

GIT IMAGING



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OBJECTIVES

1. Describe the modalities available for GIT imaging
2. Discuss the indications, contraindications and patient preparation for each of the modalities
3. Highlight the limitations of the described imaging modalities
4. Present examples of pathological processes as demonstrated in each of the modalities
5. Bring out a decision making protocol for imaging in acute abdomen setting



ANATOMICAL DIVISIONS

Fore-gut

- a. Oral cavity
- b. Pharynx
- c. Oesophagus
- d. Stomach
- e. Part of duodenum

2. Mid-gut

- a. Part of duodenum
- b. Small bowel – jejunum, ileum
- c. Part of large bowel – caecum, ascending, mid-transverse colon

3. Hind-gut

Mid-transverse, descending, sigmoid colon, rectum, anus

4. Accessory organs/tissues

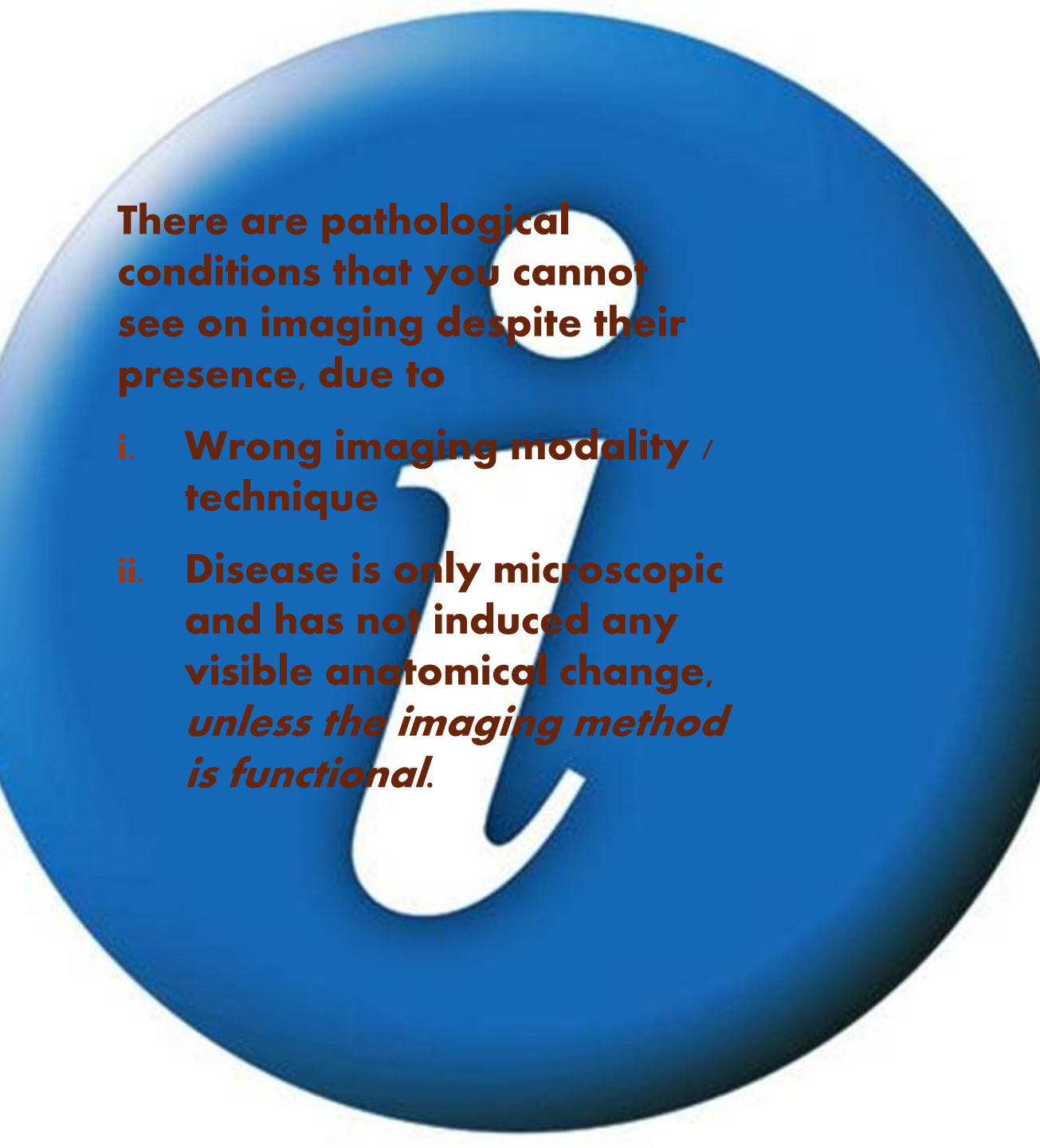
- Salivary glands
- Liver
- Gall bladder
- Pancreas
- Vascular structures
- Neural structures
- Lymphatic system



GIT PATHOLOGY

1. Congenital anomalies
2. Inflammation
3. Obstruction
4. Neoplasia
5. Trauma
6. Motility disorders
7. Vascular
8. Metabolic





There are pathological conditions that you cannot see on imaging despite their presence, due to

- i. Wrong imaging modality / technique**
- ii. Disease is only microscopic and has not induced any visible anatomical change, *unless the imaging method is functional.***



MODES OF GIT IMAGING

1. Plain radiography
2. Contrast radiography
3. Ultrasound
4. CT Scan
5. MRI Scan
6. Radionuclide imaging (Nuclear Medicine)
7. Angiography



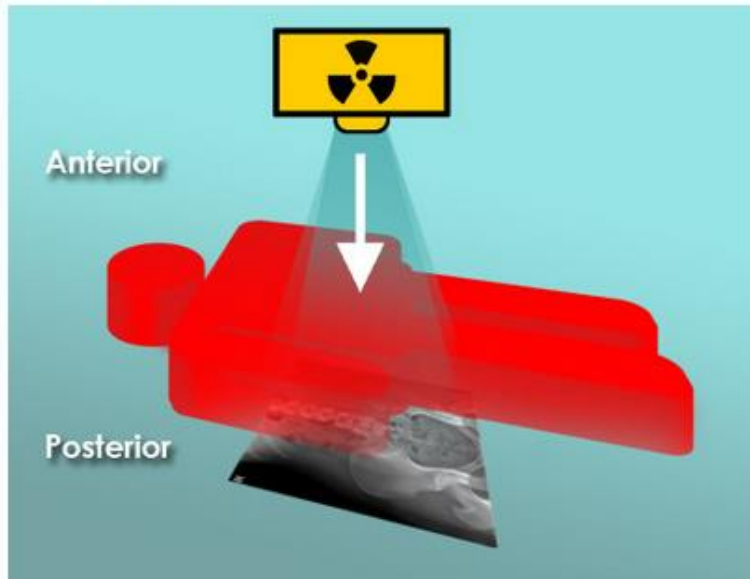
PLAIN RADIOGRAPHY

- Plain radiographs are frequently still the first investigation in the **acute abdomen**
- For non-acute situations, the relatively small yield of information from a plain radiograph does not justify the radiation dose that it entails, unless it is on follow up basis
- Plain radiographic findings must corroborate with clinical findings: sometimes even obvious signs can be non-specific generating a plethora of differential diagnoses. A good example is the presence of air-fluid levels which may be benign or a pointer to obstruction

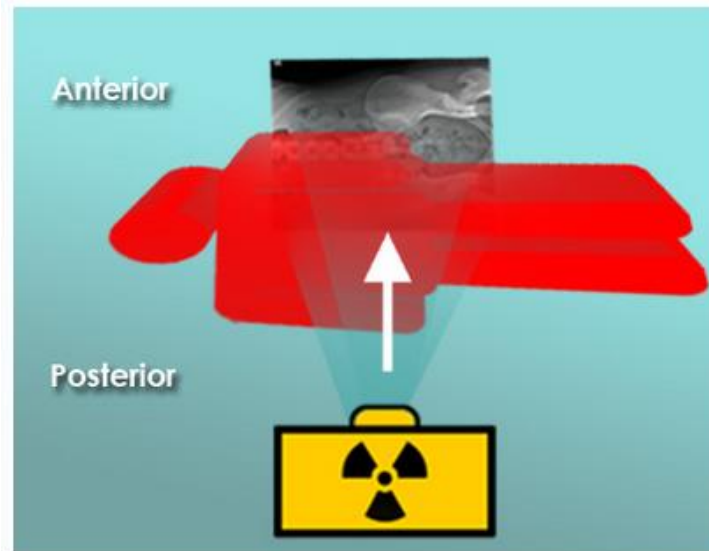


PLAIN RADIOGRAPHY: PROJECTIONS

Supine AP projection



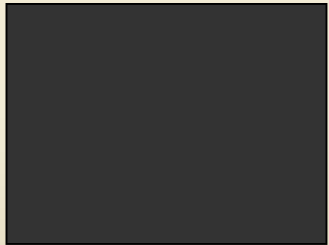
Decubitus positioning



AXR - THE DENSITIES



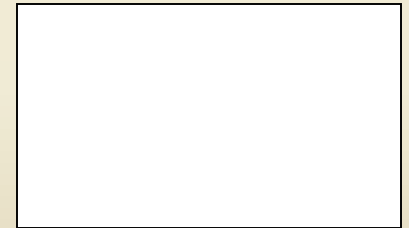
Air



Fat



Soft tissues



Calcified structures



ABDOMINAL X-RAY: SYSTEMATIC APPROACH

- Check the patient details
- Assess quality (including presence of artifacts).
- Bowel gas
- Soft tissues
- Bones
- Abnormal calcifications



AXR – AIR DISTRIBUTION

Intra-luminal

Normal

- Gastric bubble (erect film)
- Large bowel
- Very minimal or non-detectable in small bowel

Check for abnormalities

- Size
- Distribution: peripheral – large bowel, central – small bowel

Extra-luminal

- Always abnormal
- Key areas to look at
 1. Subdiaphragmatic (erect film)
 2. Bowel wall
 3. Liver – portovenous, biliary.



AXR - AIR DISTRIBUTION



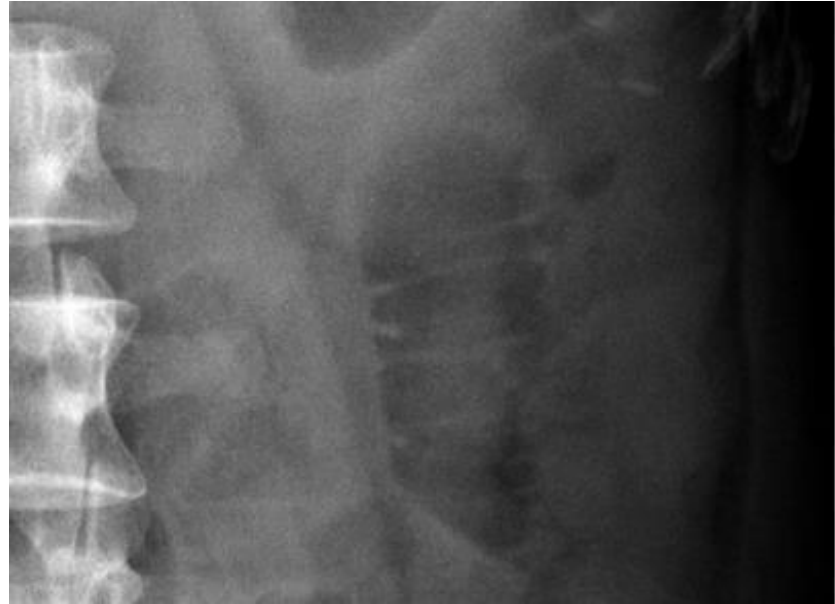
Normal findings



AXR - AIR DISTRIBUTION



Stomach



Small bowel



AXR - AIR DISTRIBUTION



Large bowel



AXR- SOFT TISSUES



Liver: Note the surgical clip within the gall bladder fossa from previous surgery



Lung bases: vascular markings are visible.



AXR- SOFT TISSUES



Psoas muscles shadows



Left kidney



AXR- SOFT TISSUES



Spleen, left kidney and psoas muscle



Urinary bladder



AXR – BONES



AXR – ARTIFACTS AND CALCIFICATIONS



AXR – ABNORMAL AIR DISTRIBUTION – INTRALUMINAL



Supine



Small bowel obstruction

Erect



AXR – ABNORMAL AIR

DIST

UMINAL



Large bowel obstruction – supine



AXR – AIR DISTRIBUTION – INTRALUMINAL ABNORMAL



Paralytic ileus



Sigmoid volvulus



meteorism



ABNORMAL INTRALUMINAL AIR PATTERN. LOCALISATION

Feature	Obstruction	
	Small bowel	Large bowel
Bowel diameter (cm)	>3 and <5	>5
Position of loops	Central	Peripheral
Number of loops	Many	Few
Fluid levels (on erect film)	Many, short	Few, long
Bowel markings	Valvulae (all the way across)	Haustra (partially across)
Large bowel gas	No	Yes



AXR – ABNORMAL AIR DISTRIBUTION – EXTRALUMINAL



Air under the diaphragm

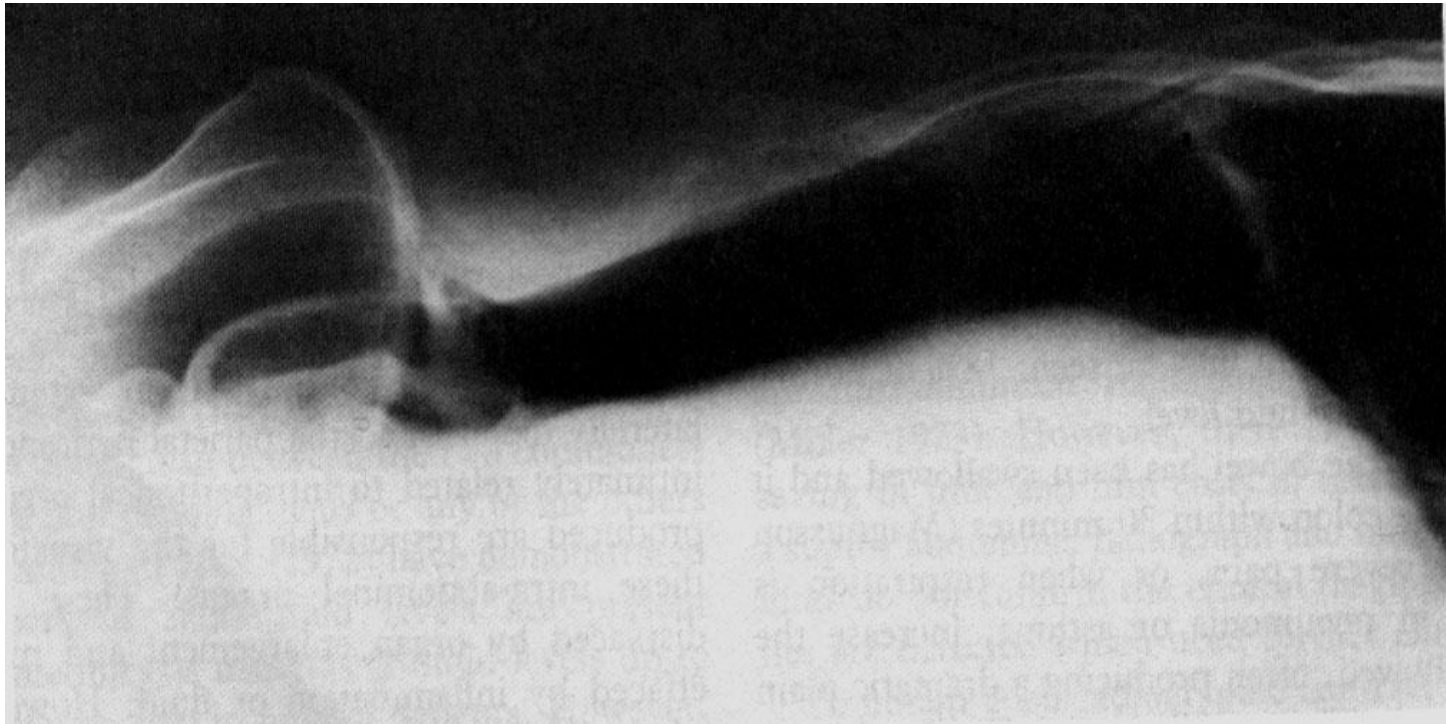


Rigler's sign – Double wall sign

Pneumoperitoneum – secondary to perforated gut



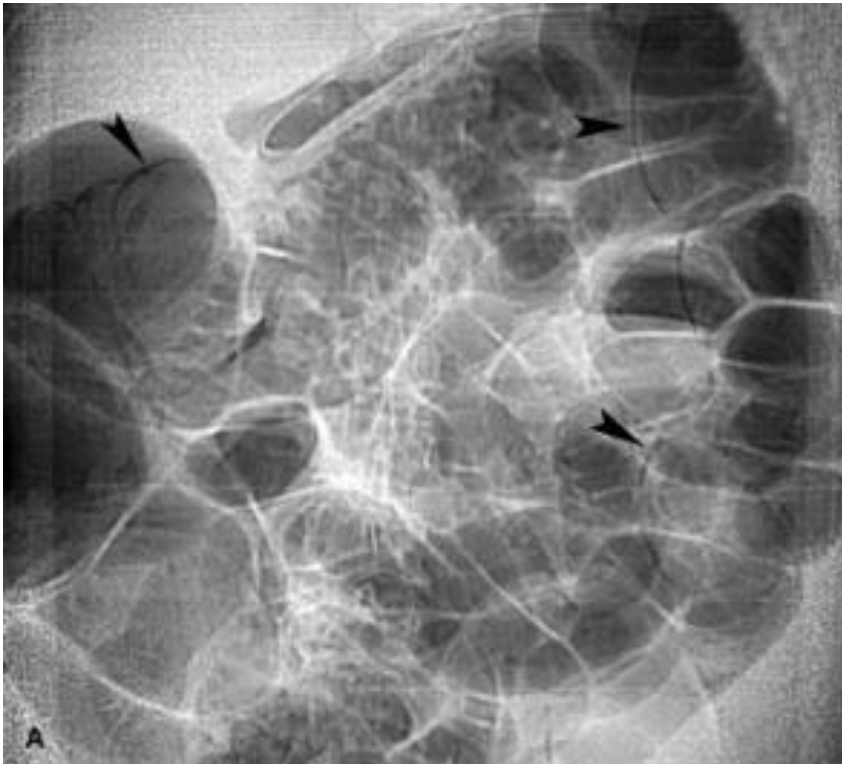
AXR – ABNORMAL AIR DISTRIBUTION - EXTRALUMINAL



Pneumoperitoneum – Lt lateral decubitus view



AXR – ABNORMAL AIR DISTRIBUTION – INTRAMURAL



Pneumatosis intestinalis

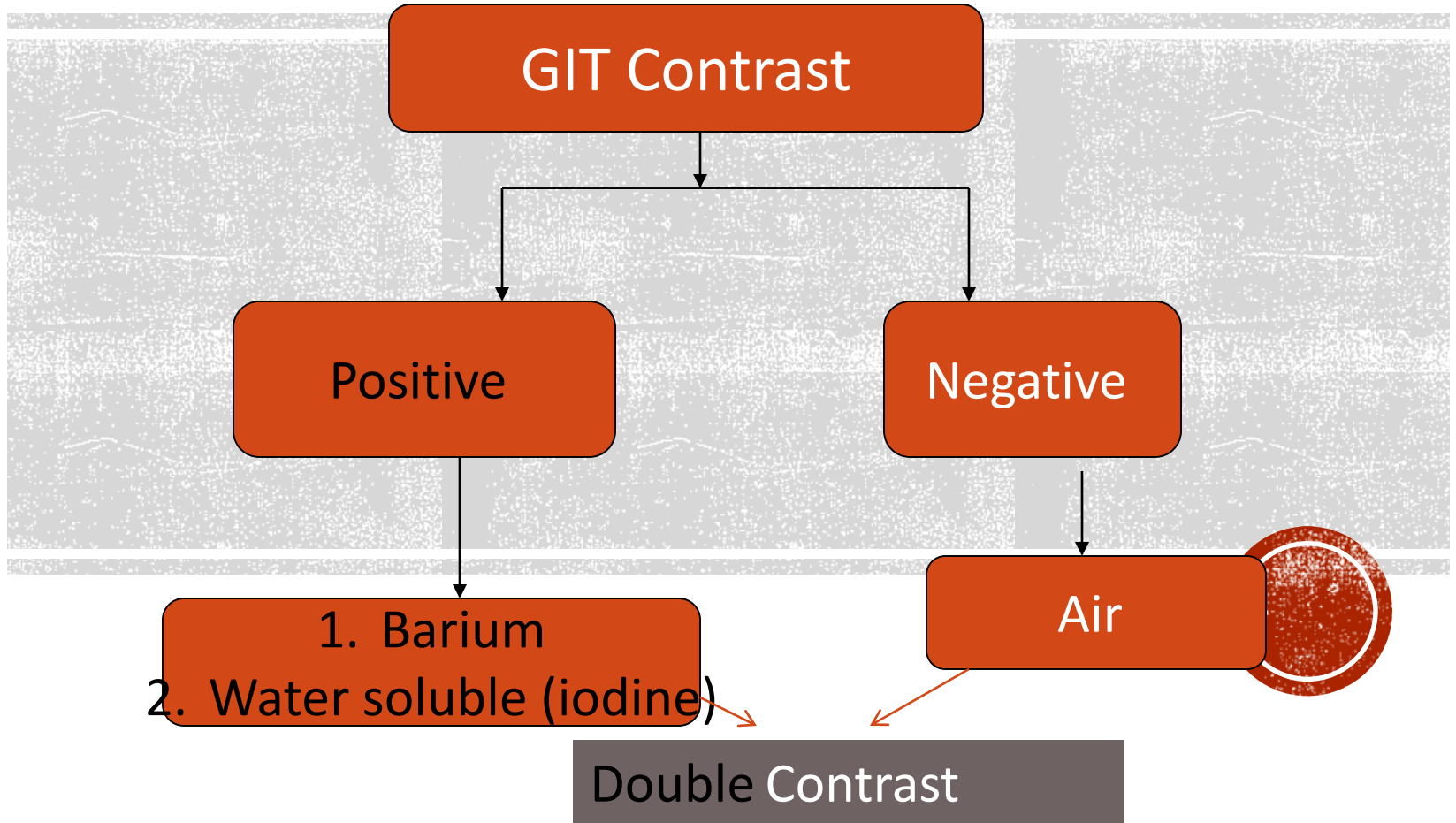


**AIR SHALL
ONLY BE
KEPT WITHIN
THE BOWEL
FOR IT TO BE
CONSIDERED
NORMAL**

**And in the
right
proportions**



GIT Contrast Radiography



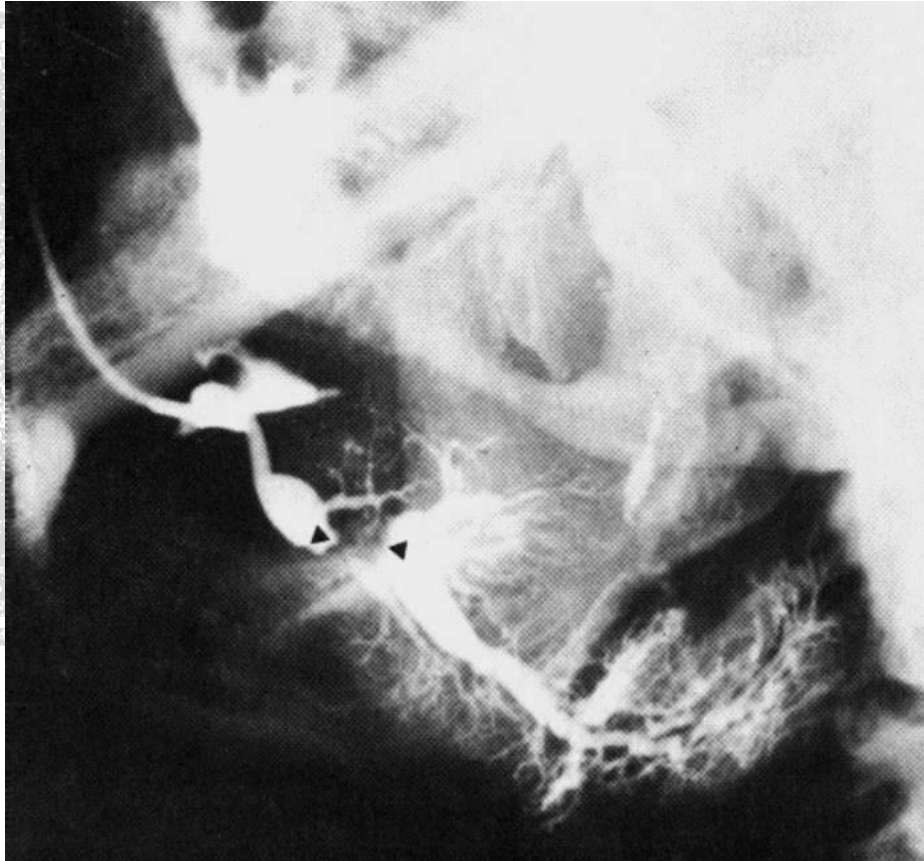
GIT Contrast Radiography – Modalities

- Sialography
- Ba. Swallow
- Ba. Meal
- Ba. meal follow through
- Small Bowel Enema (Enteroclysis)
- Ba. Enema
- Colostrogram, Sinogram, Fistulogram



GIT Contrast Radiography

- Sialography



Sialography

- Cannulation of major salivary gland ducts
- Water soluble contrast media is used
- Demonstrates luminal anatomy and pathology

INDICATIONS

1. Pain
2. Swelling
3. Sjogren's syndrome
4. Sicca
5. Post-traumatic, post-operative strictures, cysts, fistulas



GIT Contrast Radiography

- Barium Swallow

Indications

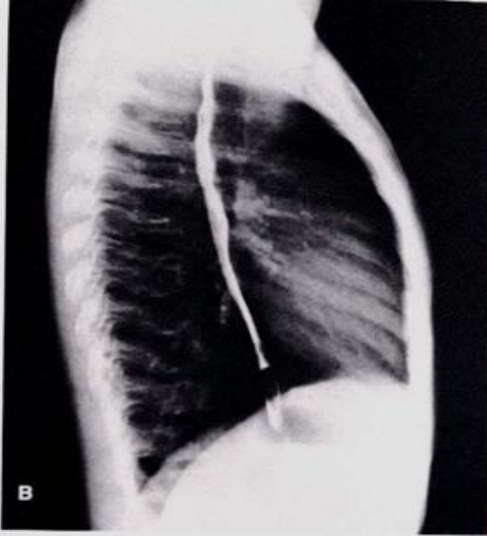
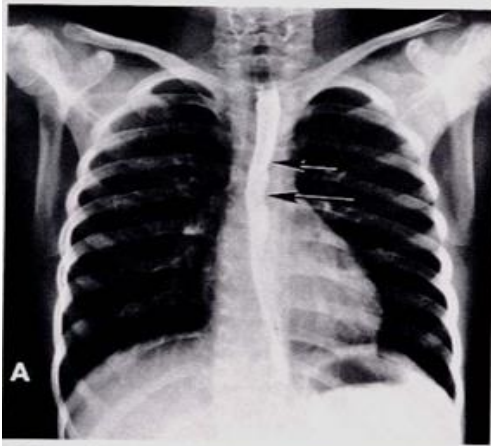
- Dysphagia
- Pain on swallowing
- Hematemesis
- Assessment of tracheo-oesophageal fistula (where plain films not diagnostic)
- Follow up following oesophageal surgery

NB: In assessment of perforation, water soluble contrast is used instead of barium.



GIT Contrast Radiography

- Barium Swallow



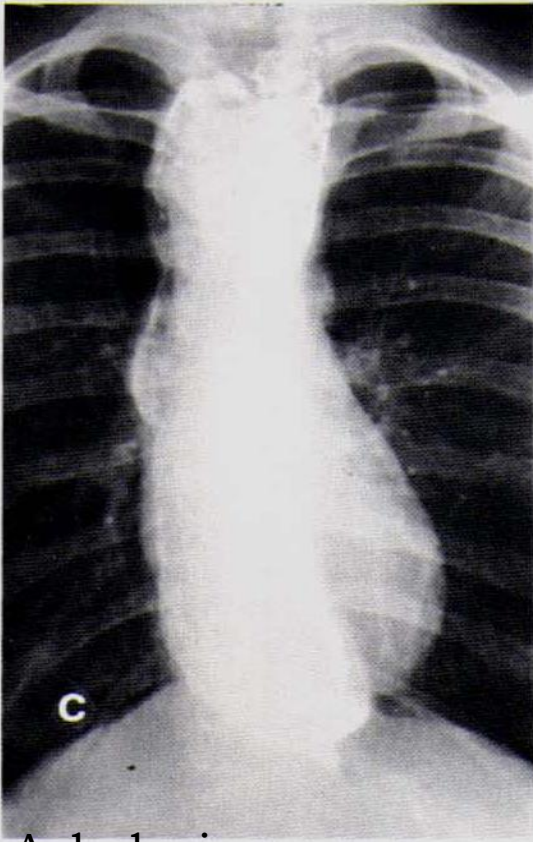
Normal findings



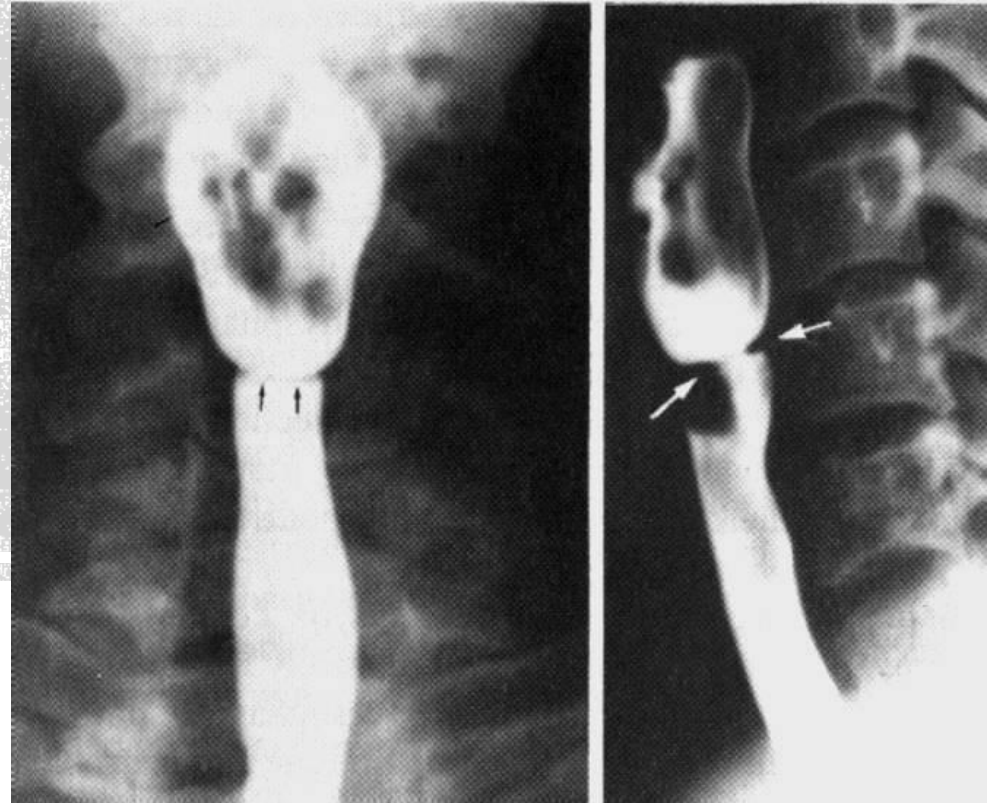
Physiological constrictions may be seen – cricopharyngeus muscle, aortic arch, left main bronchus, left atrium and gastroesophageal junction.

GIT Contrast Radiography

- Barium Swallow



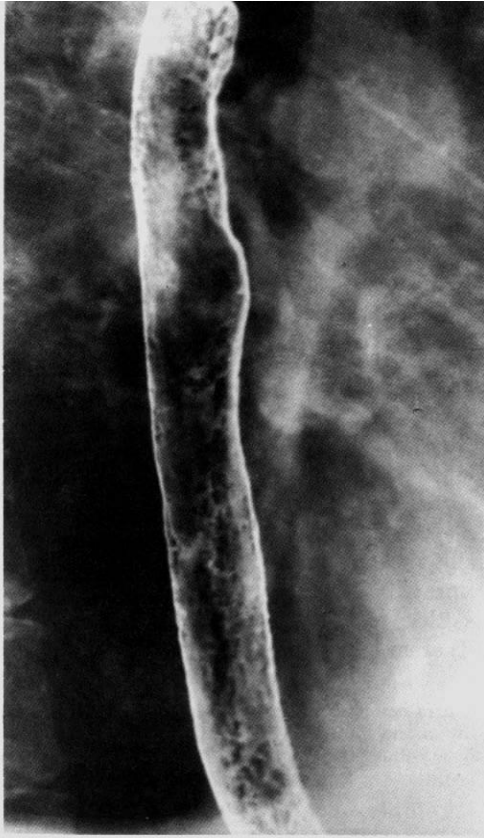
Achalasia
(seen on
single
contrast)



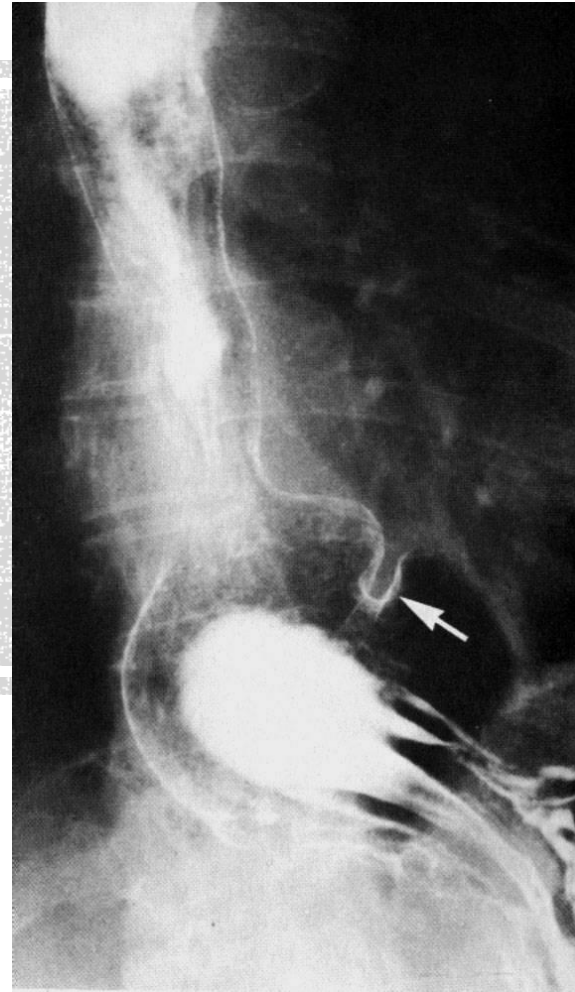
Oesophageal webs (seen on double
contrast)

GIT Contrast Radiography

- Barium Swallow



Oesophageal candidiasis (on double contrast)

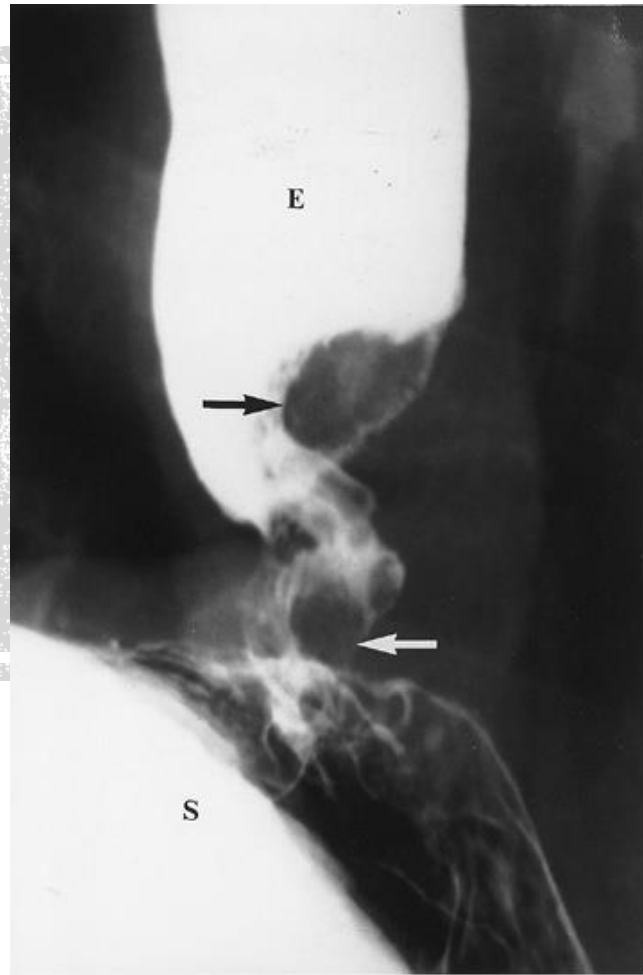


Hiatal hernia (double contrast)

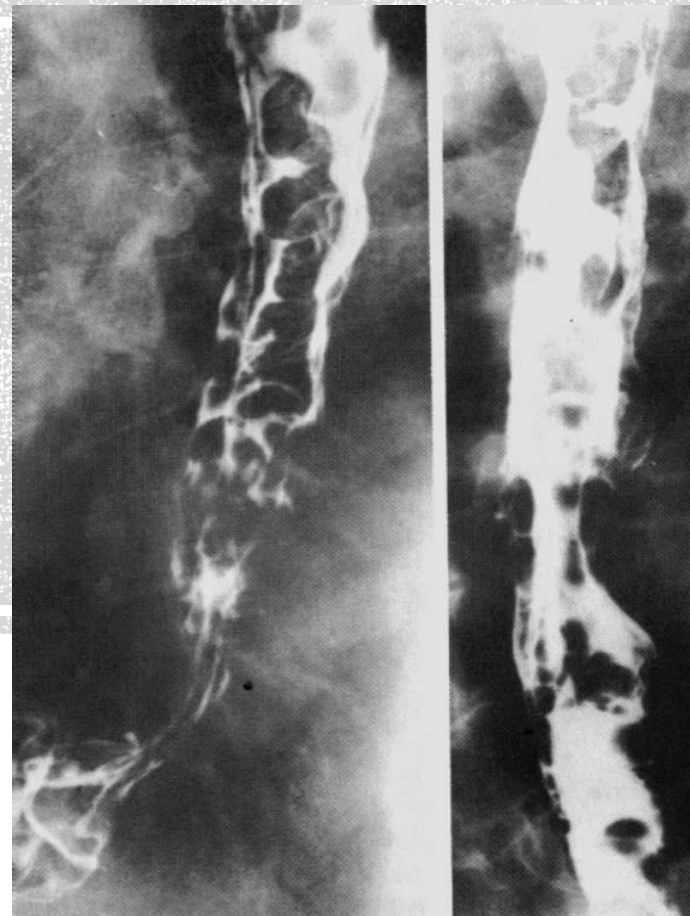


GIT Contrast Radiography

- Barium Swallow



Ca. oesophagus
(double contrast)



Oesophageal varices (double
contrast)

GIT Contrast Radiography

- Barium Meal

Double contrast is an examination of choice in adults. Single contrast is used in children and very ill adults.

INDICATIONS

- dyspepsia
- weight loss.
- Follow up after surgery
- suspected gastrointestinal bleeding or unexplained iron deficiency
- partial obstruction



GIT Contrast Radiography

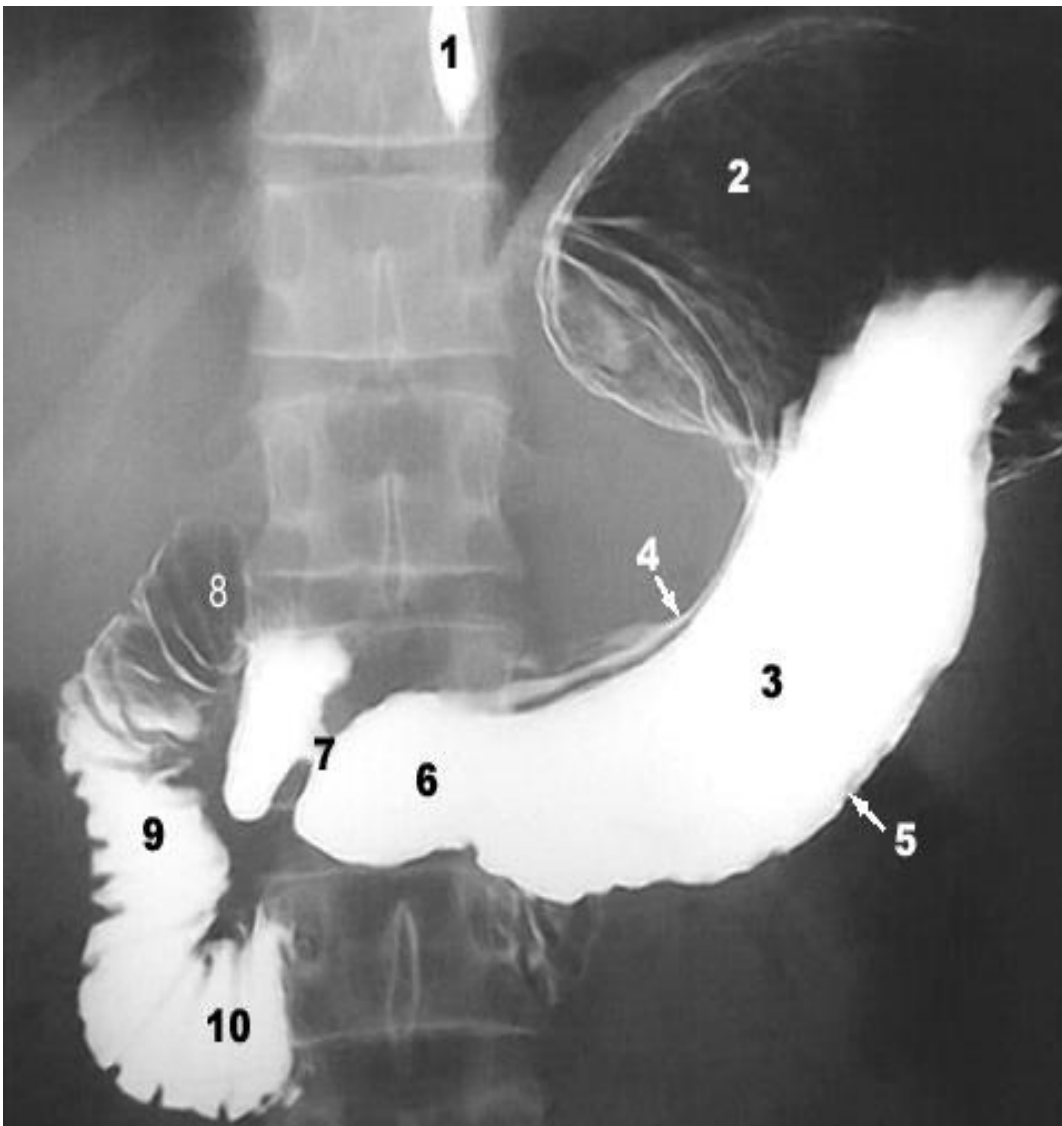
- Barium Meal

Contraindications

- Complete large bowel obstruction
- Suspected perforation (there is up to 50% mortality if barium leaks into the peritoneum).



Normal Ba. Meal (Double contrast)



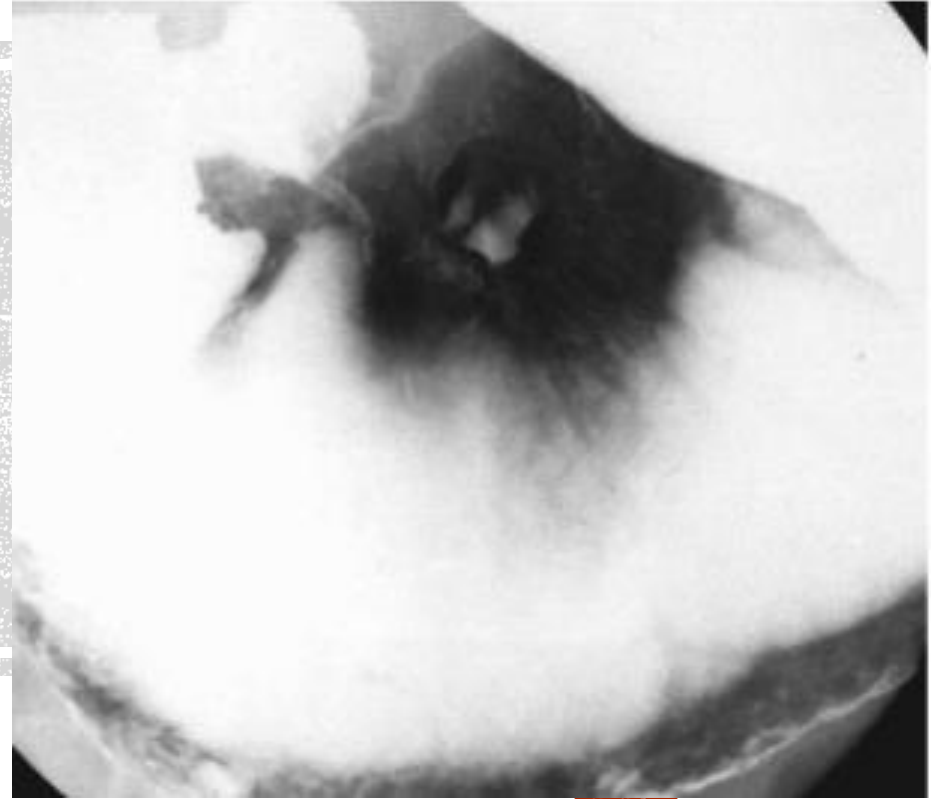
- 1 esophagus 2 fundus of the stomach 3 body of the stomach
4 lesser curvature 5 greater curvature 6 pyloric antrum
7 pylorus 8 duodenal bulb (1st half of 1st stage of duodenum)
9 2nd stage of duodenum 10 3rd stage of duodenum

GIT Contrast Radiography

- Barium Meal (Double Contrast)

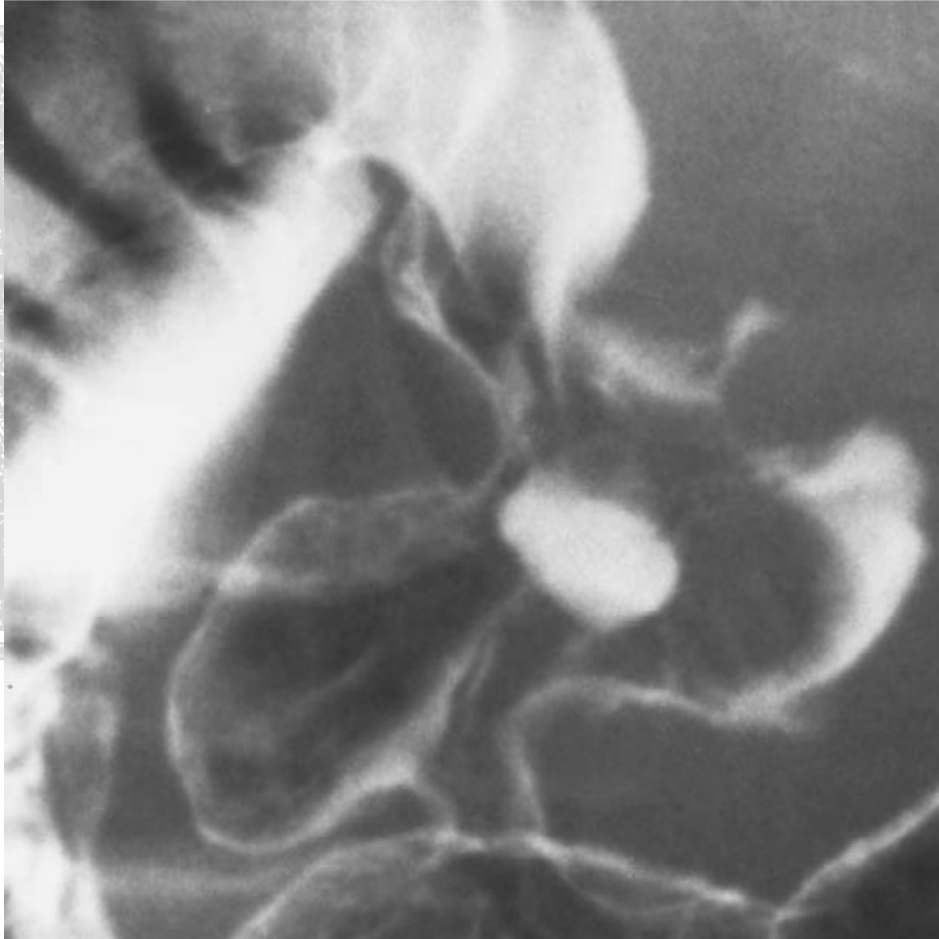


Stomach ulcer



GIT Contrast Radiography

- Barium Meal



Duodenal Ulcer



GIT Contrast Radiography

- Barium Meal Follow Through

Indications

- Pain
- Diarrhoea e.g. malabsorption syndromes
- Bleeding
- Partial obstruction

Contraindications

As for Ba meal

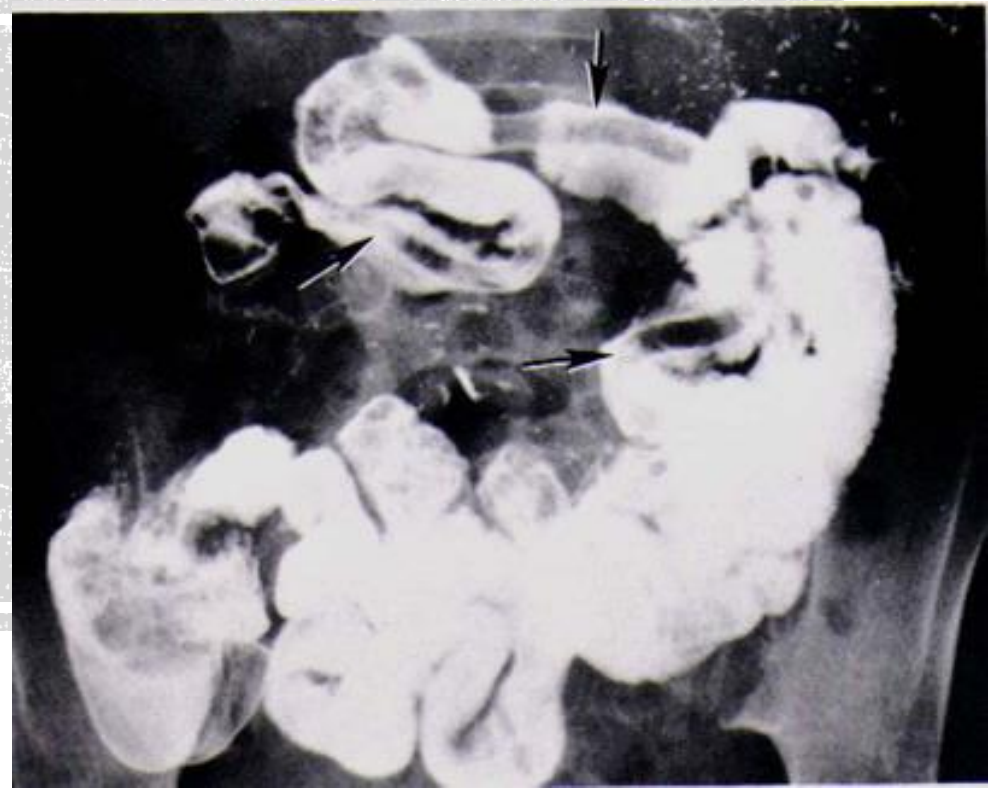


GIT Contrast Radiography

- Barium Meal Follow Through



Normal



Ascariasis

GIT Contrast Radiography

- Small Bowel Enema (Enteroclysis)

- Gives better visualization of small bowel than that achieved by barium meal follow through.
- However it has the disadvantage of being unpleasant to the patient due to intubation and time consuming to the radiologist.

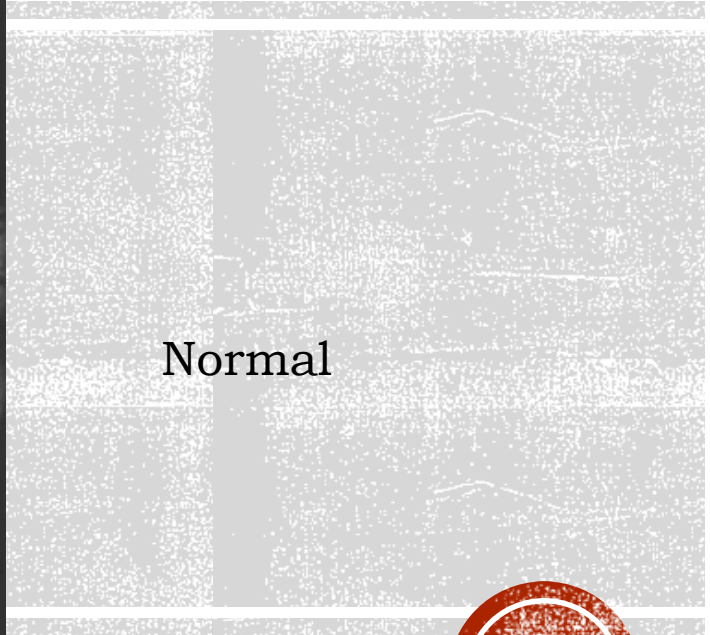
Indication

- Same as for Barium meal follow through



GIT Contrast Radiography

- Small Bowel Enema (Enteroclysis)



GIT Contrast Radiography

- Ba Enema

Examination of the large bowel.

It is currently getting replaced by CT colonography.

Two methods commonly used.

- i. Double contrast: This is examination of choice to demonstrate mucosal pattern.
- ii. Single contrast: This is used in children since it is not usually necessary to demonstrate mucosal pattern. It can also be used to reduce an intussusception



GIT Contrast Radiography - Ba Enema

Indications

- Change in bowel habits
- Unexplained abdominal pain
- Melena
- Obstruction e.g. intussusception

Contraindications

- Toxic megacolon
- Pseudomembranous colitis
- Rectal biopsy within previous 3 days



GIT Contrast Radiography

- Ba Enema

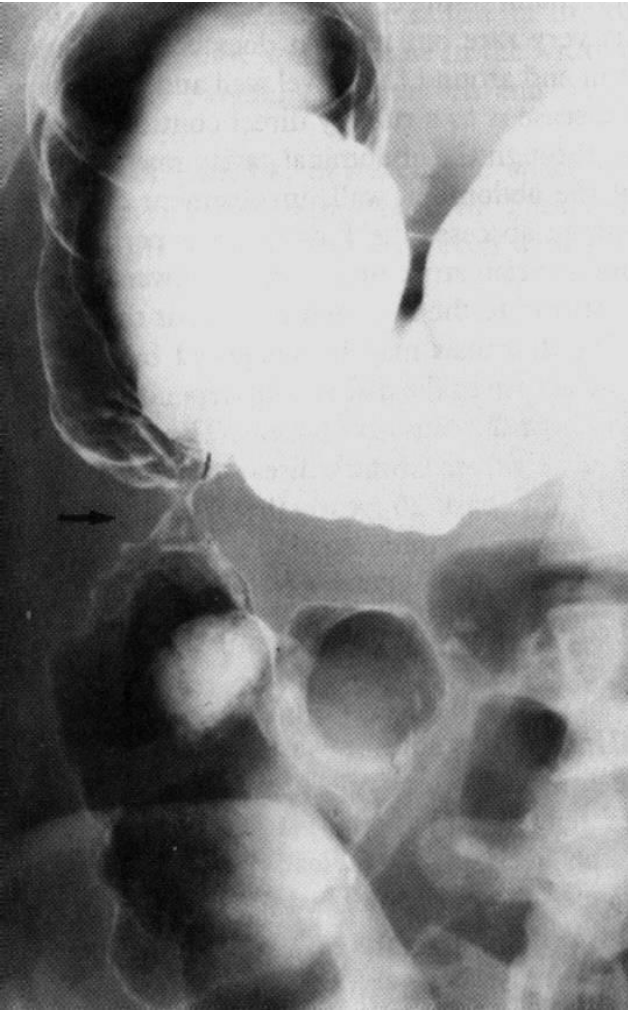


Normal

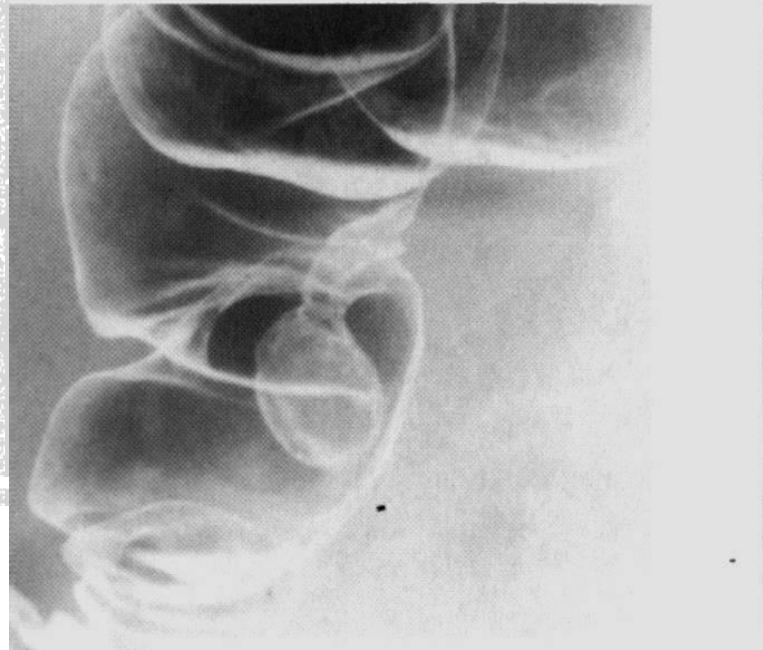


GIT Contrast Radiography

- Ba Enema



Ca. colon (ascending portion)

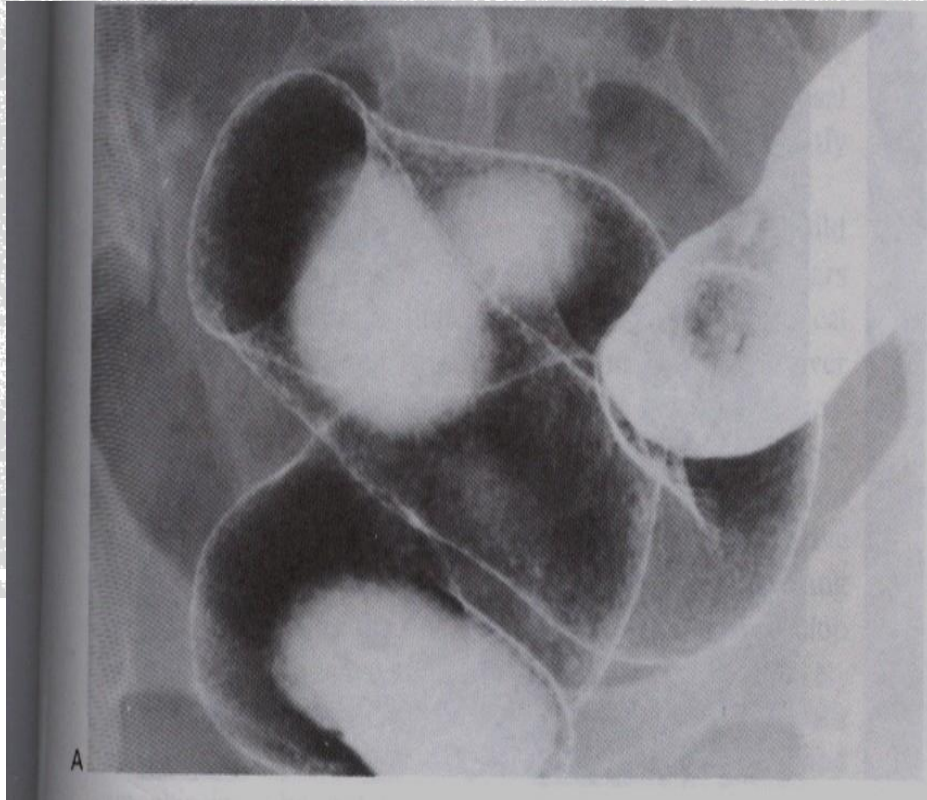


Colonic polyp



GIT Contrast Radiography

- Ba Enema



Ulcerative colitis



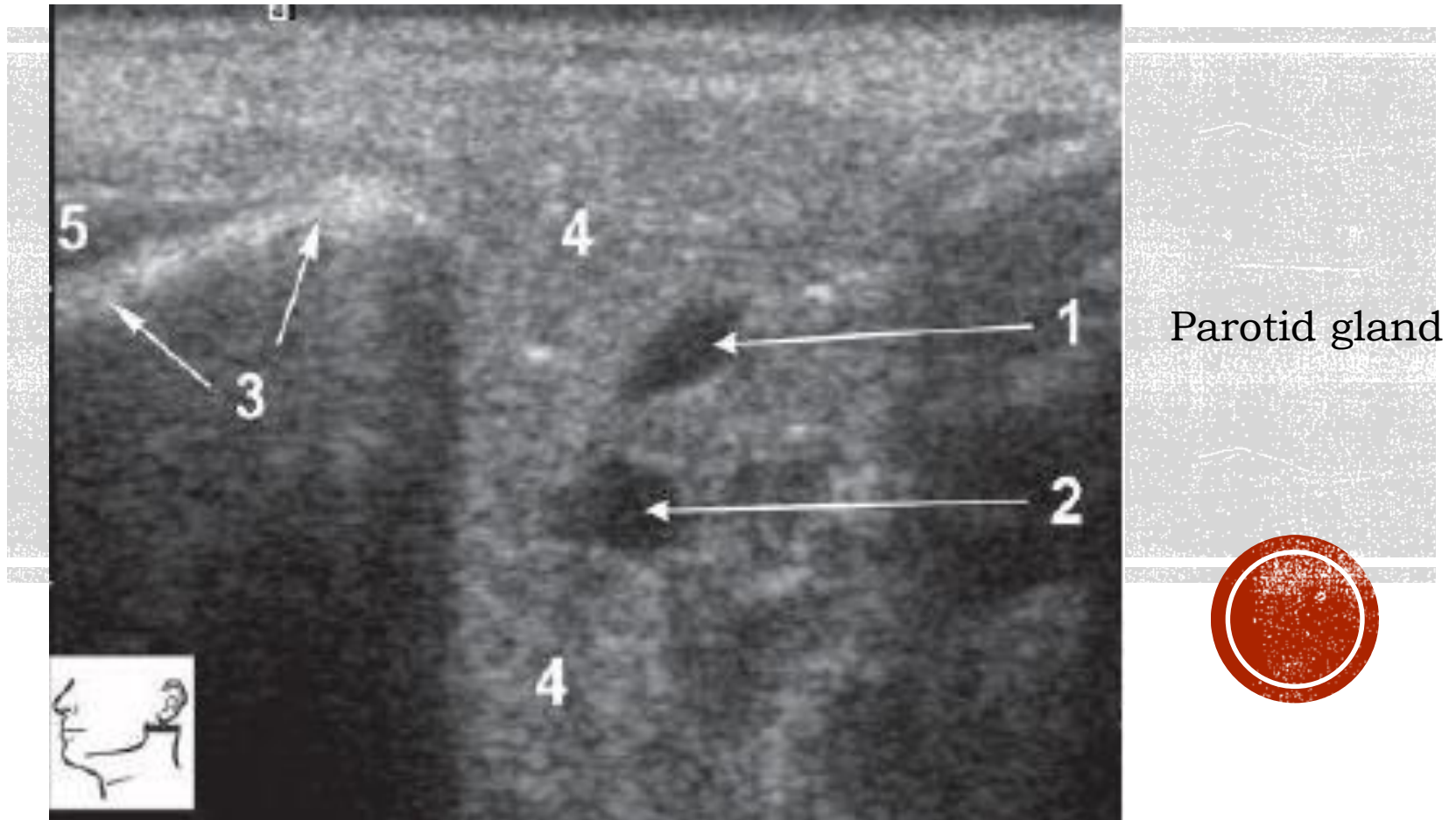
Ultrasound in GIT Imaging

Though of limited value in imaging the GIT, for the reason that gas produces poor sound penetration, it can be useful in the following areas

1. Suspected masses
2. Suspected peritoneal fluid collections
3. Suspected calculus
4. Suspected inflammatory conditions like appendicitis
5. Suspected intussusception
6. Suspected hernias
7. The jaundiced patient



Ultrasound in GIT Imaging - Salivary Glands

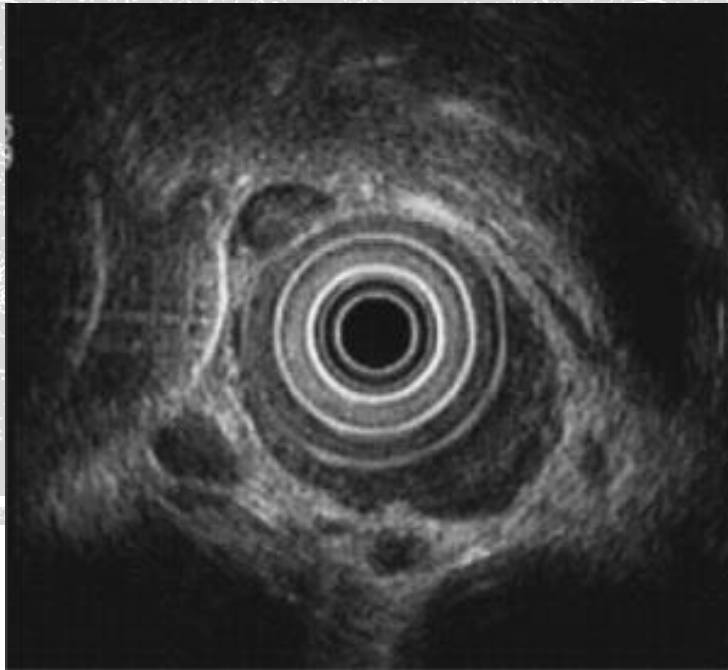


1- retromandibular v. 2 – ECA 3- mandible 4 – parotid gland

5 – masseter M

Ultrasound in GIT Imaging

- Oesophagus



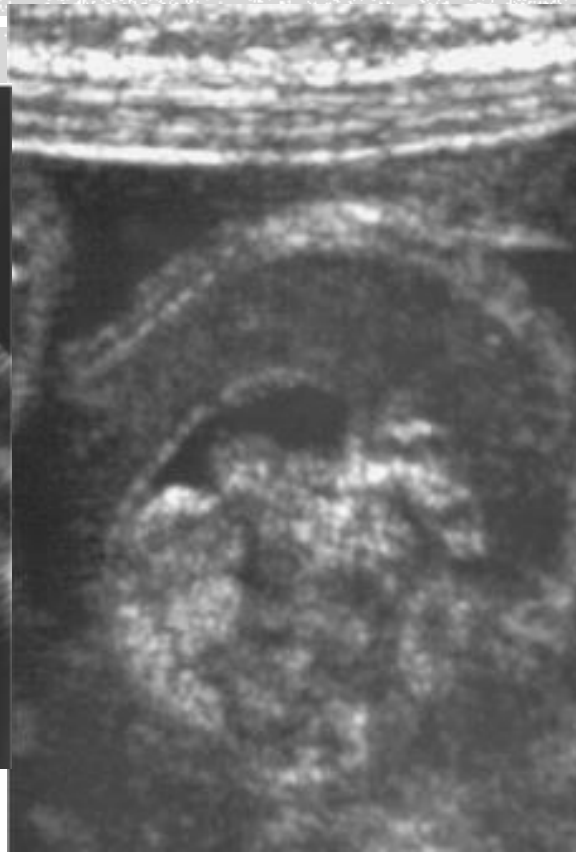
Endoluminal ultrasound demonstrating intramural involvement from Ca. oesophagus



Ultrasound in GIT Imaging



Hypertrophic pyloric stenosis

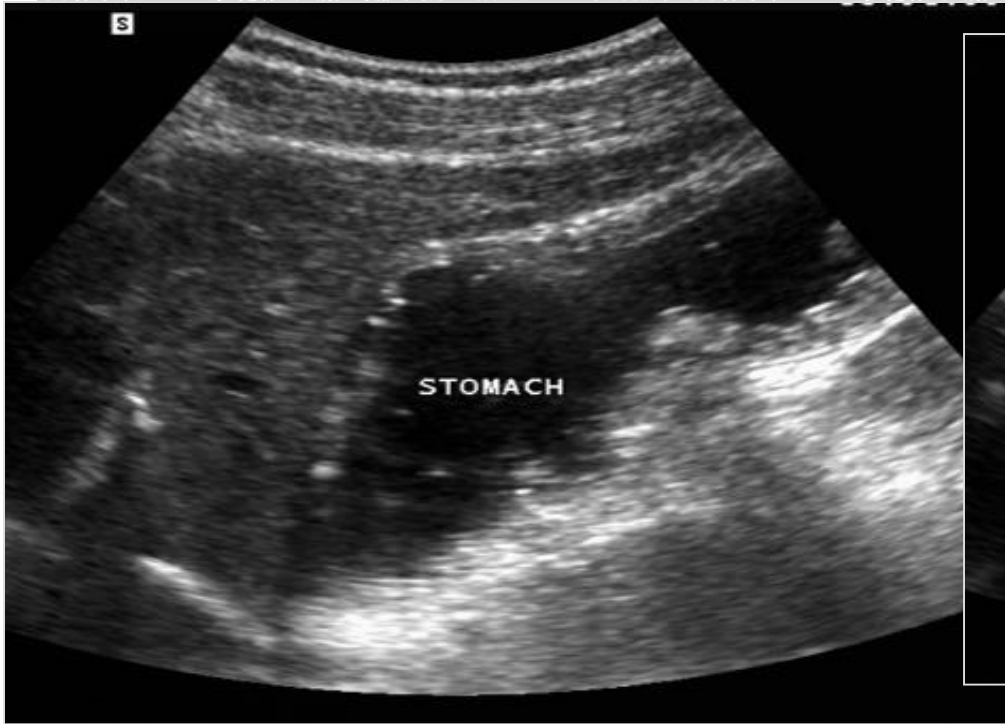


Intussusception

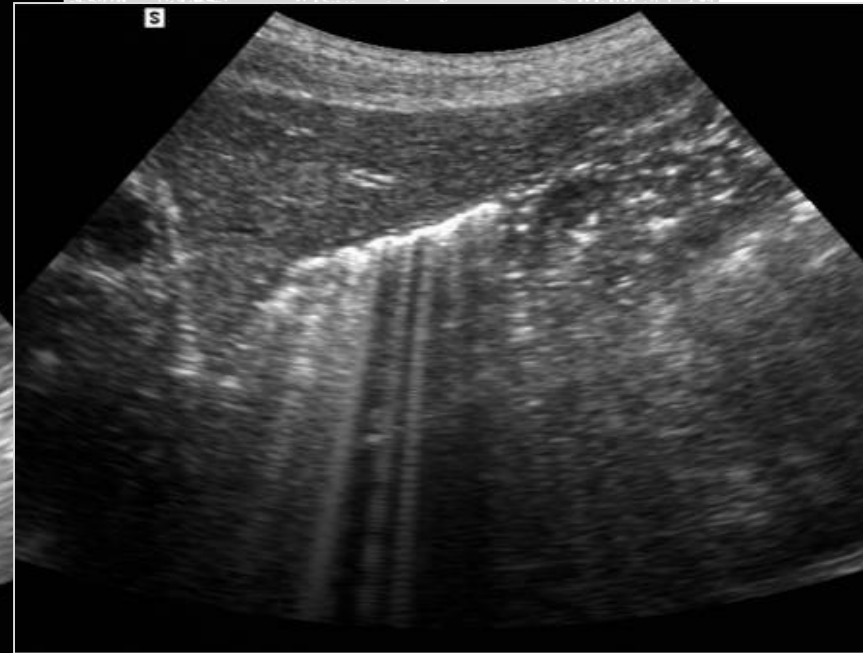


Appendicitis

Ultrasound in GIT Imaging



Fluid filled stomach

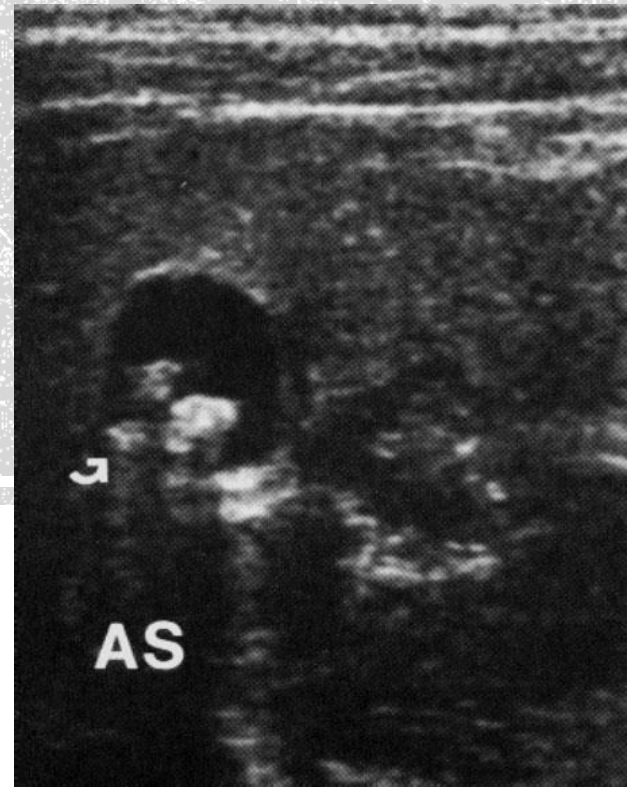


Gas filled stomach

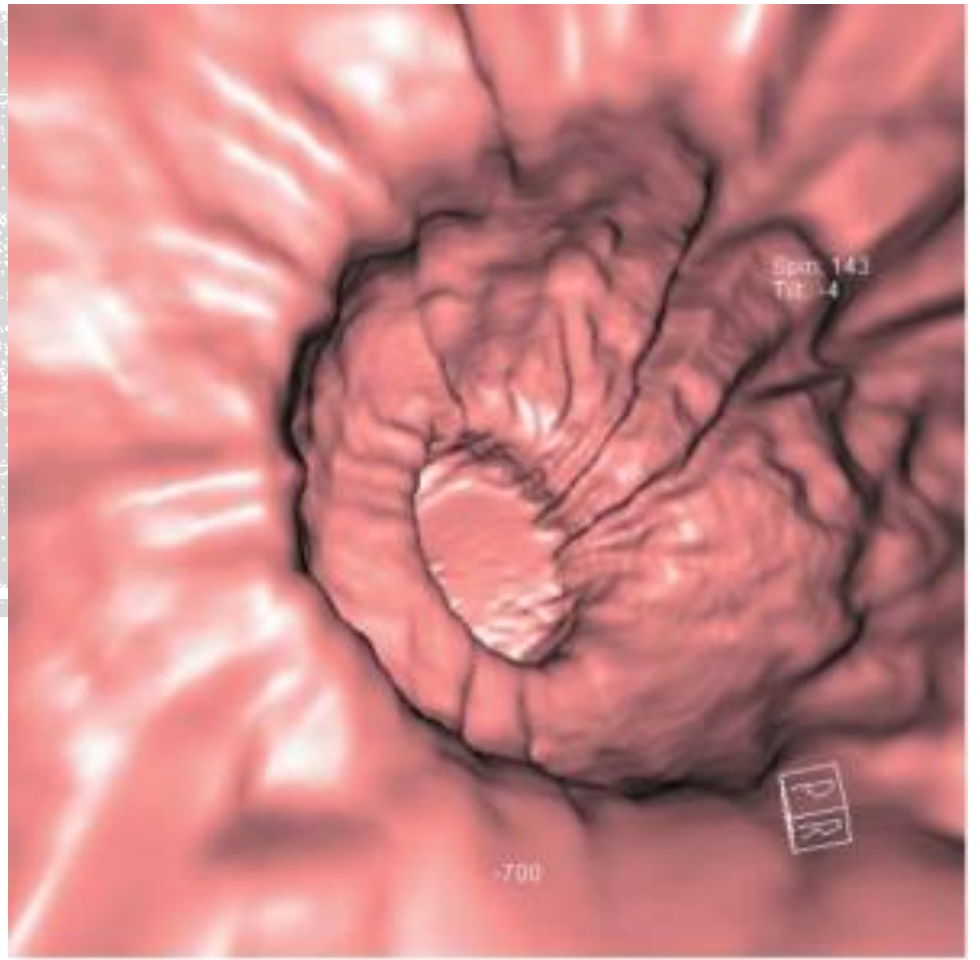
Ultrasound in GIT Imaging



Liver metastases
from colonic
cancer



Gallbladder calculi



Computerised Tomography (CT) in GIT

1. Gaining popularity as investigation of choice in acute abdomen and trauma
2. Complement other radiological studies of the GIT to determine the extent of disease
3. Evaluate the mesentery, adjacent solid organs, the peritoneal cavity, and the retroperitoneum
4. Stage malignancies and evaluate for recurrence
5. CT enteroclysis to evaluate the small bowel
6. Virtual endoscopy – CT Colonography has largely replaced Ba enema as the imaging modality of choice in large bowel disease. It is also incorporated as a screening tool for colorectal carcinoma in high risk groups.



Computerised Tomography (CT) in GIT

Take note of the following:

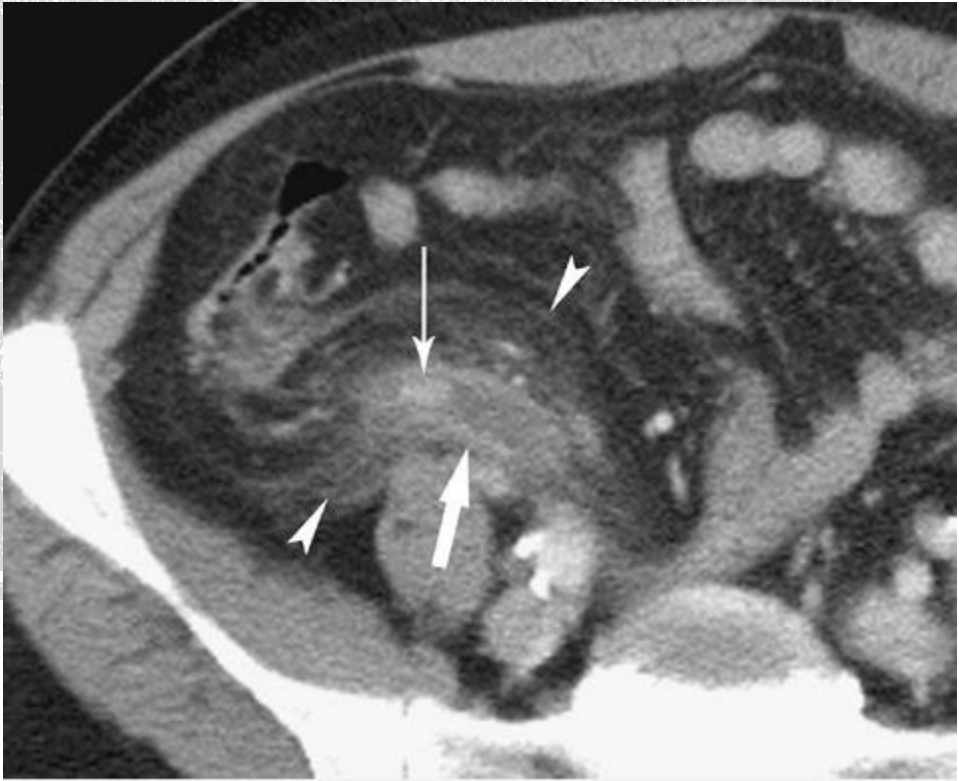
1. CT is relatively expensive and unavailable
2. Caution has to be taken since it gives high radiation dose to the patient



Computerised Tomography (CT) in GIT

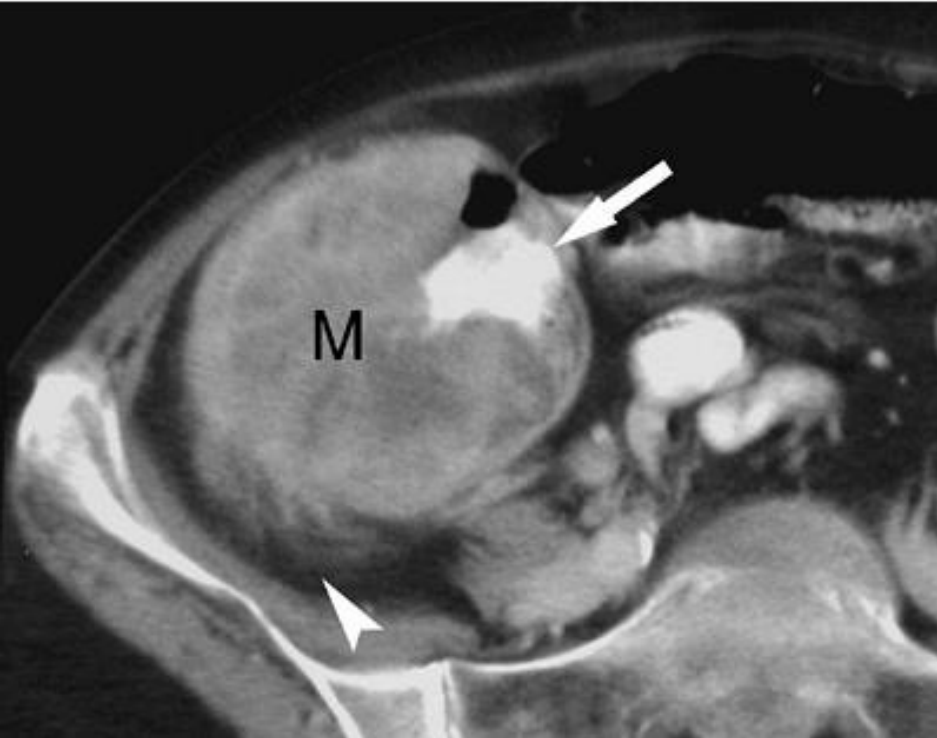


Normal appendix



Acute appendicitis

Computerised Tomography (CT) in GIT

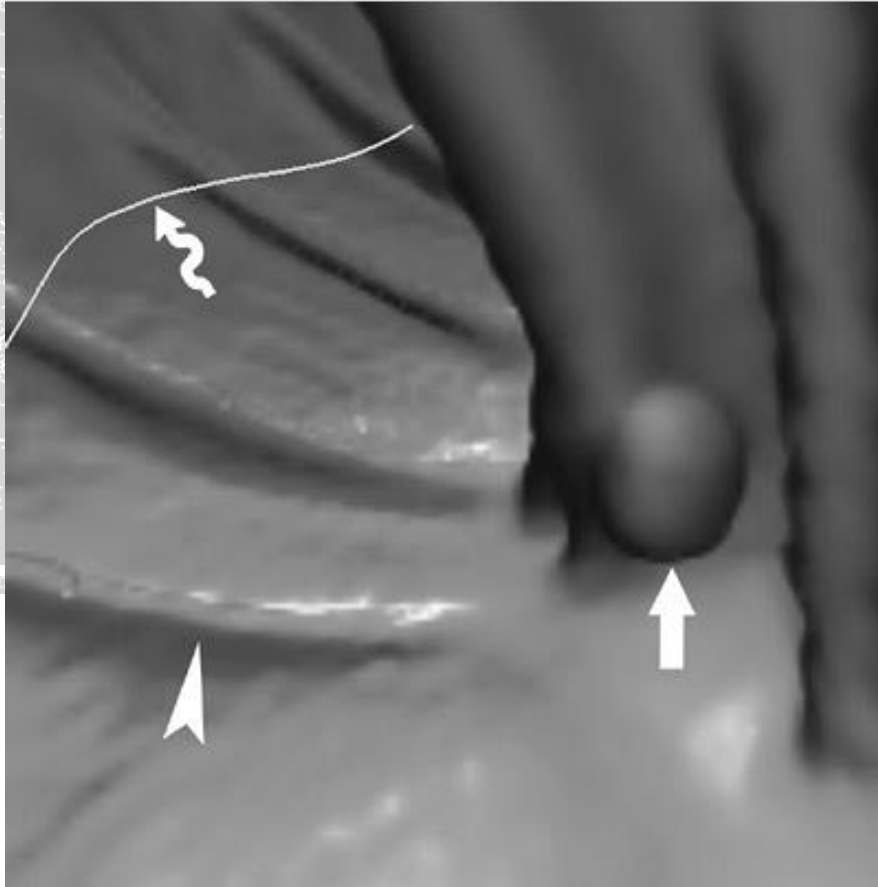


Caecal malignant tumour



Metastatic liver lesions
from Ca.colon

Computerised Tomography (CT) in GIT



CT (virtual) colonoscopy)
reveals a polyp



Magnetic Resonance Imaging (MRI) in GIT

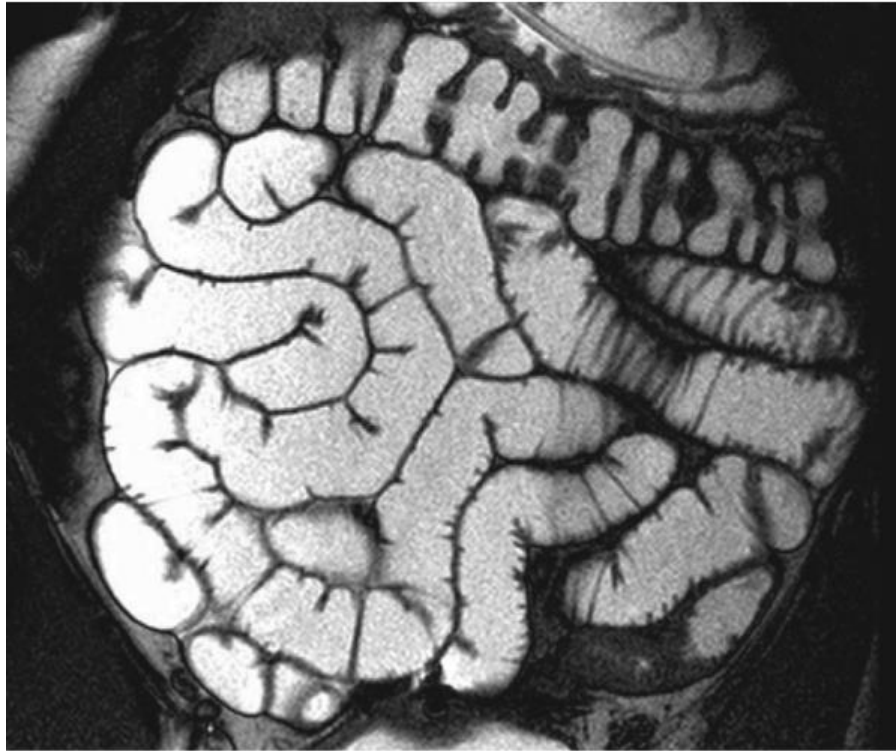
Though more expensive and less available compared to the modalities we have already discussed it has these main advantages

1. Excellent soft tissue contrast
2. Non- ionising radiation
3. Multi- sequential multi-planar capabilities

Its application includes the same as CT except that it is not used in acute setting.



Magnetic Resonance Imaging (MRI) in GIT



Small bowel - FISP



Small bowel - FLASH

Magnetic Resonance Imaging (MRI) in GIT



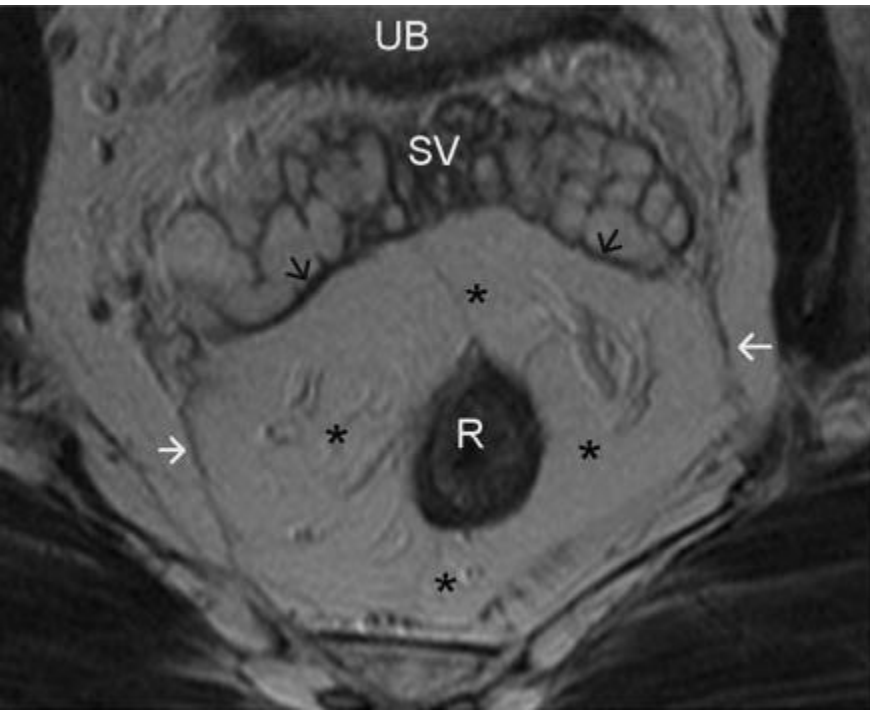
Hepatocellular
carcinoma



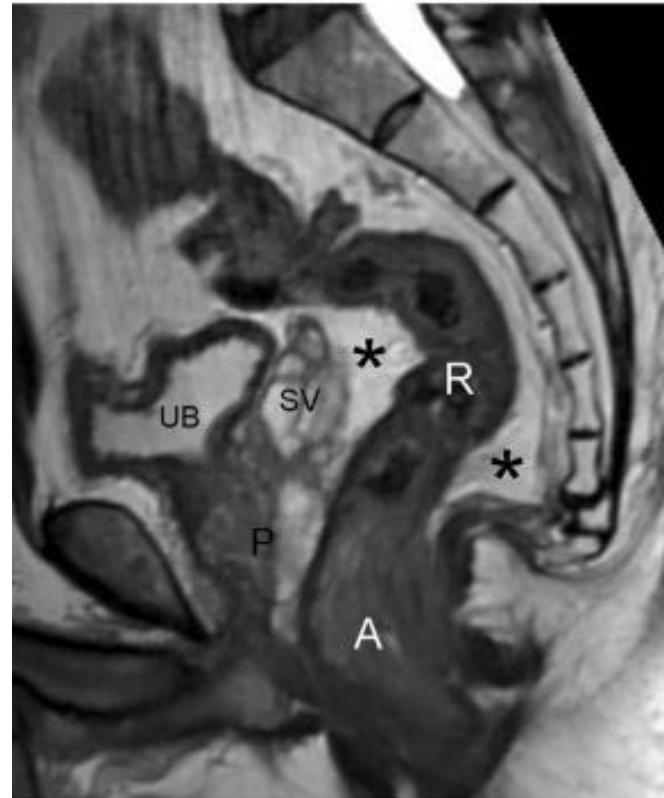
INCREASING ROLE OF MRI IN RECTAL CANCER

- Paradigm shift has taken place in imaging of rectal carcinoma with High Resolution MRI taking centre stage in tumour staging.
- Excellent anatomical depiction can be attained with this modality influencing surgical decision making since the introduction of total mesorectal excision (TME) as standard surgical procedure. The mesorectal fascia determines the potential circumferential resection margin (CRM).





Normal anatomy: Axial Turbo SE T2W image shows the mesorectal fat (*), the mesorectal fascia (white arrows) and confluence of Denovillier's and mesorectal fasciae (black arrows).

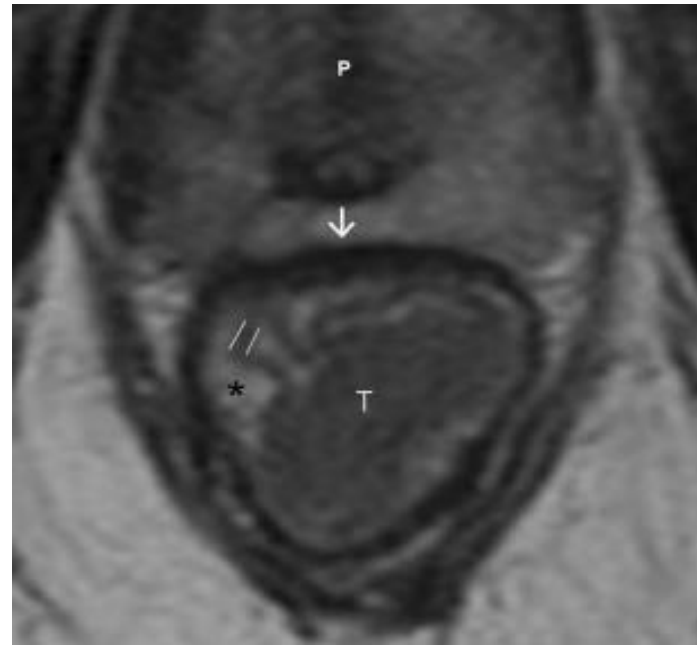


Sagittal turbo SE T2W image demonstrates the normal anatomy





A

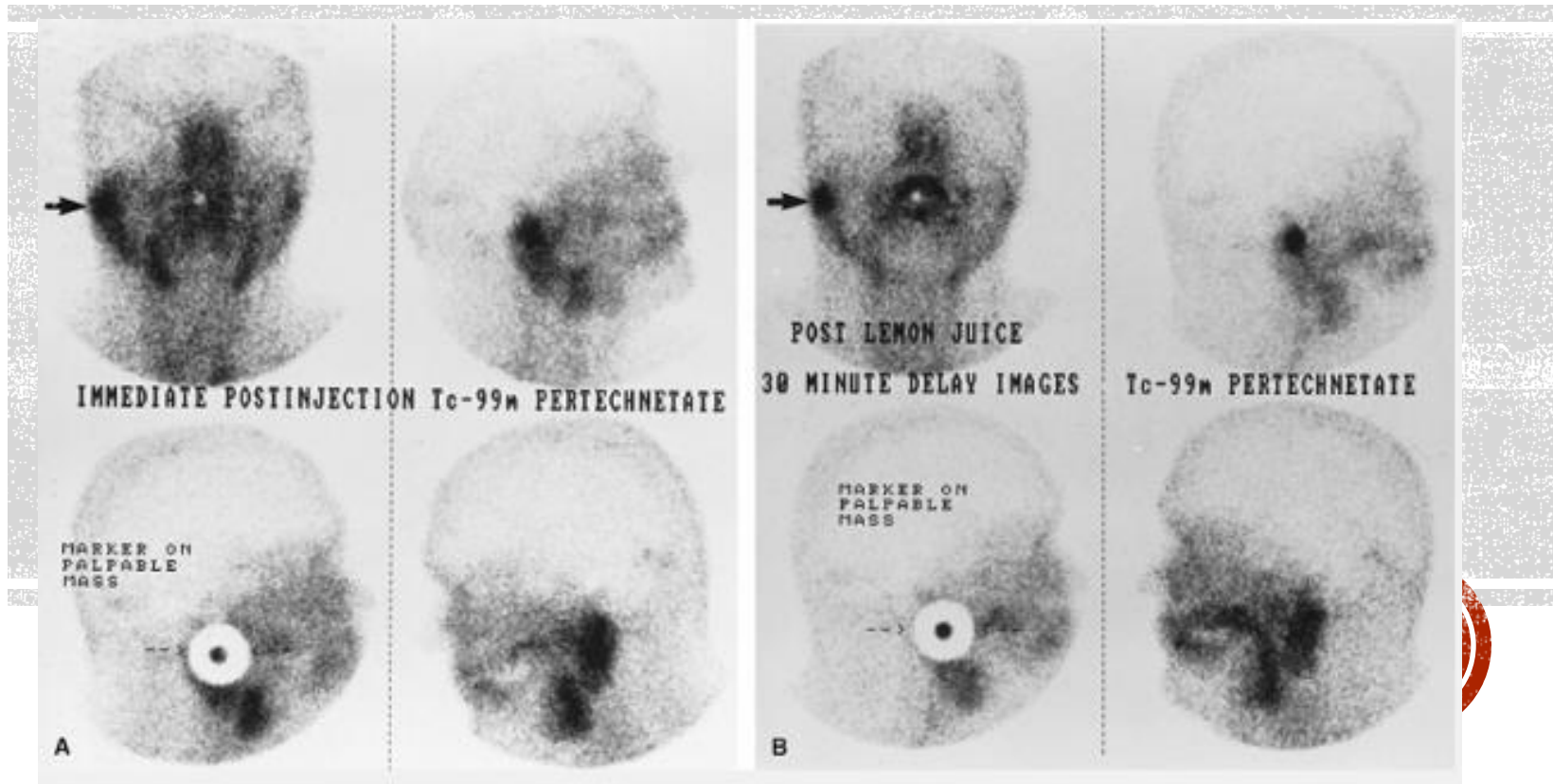


B

The driver of the paradigm shift as demonstrated in this rectal tumour on CT (A) and HRMRI (B). The MR image confidently puts it as stage 1 tumour since the muscularis propria is intact.

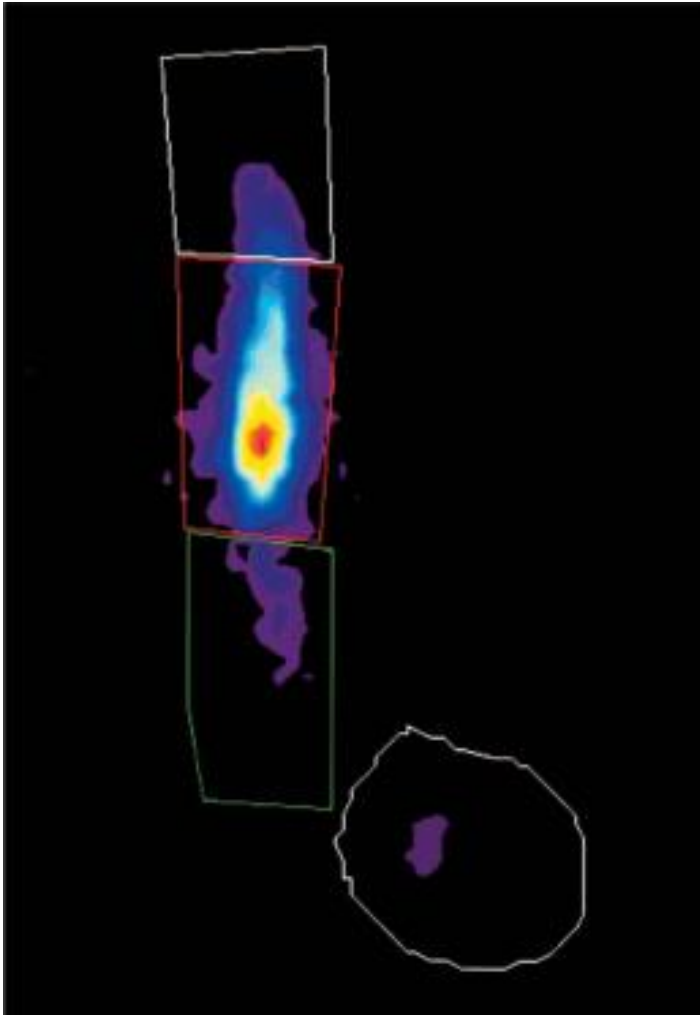


Radionuclide Imaging in GIT

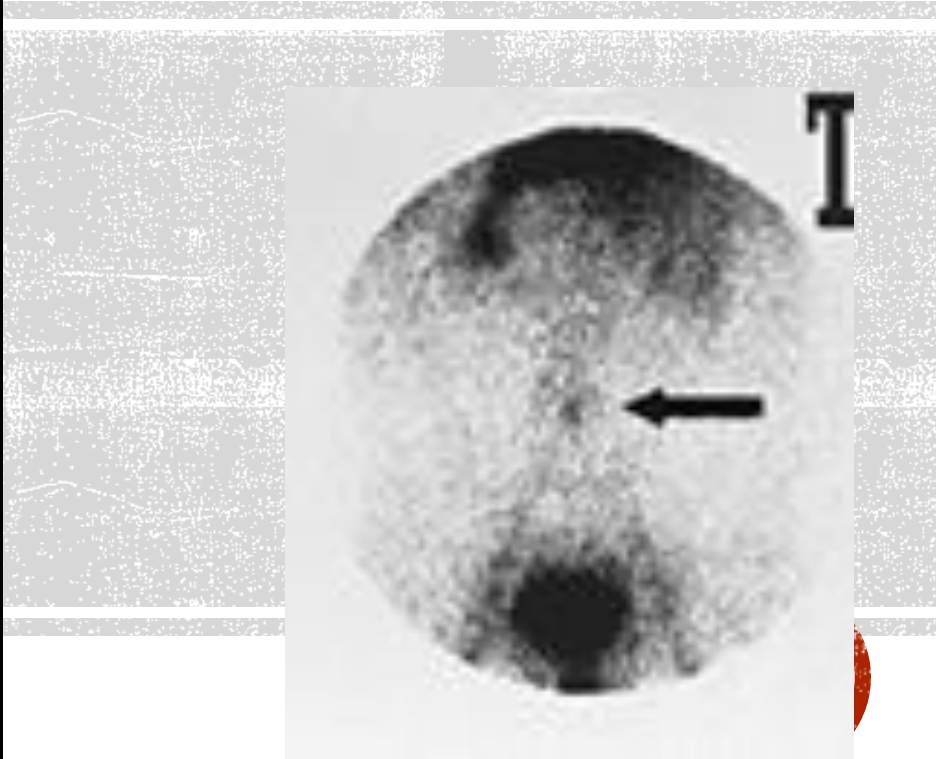


Salivary gland tumor

Radionuclide Imaging in GIT

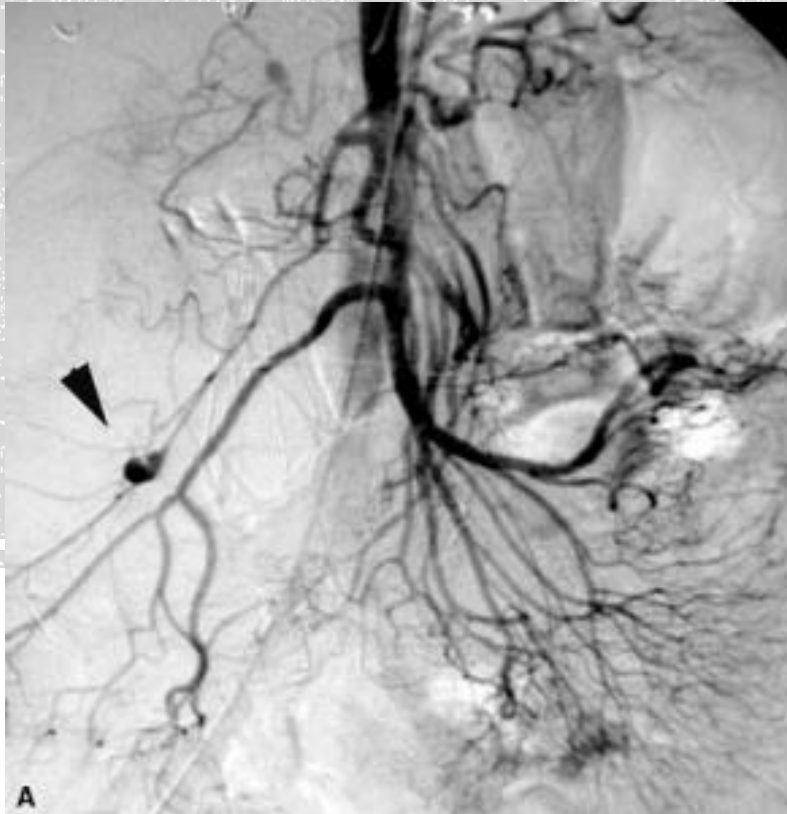


Achalasia



Meckel's diverticulum

Angiography in GIT



Right colic artery
extravasation of contrast
demonstrating point of
hemorrhage



ACUTE Decision Making

Suspected diagnosis	Imaging method		
	Plain radiography	Ultrasound	Computed tomography
Appendicitis	No	Yes (young patients)	Yes
Cholecystitis	No	Yes	No
Acute pancreatitis	No	Yes (cause)	Yes (complications)
Bowel obstruction	Yes	No	Yes
Bowel perforation	Yes	No	Yes
Diverticulitis	No	No	Yes
Renal colic	No	No	Yes

Thank you



Musila Mutala

