



# Radiology of GI system diseases

## Objectives

1. To know common GIT Pathologies presentation.
2. To understand step wise approach in requesting GIT Radiology Investigations.
3. To know common Radiologic pathologies in GIT.

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## Color Coding

Important | Notes | Extra

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## Esophagus

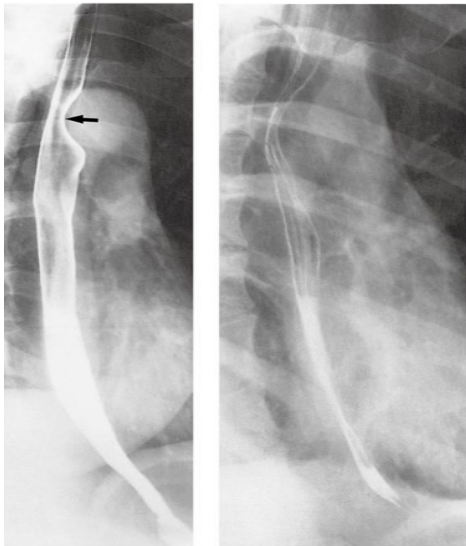
### Clinical Signs and symptoms of Esophageal Disease:

- Dysphagia, Odynophagia (painful Swallowing).
- Regurgitations, Vomiting.
- Age (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, Weight Loss).

### Imaging modalities:

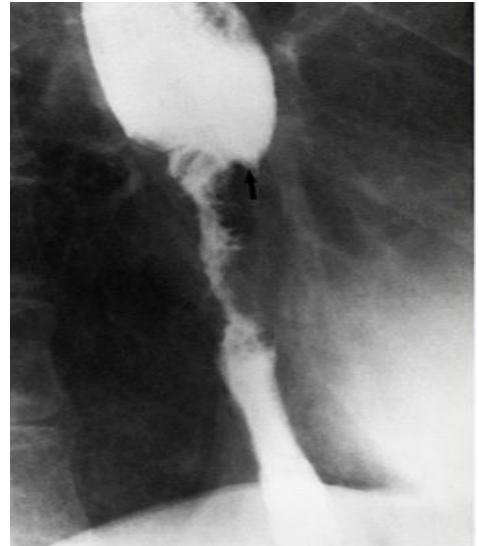
- X-ray.
- **Fluoroscopy (contrast study) "1st choice"** (Barium swallow = shows us the lumen and mucosal lining) we do not use it if we suspect perforation.
- Ultrasound (rarely used), and if we had to use it, we use the endoscopic not through the skin.
- CT we can use it, but it's not the study of choice.
- MRI (limited role).
- Nuclear Medicine > not used.
- Angiography > not used.

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



#### Normal Esophagus

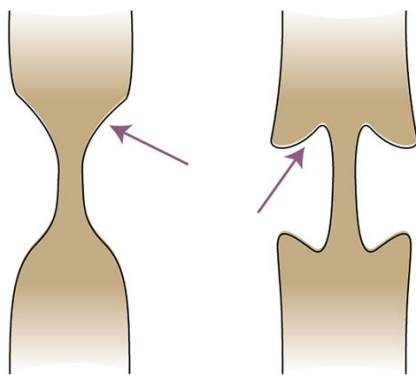
shows full Barium with a smooth outline and indentation made by aortic arch. Compare **Tapered** narrowing in the images



#### Esophageal Carcinoma

**Irregular narrowing** in the mid of esophagus with **dilated** upper esophagus because of the narrowing (there is a mass constricting the lumen which gives **shouldering** at the upper end) always there is always dilatation before any stricture

### Normal oesophagus vs. Shouldering

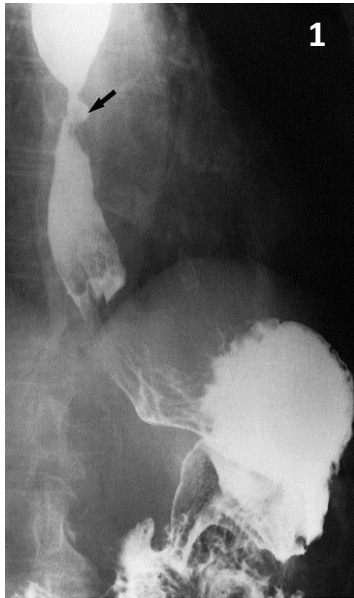


(a)

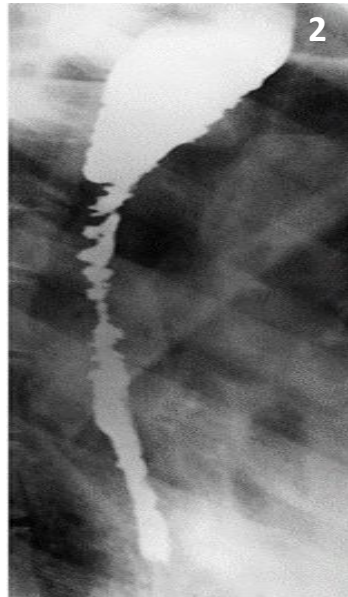
(b)

- Tapering ends.
- Overhanging edges or **shouldering** (shouldering indicates overgrowth of the wall "mass" so we can not see the wall clearly on barium swallow)

**Esophagus** All studies in this page are barium swallow



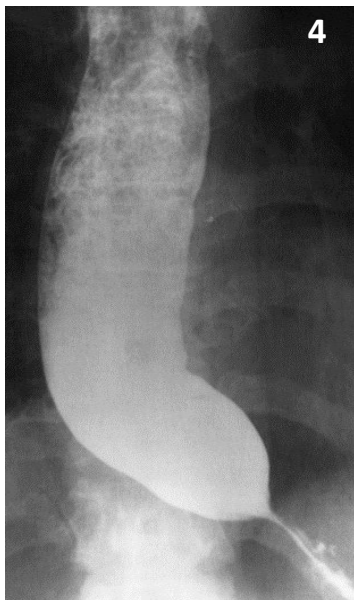
**Peptic stricture** due to GERD in a patient with **hiatus hernia**. There is smooth narrowing of the mid esophagus we see it in gastroesophageal junction with an ulcer within the stricture (arrow).  
**Tapered smooth focal stricture, no shouldering** so benign



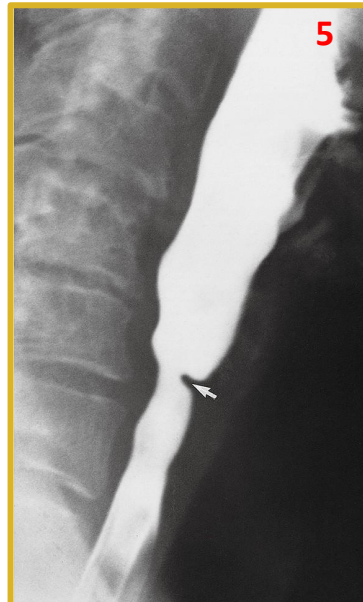
**Corrosive Stricture**  
Irregular narrowing in the whole esophagus with dilated inflow.  
**no shouldering > benign**  
\*Corrosive are chemicals like acids or bases.  
ممکن نشوفها عند اللي بيغى ينتحر ويشرب مواد حارقة



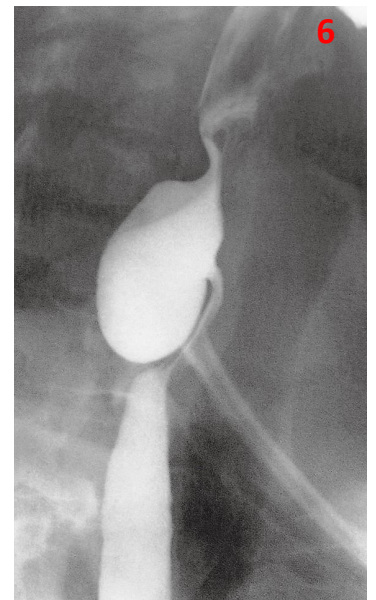
External posterior compression causes **narrowing of esophagus** due to apparent subclavian artery as it passes behind the esophagus (arrow) **anomalous right subclavian artery**.



**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**



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



Pharyngeal outpouching filled with contrast with compression of the esophagus (**Zenker's Diverticulum**) In elderly

## Stomach

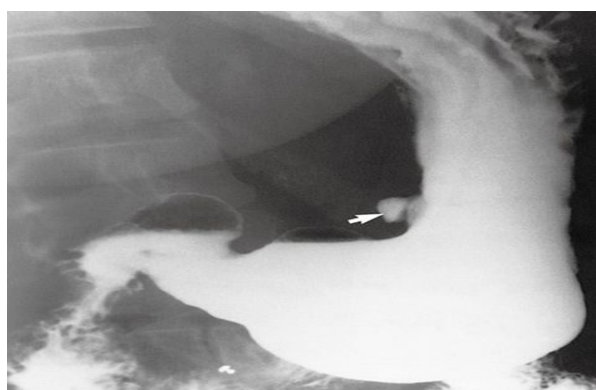
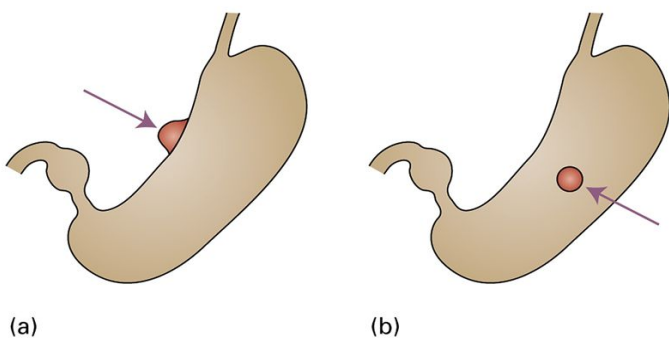
### Clinical signs and symptoms:

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

### Imaging Modalities:

- X-ray.
- Fluoroscopy, contrast study (Barium meal).  
(used to visualize stomach mucosa).
- Ultrasound > in pediatric for pyloric stenosis.
- CT.
- MRI.
- Nuclear Medicine > not used.
- Angiography > not used.

### Different located gastric ulcers



**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.

### Benign ulcer due to its regular lining

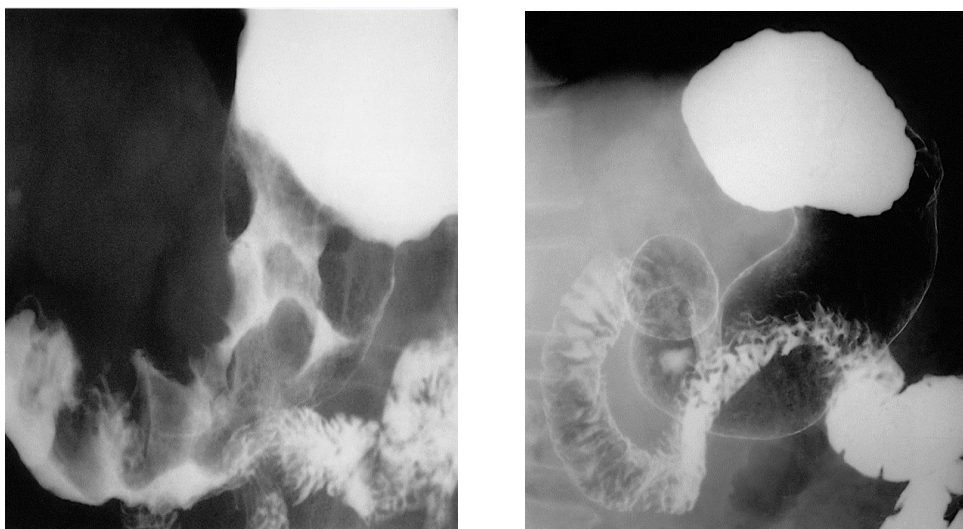
**Up:** In profile ulcer, outpouching filled with contrast in the lesser curve of the stomach (arrow).

**Down:** En face of an ulcer (arrow) is seen as rounded collection of barium, زي الحفر تدخل فيها الصبغة.

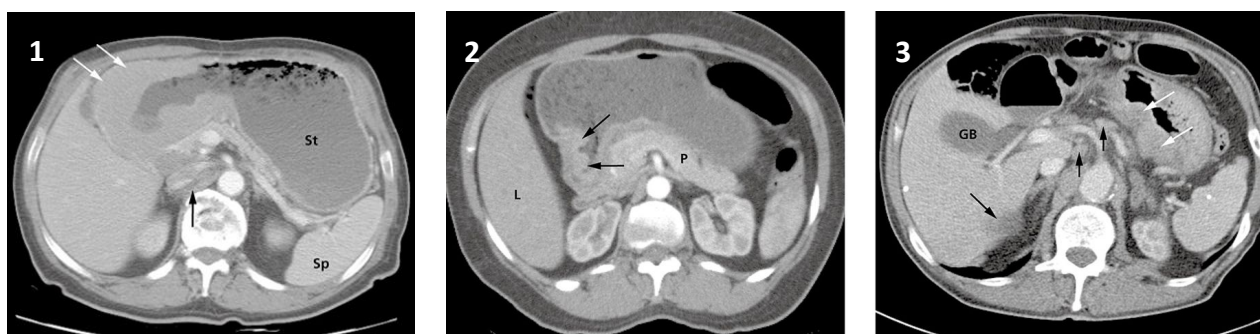
**Why do we see an ulcer as an outpouching?** The ulcer makes the stomach walls weak, so it protrude outside the stomach.

Notice the thin white lining (orange arrows) it represents the lesser curve, and the ulcer located far away from it, so it is En face ulcer.

## Stomach



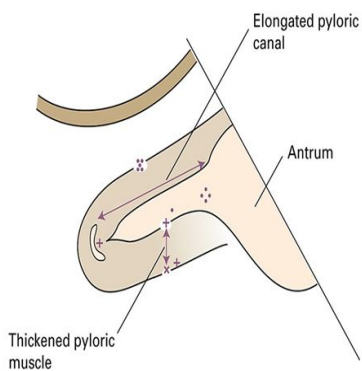
**Gastric Carcinoma** on Barium study (Left image), right image is **normal** (for reference)  
 Black areas (black clouds) are large **filling defects** in the antrum and body of stomach which indicates mucosal abnormality (**infiltration**). The difference between gastric masses and ulcer is that the 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**.

**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.
  - 2- Black arrows on the **second picture** indicate a focal ulcer arising in the antrum.
  - 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.
- 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**



Ultrasound has very limited role in stomach but may play a role in **Pyloric Stenosis** in pediatric Age group.  
**Doctor's notes:** usually the second male in the family, less than 6 weeks of age and presents with projectile vomiting and olive-shaped mass when feeling the upper belly which indicates the presence of **hypertrophic pylorus**.

## Small bowel

### Clinical signs and symptoms:

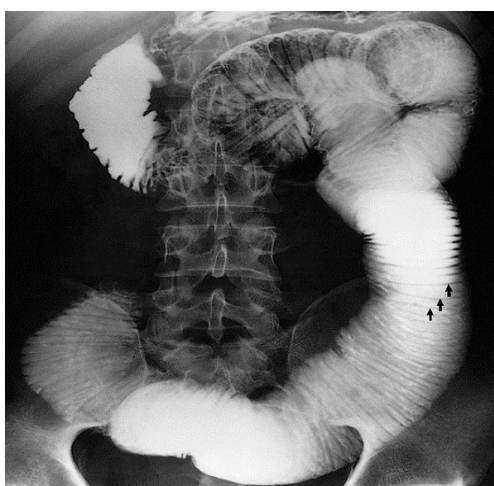
- Malabsorption.
- Vomiting.
- Diarrhea.
- Age (some diseases related to specific age).
- Constitutional symptoms (Fever, sweating and weight loss).

### Imaging modalities:

- X-ray (Bowel obstruction and perforation) best initially.
- Fluoroscopy (Contrast study).
- 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.
- MRI replacing the Fluoroscopy and CT.
- Nuclear medicine > not used.
- Angiography > not used.

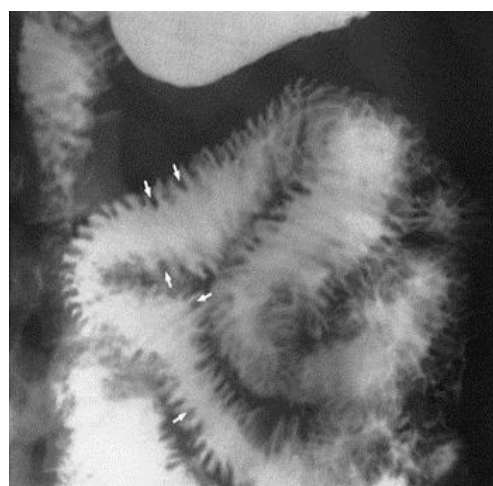


Normal fluoroscopic images of the small intestine



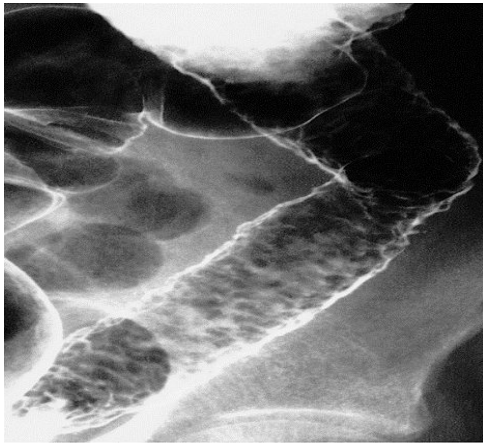
Significant **dilation** of the small bowel obstruction. The diameter of the wall is greatly increased. The feathery mucosal pattern is lost and the folds appear as thin lines traversing the bowel, known as valvulae conniventes.

Notice the thinned mucosal pattern. Featureless, patient with (dilation + malabsorption = celiac disease)

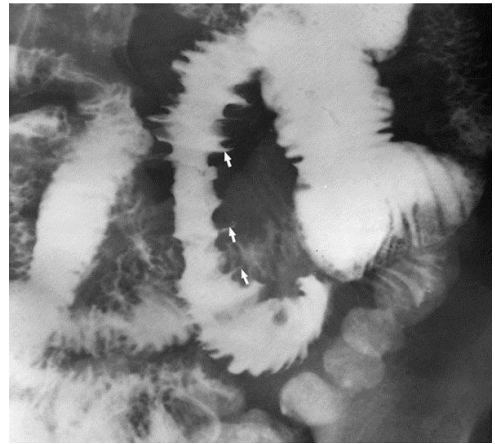


Mucosal abnormality with **infiltration of the bowel** (in this case from oedema) with **thickening of the mucosal folds** (some are arrowed) Feathery, thumb-printing

## Small bowel



(mucosal ulceration the black spots in the picture) small erosions of the mucosal lining (**cobblestone sign**) سطح القمر المبقع

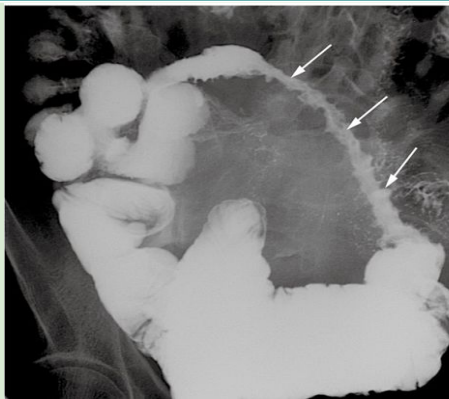


**Deep Ulceration** abnormal loops of bowel in crohn's disease showing the ulcers as outward projections (arrows). If the erosion extends to submucosa we will see the contrast filling the submucosa (**thorns rose**) Streak of contrast filing the wall



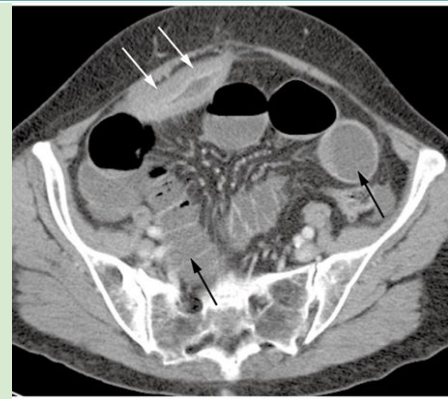
Note: both of these changes are seen in the crohn's disease (cobblestone sing & thorns rose)

### Barium follow through



**Narrowing.** There is a long stricture (**arrows**) in the ileum due to Crohn's disease and an abnormal mucosal pattern. There is also separation of the abnormal segment from other loops of the bowel, with a narrowed lumen (**arrows**).

### CT Scan



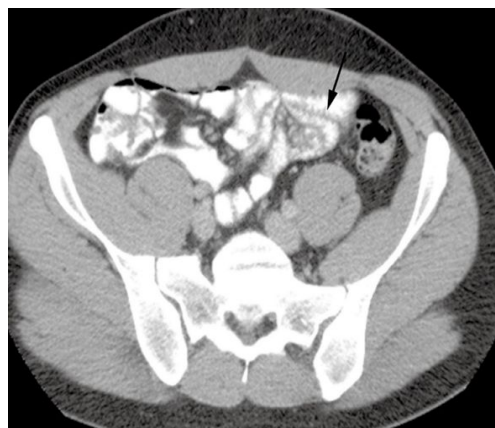
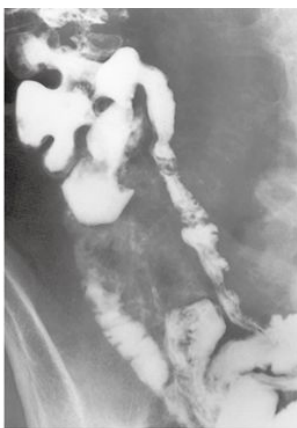
CT in the same patient demonstrating **marked thickening** of the abnormal loop of small bowel, with a narrowed lumen (**white arrows**). Several dilated loops of small bowel are also seen (**black arrows**), due to some obstruction at the level of the stricture.

**Note:** these changes are seen in the **Crohn's disease**.

## Small bowel



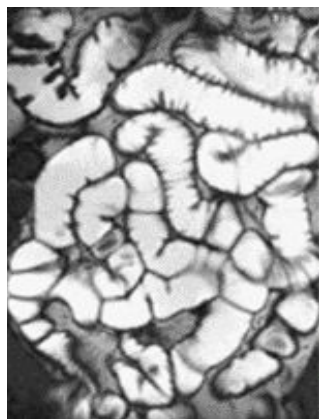
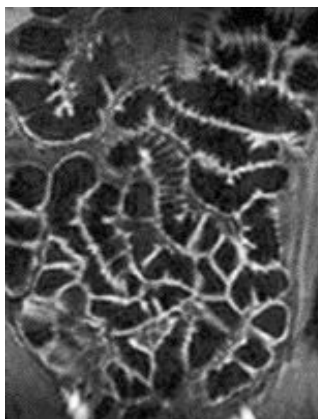
Normal smooth regular *ileocecal junction*



Normal CT scan of the small bowel



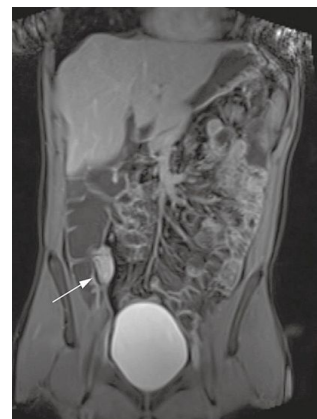
**Lymphoma.** CT with the bowel opacified by contrast agent. The wall of all bowel loops is considerably thickened. The arrows point to a portion of bowel which is particularly involved by lymphoma. Lumen surroundings are clear in CT. **Thickening** (more than 1 cm) is seen in the wall due to **infiltration** of any type of cells: (Malignant cells **lymphoma**) or any cause of infiltrative disease.



Normal MRI enterography



Coronal T2 post contrast image



Coronal T1 post contrast image

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



## 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).

### Imaging Modalities:

- X-ray. > for obstruction
- Fluoroscopy - Barium enema (Contrast study)
- Ultrasound (we don't use it because large bowel is filled with gas).
- CT.
- MRI.
- Nuclear medicine > not used.
- Angiography > not used.

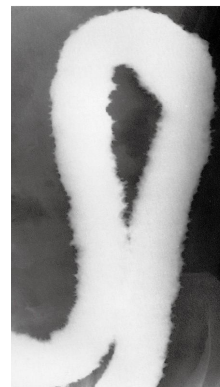


Normal appearance of **double contrast** in the colon and it has normal mucosal lining and **Haustration**. Normally, haustration must be seen clearly in ascending and transverse colon

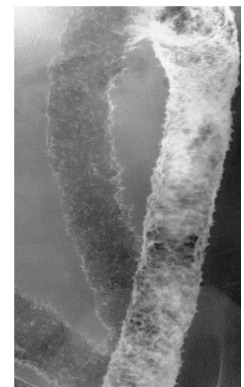
### a. Ulcerative Colitis



**Ulcerative colitis** with longstanding disease. We can see clearly the **lead pipe appearance**, and reflux into the ileum through an incompetent ileocecal valve has occurred. We know the incompetence of the valve by the backflow of the contrast from the colon into the ileum + **NO HAUSTRA**.



**Single contrast**



**Double contrast**

**Ulceration.** In this case of ulcerative colitis, the ulceration causes the normally smooth outline of the colon to be irregular. **NO HAUSTRA** which indicates ulceration due to repeated episodes of inflammation. Double contrast study shows multiple mucosal black dots represents mucosal ulceration causes the normally smooth outline of the colon to be irregular.

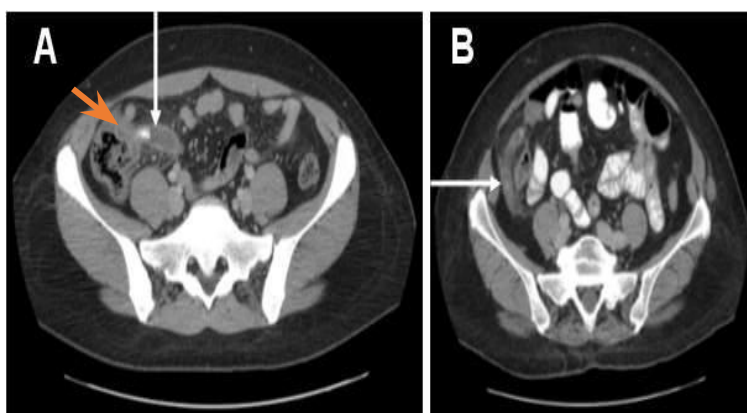
## Large bowel



CT scan showing Normal appendix

Young healthy male complaining of right iliac fossa pain with leukocytosis and fever.

- 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).



- 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 (orange arrow in image A), The white arrow points at the appendix.
- The complications of acute appendicitis: **perforation, abscess formation and mass formation.**
- Before CT scan invention they used to give the patient contrast enema and if it fills the lumen of the appendix this means the patient has appendicitis!!!



### Appendicitis

- 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 assessing appendix but in situations like (pregnant lady or neonate) we can use US with 60% sensitivity.

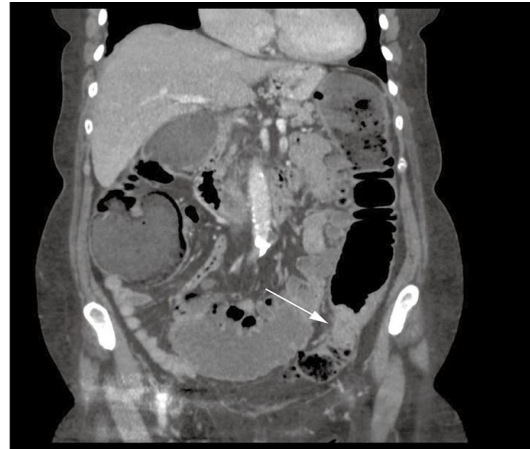
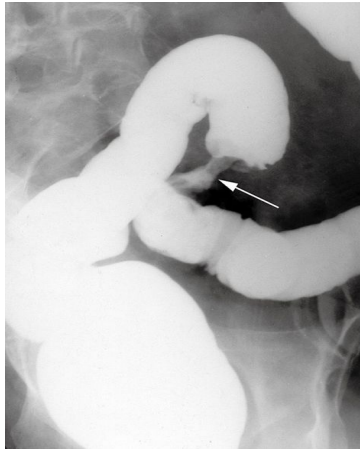


### Appendicitis

(longitudinal US scan, US can be longitudinal or transverse)  
there is **marked thickening of the wall of appendix** (double headed arrows) fluid is seen within the lumen and surrounding the appendix (white arrows).

## Large bowel

### b. Colon cancer (Apple core sign)



**Stricture.** 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.

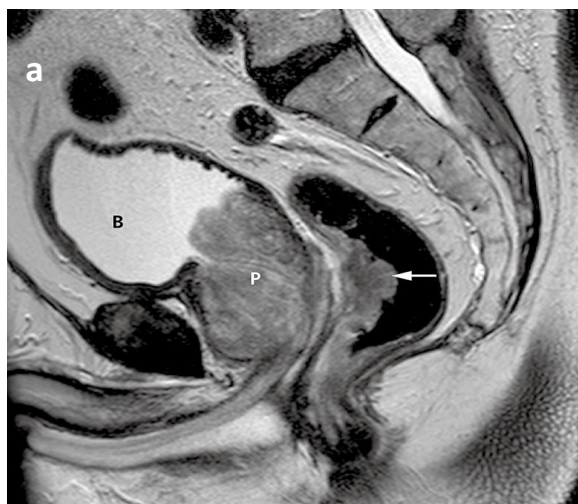


**Colon carcinoma** standard axial CT acquired on thin sections showing a tumor in the transverse colon. (thickened wall, tumor plugging into the lumen)

**Example:** 60 y/o male presents with fatigue only. He has chronic anemia, and nothing else > this suggests colon cancer. Notice the apple core appearance on fluoroscopy and the soft tissue mass in the CT scan.

## Large bowel

## c. Rectal Carcinoma

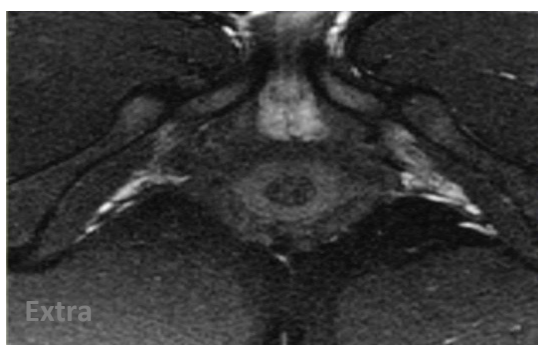


This is **MRI of Rectal Carcinoma**

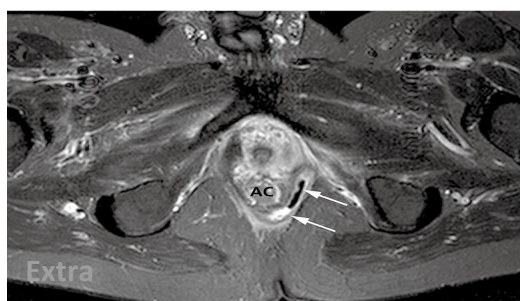
- (a) Sagittal T2-weighted image demonstrating a polypoid growth (arrow) arising from the anterior wall of the rectum. Note the benign hyperplasia of the prostate (P) and a slightly trabeculated bladder (B).
- (b) Axial image of the same tumor (white arrow). Note the mesorectal fascia (black arrows) 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.**
- **MRI is very good for rectal cancer local grading & CT for distal metastasis.**

d. **Perianal Fistula** this part is not in doctor's slides but we suggest that you study it



Normal perianal area



Perianal fistula in Crohn's disease. MRI with contrast is the best in perianal disease

# Summary

Sign	Indication
Most of Esophagus is Dilated ( <b>food residual</b> ) with smooth narrowing at the lower End ( <b>Bird beak sign</b> )	<b>Achalasia</b>
Mass will clear the contrast and will appear black ( <b>filling defects</b> )	<b>Gastric Carcinoma</b>
Cobblestone sign + thorns rose	<b>Crohn's disease</b>
Lead pipe appearance	<b>Ulcerative colitis</b>
White spot in the appendix	<b>Appendicolith</b>
Apple core sign	<b>Colon cancer</b>



## Remember:

- Shouldering indicates overgrowth of the wall (mass).
- 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.

**Q1) Which one of the following is an aggressive feature on barium swallow:**

- A. Accumulation of contrast toward certain site in the stomach.
- B. Outpouching that is filled with contrast.
- C. Visualization of mucosal layer in fundus.
- D. Area that is clear from contrast in antrum.

**Q2) What do you see in this fluoroscopic image:**

- A. Normal small bowels.
- B. Dilation of the small bowel.
- C. Thickening of the wall.
- D. Small erosion of the mucosal lining.



**Q3) What is the name of this study:**

- A. Barium meal.
- B. Follow through.
- C. Barium enema.
- D. MRI enterography.

**Q4) What do you see:**

- A. Small erosion of the mucosal lining.
- B. Narrowing of the lumen and thickening in the wall of ileocecal junction.
- C. Deep ulcers.
- D. Thickening of the wall of small bowel.



**Q5) 30 y/o F came with progressive dysphagia that started a month ago, she did a barium swallow. What is an important feature to look at in the image:**

- A. Bird beak shape.
- B. Irregular narrowing throughout the esophagus.
- C. Shouldering at the upper end of the narrowing.
- D. Outpouch that is filled with contrast.

Answers:  
1-D.  
2-A.  
3-B.  
4-C.  
5-C.