, haustration must be seen clearly in ascending and transverse colon. If you do not see Haustra in the descending Colon Don`t cry It is Nomral

enema study



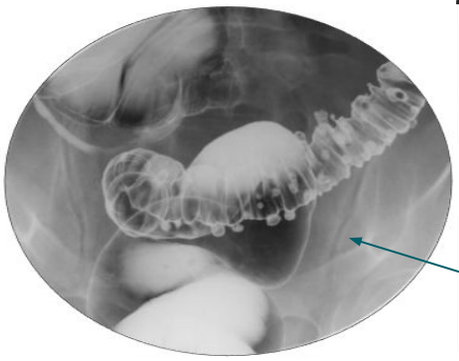
double contrast
Black(gas) + white (contrast)=double

single contrast

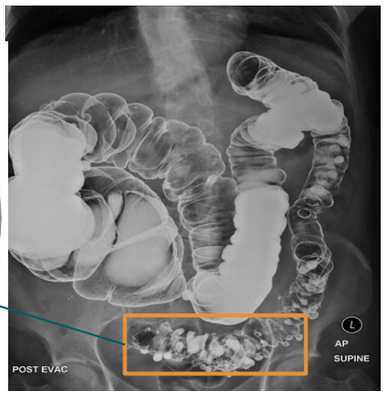
The whole page is in 38 only

Colonic diverticulosis

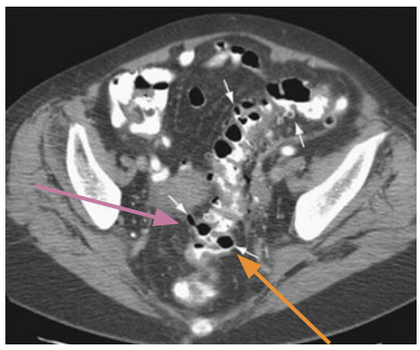
Hx of abdominal pain.
CT shows : Colonic Diverticulitis → inflammation



Barium enema
(magnified view)



Multiple outpouching
related to the sigmoid colon, smooth outline

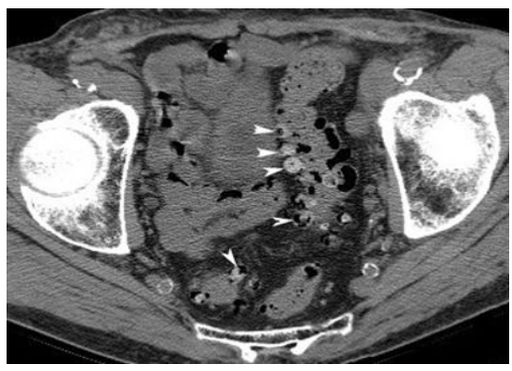


- En face
- In profile

Complication:
Acute inflammation, Perforation, abscess

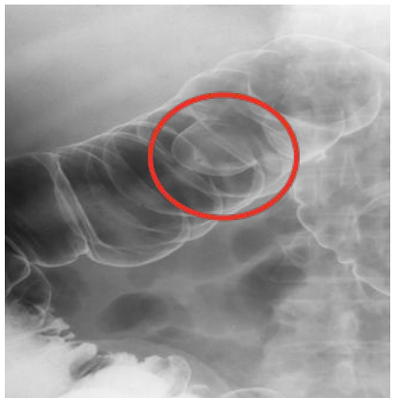
Inflammatory process adjacent to the colon diverticulitis (likely a complication)

Gas dissecting to the inflammatory process which means there is some sort of perforation



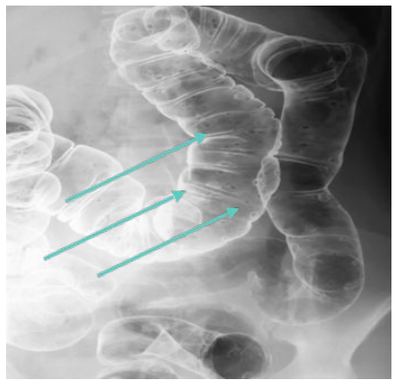
Colonic Polyps

abdominal pain and GI bleeding



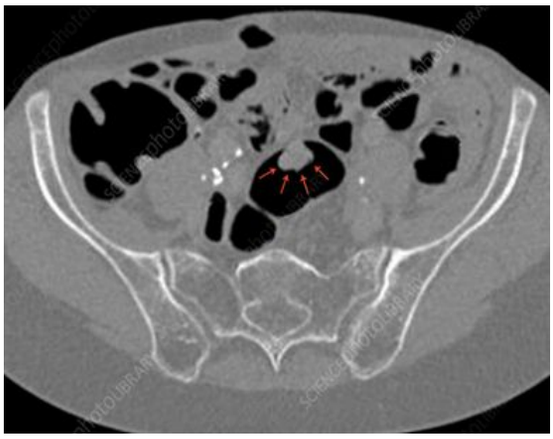
Colonic polyp

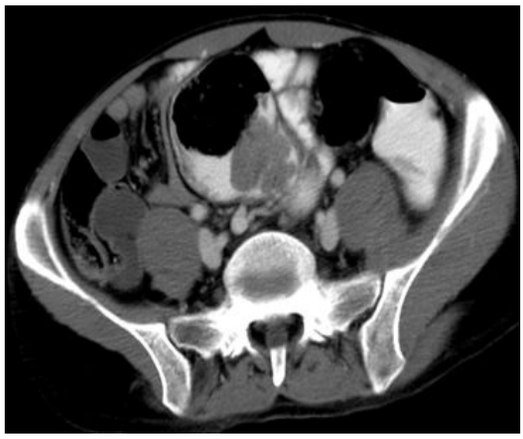
Double contrast barium enema



Colonic Polyposis

metastatic deposits within the liver





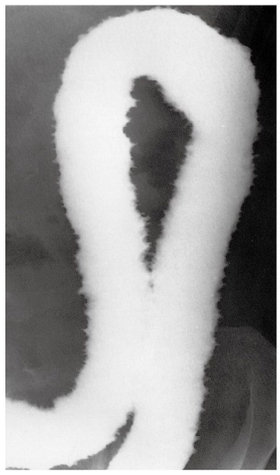
view the polyp by ct scan

Ulcerative Colitis

abdominal pain and diarrhea

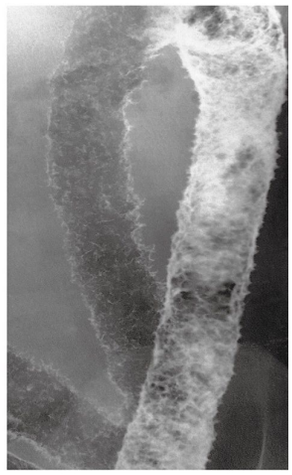
colonic Ulceration→ inflammation
the ulceration causes the normally smooth outline of the colon to be irregular. NO HAUSTRA which indicates ulceration due to repeated episodes of inflammation. (deep ulceration)
Double contrast study shows multiple mucosal black dots represents mucosal ulceration causes the normally smooth outline of the colon to be irregular.

single contrast enema



Deep ulceration

Double contrast enema



Absence of the normal appearance

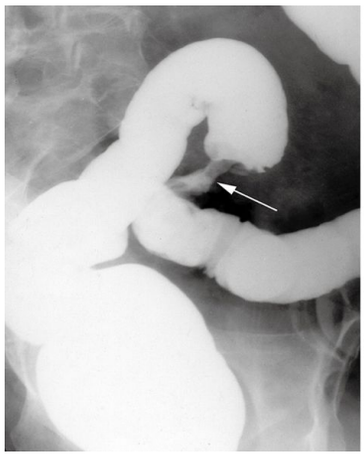
Ulcerative colitis with longstanding disease. We can see clearly the **lead pipe** appearance, and the haustra are lost and the colon becomes narrowed and shortened, coming to a rigid tube. reflux into the ileum through an incompetent ileocecal valve has occurred. No haustra no Function

We know the incompetence of the valve by the backflow of the contrast from the colon into the ileum + NO HAUSTRA.

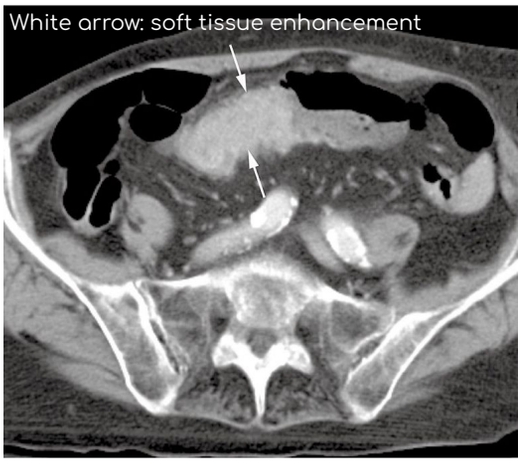
Colon cancer (Apple core sign)

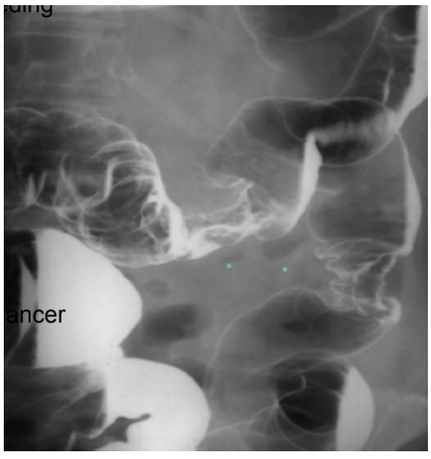
abdominal pain and lower GI bleeding
colonic Stricture→ colonic cancer.
Short segment with focal narrowing and shouldering effect which gives us Apple-core appearance Due to a mass invading the wall

double contrast enema



Barium Enema and coronal CT showing a short, circumferential narrowing in the sigmoid colon (arrows) from carcinoma.
• Barium enema (left image) shows narrowing of the lumen due to presence of soft tissue mass "Apple core sign" = (narrowing + shouldering).
• We can't see the mass in the FLUOROSCOPY (only narrowing) BUT we can see it in the CT.





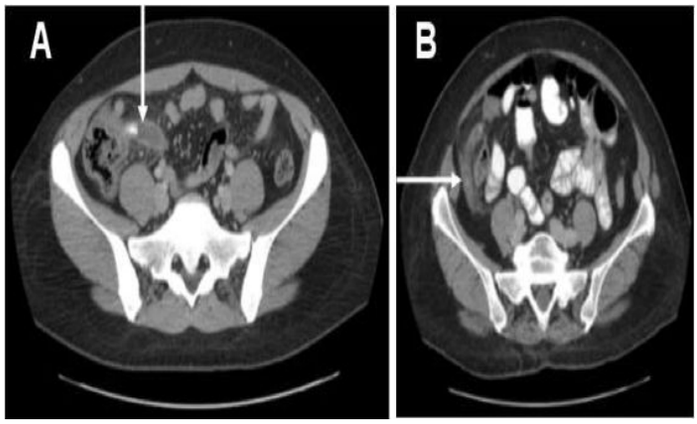
Multiple lesions

Colon carcinoma standard axial CT acquired on thin sections showing a tumor in the transverse colon. (thickened wall, tumor plugging into the lumen)

Acute Appendicitis

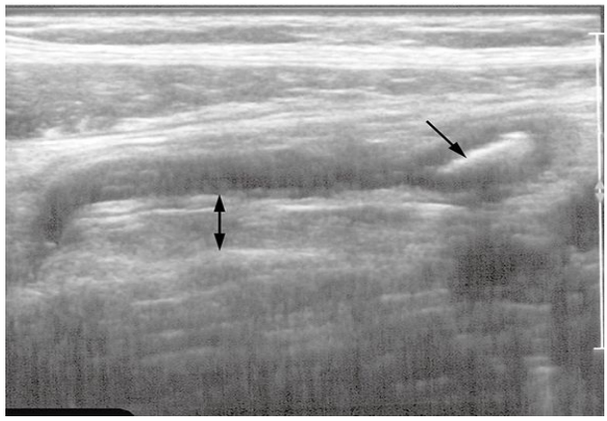
Right iliac fossa (RIF) pain - Acute Abdomen

• Blind ended tube in right iliac fossa. could present with white spot.
• Enlarged appendix measures more than 6mm.
• Appendicolith the white spot in the appendix (white arrow in image A), The white arrow points at the appendix.
• The complications of acute appendicitis: perforation, abscess formation and mass formation. tient has appendicitis!!!



Appendicitis;
Longitudinal US demonstrating marked thickening of the wall of the appendix (double head arrows),
Fluid is seen within the lumen and surrounding the appendix (white arrow)

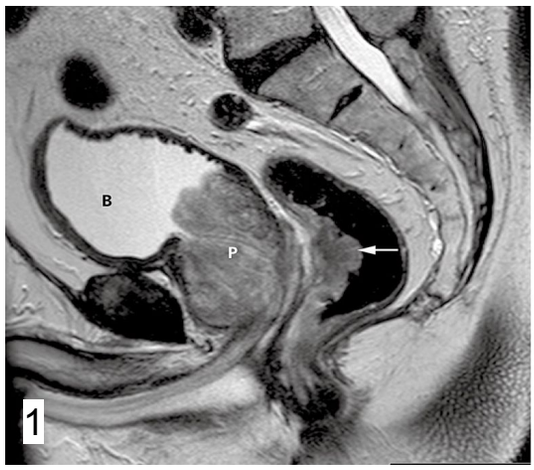
• In US there is thickening of the wall (double headed arrow) and we can see appendicolith in the tip of the appendix (single headed arrow).
• CT has higher sensitivity than US is assesing appendix but in situations like (pregnant lady or neonate) we can use US with 60% sensitivity.
So CT is imp for appendicitis

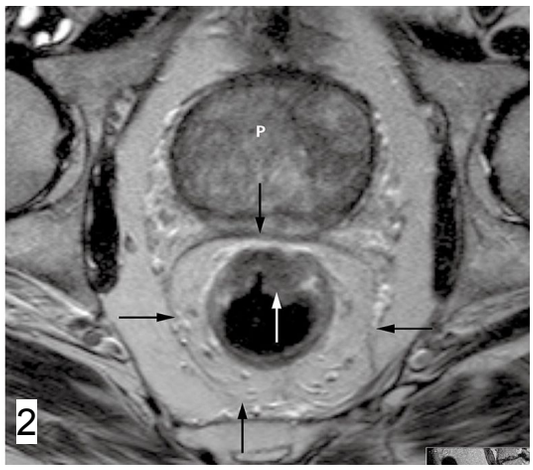


What is the Diagnosis? Appendicitis.
What is the best modality to diagnose ?
CT Scan (If it is a pregnant lady or pediatric patient then we do ultrasound).
Why Us is not that good?
Because the appendix place is variable from patient to another Remember we have 5 places

CT scan showing Normal appendix

Rectal Carcinoma





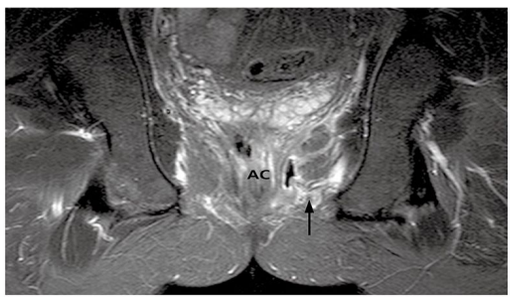
MRI can help stage Rectal Carcinoma

1. Sagittal T2-weighted image demonstrating a polypoid growth (arrow) arising from the anterior wall of the rectum. Note the benign hyperplasia of the prostate (P) and a slightly trabeculated bladder (B).
2. Axial image of the same tumor (white arrow). Note the mesorectal fascia (black arrows) encases the mesorectal fat and the rectum.

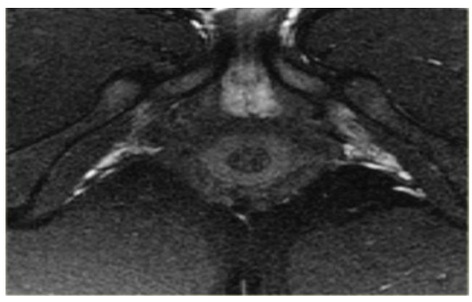
• Posterior wall of the rectum is normal and in the lumen there is gas.
• In The anterior wall there is fungating mass (polypoid growth, A fungating lesion is a lesion that fungates, that is, becomes like a fungus in its appearance or growth rate). And because there is fat between the mass and the prostate, the mass is not invading. use MRI to search for lymph nodes metastasis

So MRI -> for grading tumors
CT -> look for metastasis
If there's invasion in the layers -> for the treatment we start chemotherapy before surgery.

Perianal Fistula



Perianal fistula in crohn's disease. MRI with contrast is the best in perianal disease the only modality to show perianal fistula
It managed surgically based on MRI



Normal perianal area

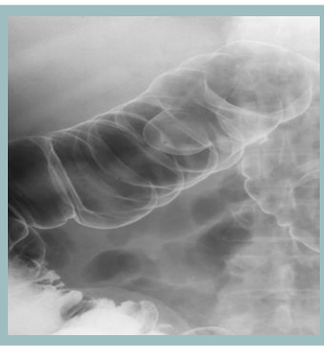
Summary

Sign	Indication
Most of esophagus is dilated with food residuals and smooth narrowing at the lower End (bird beak sign)	Achalasia
Mass will clear the contrast and will appear black (filling defects)	Gastric Carcinoma
Cobblestone sign + thorns rose	Crohn's disease
Lead pipe appearance	Ulcerative colitis
- Enlarged appendix measures more than 6mm. - marked thickening of the wall of appendix	Appendicitis
White spot in the appendix	Appendicolith
Apple core sign	Colon cancer

quiz

1- what can you see in the picture?

a. Ulcerative colitis
b. Colon cancer
c. Lymphoma
d. Colonic polyp



2-which one of the following is complication of acute appendicitis

a. thickening of the wall
b. abscess formation
c. Swelling
d. Bleeding

3-in gastric carcinoma there is diffuse thickening of the wall of the stomach which can be ...?

a. Primary Gastric Cancer
b. Infiltration
c. Metastasis
d. all

4- 32 years old, female, have peptic ulcer, came with severe abdominal pain, you suspect peptic ulcer perforation. What is the initial test you can order for her?

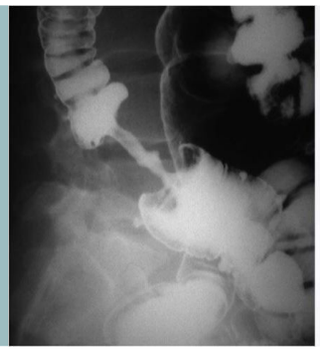
a. X-ray
b. MRI
c. CT
d. US

5-Patient with bloody diarrhea and vomiting

a. Ulcerative colitis
b. Crohn's disease
c. Colon cancer
d. Celiac disease

6- Elderly patient with progressive dysphagia, what is the diagnosis?

a. Ulcerative colitis
b. Crohn's disease
c. Colon cancer
d. Celiac disease



Answers
1)D
2)B
3)D
4) a
5)a
6)c