

# Radiological tips in bowel diseases

- Dr.shaymaa khalid

# Objectives:

- To know the main radiological tools used to investigate bowel diseases .
- To know the common radiological findings in these diseases.
- To know the role of imaging in these diseases.

# Small bowel obstruction

- Account for 80% of all mechanical intestinal obstruction.
- It has mortality rate of 5.5 %
- May be complete or incomplete.

- **Causes:**

1. Adhesions: almost exclusively from prior surgery 60%.
2. Hernias :( often femoral or inguinal but incisional occur) 15%.
3. Neoplasm, lymphoma 2%
4. Congenital atresia in newborn.
5. Inflammatory bowel disease.
6. Gall stone ileus 2%

- **Investigations**

- Plain radiograph for the initial assessment , CT is most sensitive imaging modality.

- **Role of imaging :**

1. Confirm obstruction.
2. Demonstrate the cause.
3. Find the transition point.
4. Identify any complications e.g. ischemia or perforation

# Radiological features

## 1- Abdominal radiograph

- Abdominal radiographs are only 50-60% sensitive for small bowel obstruction . In most cases, the abdominal radiograph will have the following features:
  1. dilated loops of small bowel proximal to the obstruction.
  2. predominantly central dilated loops
  3. Valvulae conniventes are visible
  4. Multiple air-fluid levels if the study is erect.
  5. gasless abdomen: if fluid filled.
  6. String of beads appearance: small pockets of gas within a fluid-filled small bowel.
  7. the cause may be demonstrated e.g. gas in femoral hernia.



RT.  
SUPINE



RT.  
ERECT



*irreducible left  
inguinal hernia.*



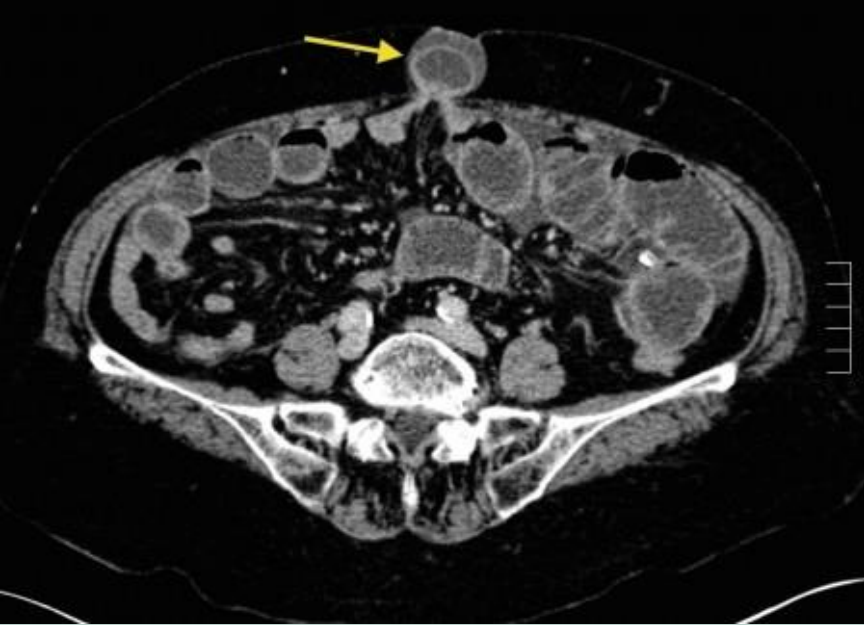
- It consists of an obliquely or horizontally oriented row of small gas bubbles in the abdomen, which represent small pockets of gas along the superior wall of the [small bowel](#) that are trapped between the [valvulae conniventes](#). The inferior margins of these bubbles have an ovoid appearance due to the meniscal effect of the intraluminal fluid.
- The string of pearls sign, when present in the appropriate clinical setting, is virtually diagnostic of small bowel obstruction.



**Stepladder sign** represents the appearance of distended small bowel loops with gas-fluid levels that appear to be stacked on top of each other, typically observed on erect abdominal radiographs in the setting of [small bowel obstruction](#).

## 2- Ct SCAN

- Dilated loops of small bowel.
- The dilated bowel may be gas or fluid filled.
- Transition point at the site of obstruction.
- The cause will be at the transition point
- If no cause is demonstrated, its likely secondary to adhesion.



**Small bowel obstruction due to hernia**



**Small Bowel Obstruction due to Adhesions**



# Large bowel obstruction

- Dilatation of proximal large bowel and collapse distally.
- If dilated over 6 cm , the bowel wall may perforate.
- **Etiology:**
- Colonic cancer 60%.
- Acute diverticulitis 35%.
- volvulus
- Ischemic stricture.
- Fecal impaction.
- Hernias.

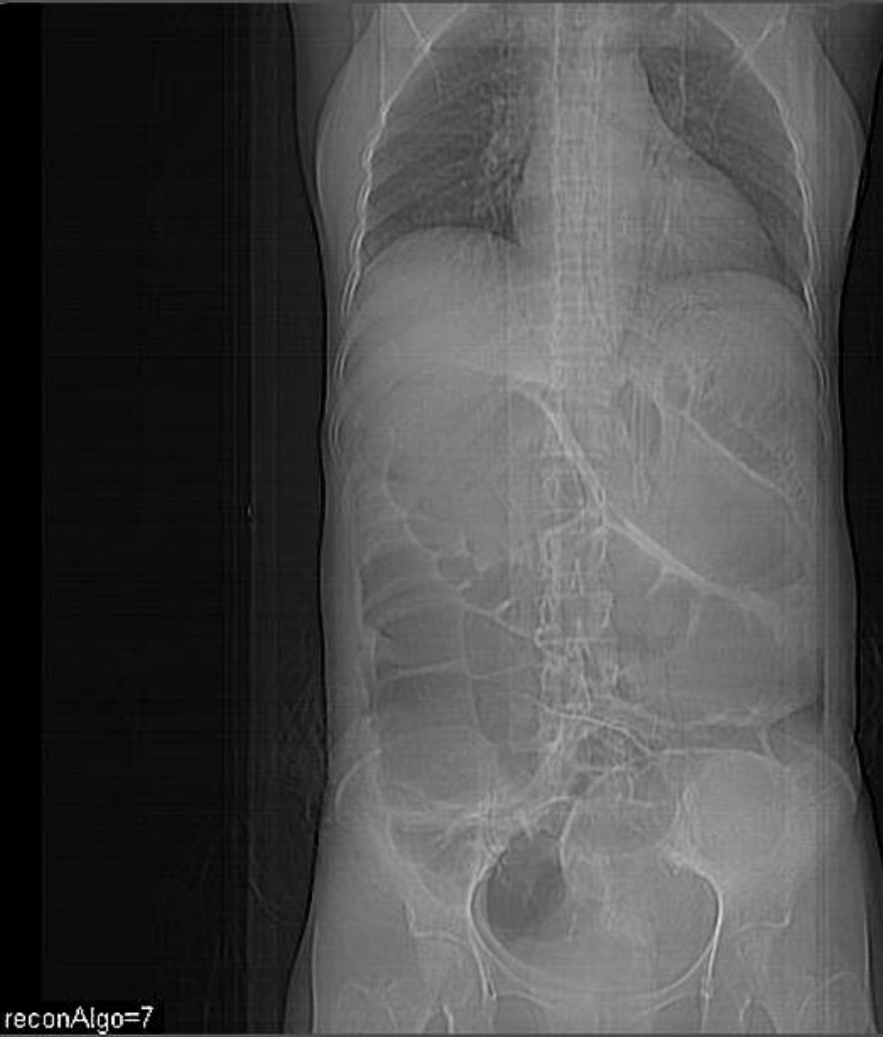
- **Role of imaging :**
- confirm diagnosis
- Identify level ( and possible the cause ) of obstruction.
- Identify any complications.
- plan treatment.

# Investigations

- **Plain radiograph**

- Colonic distension: the large bowel has the ability to distend up to 6 cm .gasses secondary to gas-producing organisms in feces.
- Since the large bowel tend to be peripherally in the abdomen, it may be possible to determine the level of obstruction.
- Collapsed distal colon: very few or no air-fluid levels are found in the large bowel because water is reabsorbed .
- Small bowel dilatation, which depends on
  - duration of obstruction
  - incompetence of the [ileocecal valve](#)
- rectum has little or no air.
- An obstructing tumor may cause complete or incomplete obstruction and result in proximal dilatation of the large bowel from the site of the disease.
- chest x ray to check for free gas under the diaphragm is also a useful screen for bowel perforation. .

- **CT** is currently the most widely used modality for assessment of large bowel obstructions and whether it is partial or complete .
- It is not only able to confirm the diagnosis and localize the location of obstruction but in most instances also is able to identify the cause.
- It should be traced distally until a transition is found. The cause is often present at this point, although sometimes the obstructing lesion is distal to the apparent transition point.
- Complications, such as those of ischemia or perforation, should be assessed for.
- The CT scan almost always performed with IV contrast to delineate blood vessels and allow enhancement of organs to be assessed.
- **Contract enemas have also largely been replaced by CT scan.**



- **Large bowel obstruction due to Rectosigmoid adenocarcinoma**

# Sigmoid volvulus

- **Sigmoid volvulus** is a cause of large bowel obstruction and occurs when the sigmoid colon twists on its mesentery, the sigmoid mesocolon.
- **Plain radiograph**
- Abdominal radiographs will show a large, a haustral dilated loop of the colon, often with a few air-fluid levels.
- The **coffee-bean sign** is a sign on an abdominal plain radiograph of a sigmoid volvulus.



# appendicitis

- CT scan is the most sensitive modality to detect appendicitis although its use should be limited because of radiation dose required and ultrasound should be employed as first line where possible.
- Causes :
  - lymphoid hyperplasia (60%).
  - Appendicolith (33%).
  - Rare: foreign body ,Chrons disease, tumor.
- Investigation
  - US is often that all required ( quick, dynamic and no radiation)
  - Cross sectional imaging is most sensitive ( CT and MRI)
- Role of imaging:
  - Confirm the appendicitis.
  - Assess for peri-appendiceal collection.
  - Assess for perforation.
  - Determine if there is another cause of the symptoms.
  - Appendicolith may also be identified.

# Radiographic features

- **Plain radiograph**

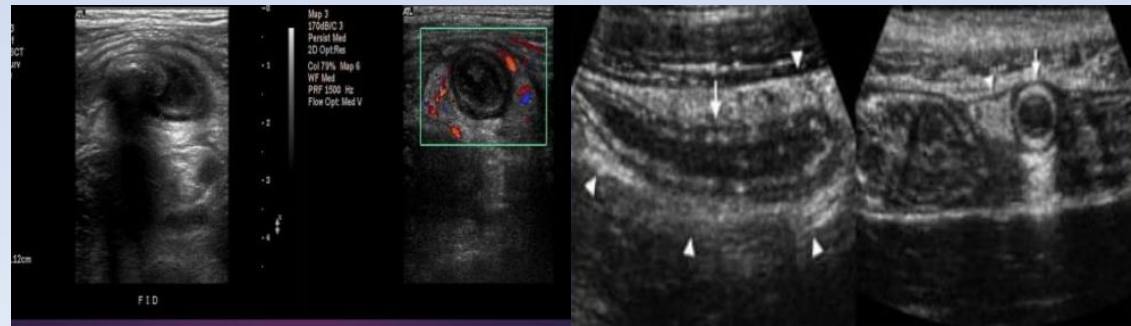
- Plain radiography is infrequently able to give the diagnosis, however, is useful for identifying free gas, and may show an appendicolith in 7-15% of cases . In the right clinical setting, finding an appendicolith makes the probability of acute appendicitis up to 90%.



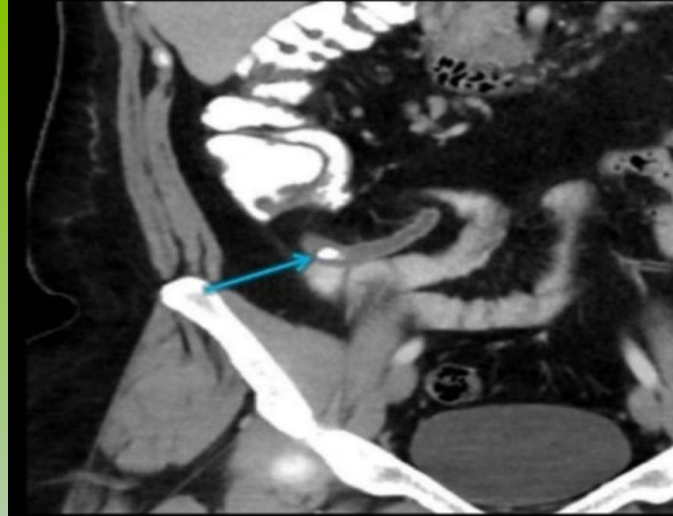


# Ultrasound

- Ultrasound with its lack of ionizing radiation should be the investigation of choice in young patients. With a competent user ultrasonography is reliable at identifying abnormal appendices, especially in thin patients.
- The technique used is known as graded compression, using the linear probe over the site of maximal tenderness, with gradual increasing pressure exerted to displace normal overlying bowel gas.
- **Real time ultrasound signs of acute appendicitis**
- **Direct signs :**
  - Non compressibility of the apendix ( perforation : appendix might be compressible)
  - Diamter of the appendix >6 mm.
  - Single wall thickness >\_ 3 mm
  - Target sign :hypoechoic ( fluid filled lumen), hyperechoic ( mucosa and submucosa),hypoechoic( muscularis layer)
  - Appendicolith : hyperechoic with posterior shadowing.
  - Color doppler and contrast enhanced US : hypervascularity in early satages of AA, hypoavascularity in abcess and necrosis.
- **Indirect sign:**
  - Free fluid surrounding appendix.
  - Local abcess formation.
  - Increased echogenisity of local mesentric fat.
  - Enlarged local mesentric lymph nodes.
  - Thickening of the pritoneum.
  - Signs of secondary small bowel obstruction.



# CT

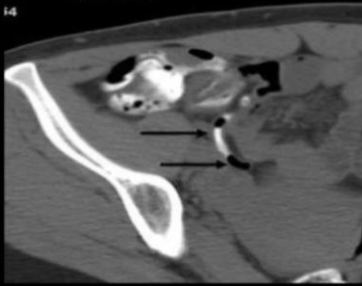


Enlarged appendix with wall thickening and enhancement, appendicolith. Features of acute appendicitis.

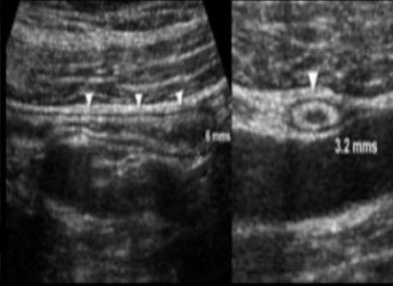
- CT is highly sensitive (94-98%) and specific (up to 97%) for the diagnosis of acute appendicitis and allows for alternative causes of abdominal pain also to be diagnosed.
- Usually performed with IV contrast ( no oral contrast is required)
- CT findings include <sup>1,2,4</sup>:
- appendiceal dilatation (>6 mm diameter) <sup>4</sup>
- wall thickening (>3 mm) and enhancement
- thickening of the cecal apex: cecal bar sign, arrowhead sign
- periappendiceal inflammation: ( fat stranding, fluid , phlegmon and abcess)
- focal wall non-enhancement representing necrosis (gangrenous appendicitis) and a precursor to perforation
- appendicolith
- periappendiceal reactive nodal enlargement:

## NORMAL APPENDIX

CT SCAN



ULTRASOUND



CT scan after oral contrast administration in 32-year-old woman with normal appendix. Note normal appendix with intraluminal enteric contrast material and gas (arrows). Appendix wall is nearly imperceptibly thin.

34-year-old healthy volunteer with a normal appendix. A and B, longitudinal (A) and transverse (B) sonogram, showing the appendix (arrowheads) with a diameter less than the 7 mm cut-off point, surrounded by normal noninflamed fat.

## Caecal bar sign

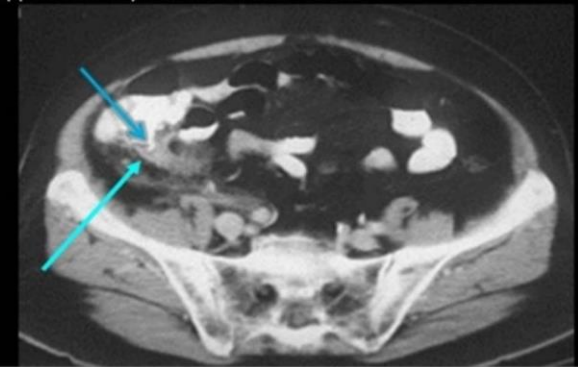
The **caecal bar sign** is a secondary sign in [acute appendicitis](#). It refers to the appearance of inflammatory soft tissue at the base of the [appendix](#), separating the appendix from the contrast-filled [caecum](#).



## Arrowhead sign

The **arrowhead sign** refers to the focal caecal thickening centered on the appendiceal orifice, seen as a secondary sign in [acute appendicitis](#). The contrast material in the cecal lumen assumes an arrowhead configuration, pointing at the appendix.

The arrowhead sign is applicable only when enteric contrast distends the caecum.



Acute appendicitis. This coronal CT image clearly shows the appendix (arrows) extending medially from the caecum. The tip of the appendix is dilated and there is haziness ('stranding') of the fat around it, indicating an inflammatory process. CT is also excellent at identifying the potential complications of appendicitis, such as perforation, abscess formation, portal vein thrombosis and liver abscess formation.

# Inflammatory bowel disease

- Is a generic term used to describe diseases of the GI tract that have an inflammatory cause. Chrons( CD) disease and ulcerative colitis(UC) are the commonest causes.
- CD : any part of the bowel may be affected, skip lesions, fistulation.
- UC :only the colon is affected.
- **Investigations:**
- **Blood tests:** raised inflammatory markers, E.G.CRP,ESR.
- **Coloscopy:** visualize abnormal areas and allow biopsy.
- **Ultrasound:** thickened bowel wall.
- **CT :** used in acutely unwell patient to indentify complications.
- **MRI:** assessment of small bowel or perianal fistula( chrons)
- **Role of imaging**
  1. Radiology can be useful for diagnosis and follow up.
  2. Indentify abnormal bowel
  3. Determine response to therapy
  4. Indentify complications

# Radiological features

## Ultrasound

- Bowel US allow assessment of the whole bowel.
- Findings include: bowel wall thickening , loss of normal bowel wall architecture, increased vascularity, US may also detect complications: localized perforation, interloop abscess and fistula.

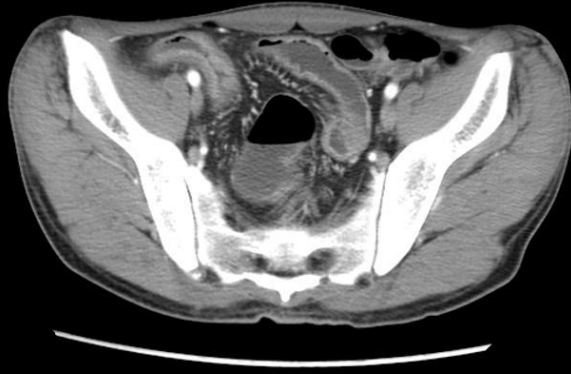
## CT

- CT with both IV and luminal contrast can be used to assess small and large bowel .
- Findings include : bowel wall thickening ,ulceration, strictures ,fistulae (CD),abscess formation and perforation.

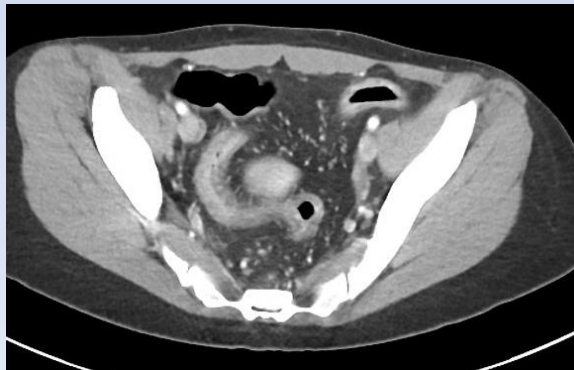
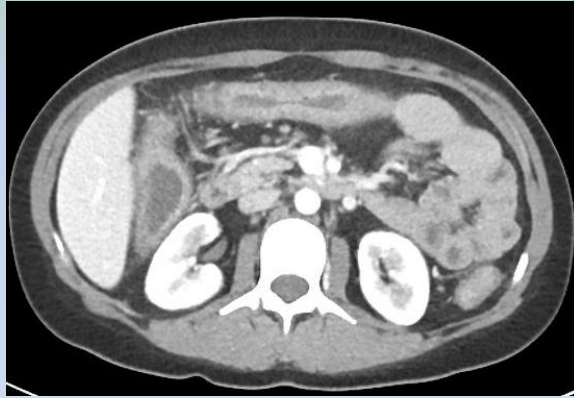
## MRI

- MRI particularly useful in Crohns disease : assessment of small bowel disease and assessment of perianal fistulae.

# Crohn disease



# Ulcerative colitis



Feature	Ulcerative Colitis	Crohn Disease
Distribution	Continuous	Discontinuous ("skip")
Symmetry	Symmetric	Asymmetric
Fat halo sign location	Colon	Small bowel
Side	Left sided or diffuse	Right sided or diffuse
Rectum	Involved	Often not involved
Ileocecal valve	Open	Stenosed
Small-bowel involvement	Terminal ileum only	Any small-bowel segment
Terminal ileum involvement	Backwash ileitis	String sign
Fat	Perirectal fat increased	Mesenteric fat increased
Pericolonic stranding	Rare	Frequent
Lymph nodes	Not enlarged	Usually enlarged
Fistulae	No	Yes
Toxic megacolon	Yes*	Yes
Stricture	Yes	Yes <sup>†</sup>
Abscess	Yes	Yes <sup>†</sup>

# Colorectal cancer

- Is the most common cancer of the GIT and the second most frequently diagnosed malignancy in adults .CT and MRI are the modalities most frequently used for staging.

## Investigation:

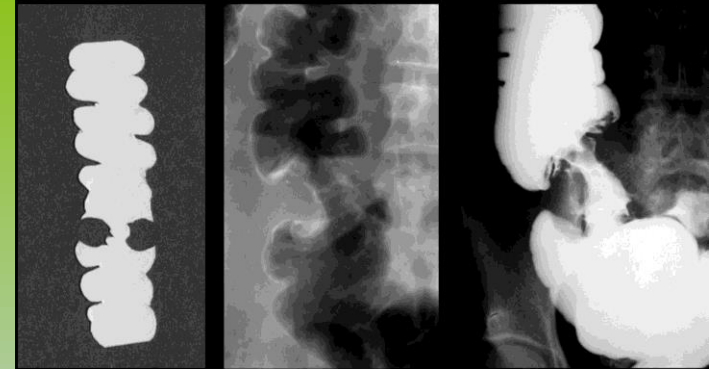
- CT for diagnosis and staging.
- MRI for local staging in rectal carcinoma.
- CT colonoscopy for screening .
- Barium studies no longer used in most centers.

## Role of imaging:

- Initial diagnosis: virtual colonoscopy.
- Abdominal CT scan in the acute patient.
- Local staging in rectal carcinoma by MRI.
- Staging by CT ( chest , abdomen and pelvis).



# Radiological features

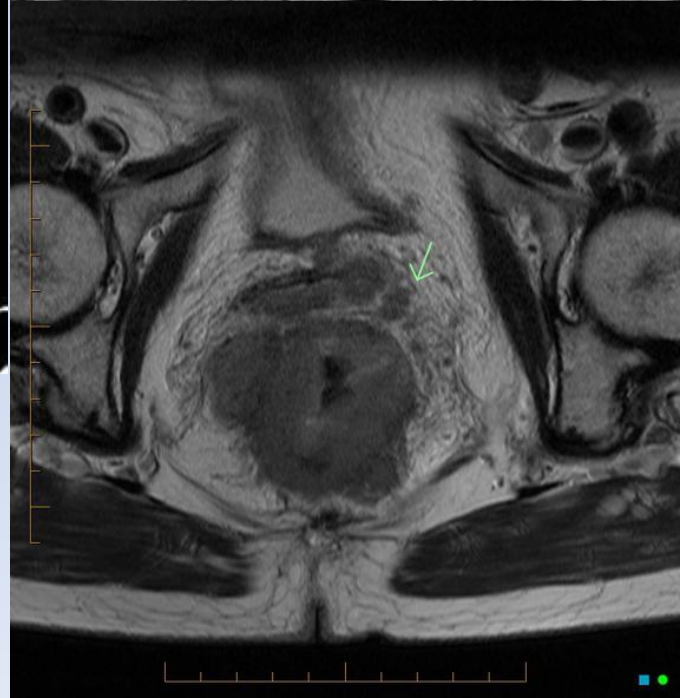
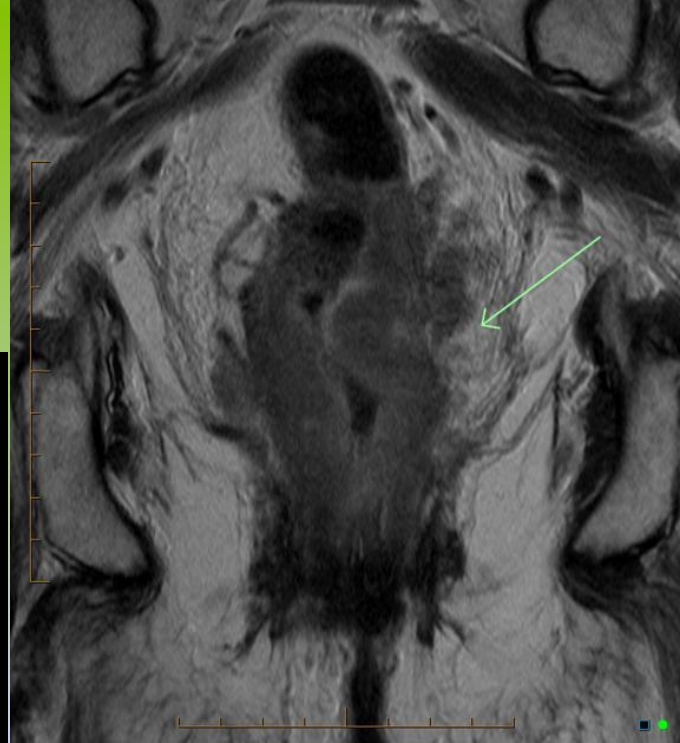


## CT :

- Soft tissue density masses arising from the bowel wall.
- Challenging to see small tumors on CT.
- Low sensitivity for bowel cancers(45-77%)
- Bowel wall thickening with luminal narrowing.
- Proximal luminal dilatation.
- Ulceration in larger mass.
- Complications ,e.g. fistula, obstruction ,intussusceptions, perforation.



- Circumferential wall thickening of the rectum with narrowing of the lumen.



# Gastric cancer

## Investigations

- **Endoscopy** used to visualize and biopsy.
- **CT** used for staging of metastatic disease.

## Role of imaging:

- Imaging is limited to the assessment of distant metastatic disease in gastric cancer.
- Plain radiograph and ultrasound are of limited value.
- CT is the modality that is used for assessment of distant spread.
- PET/CT is used in some centers.

## Radiographic features:

- CT:
- performed with negative contrast ( distended with water or gas)
- Polyploid mass in the stomach.
- Focal wall thickening.
- Ulceration.



- Marked circumferential thickening of the gastric wall (linitis plastica) associated with multiple lymphadenopathy and multiple round hypodense lesions corresponding to hepatic metastasis

**THANK YOU!**

