ABDOMINAL AND GASTROINTESTINAL TRACT IMAGING

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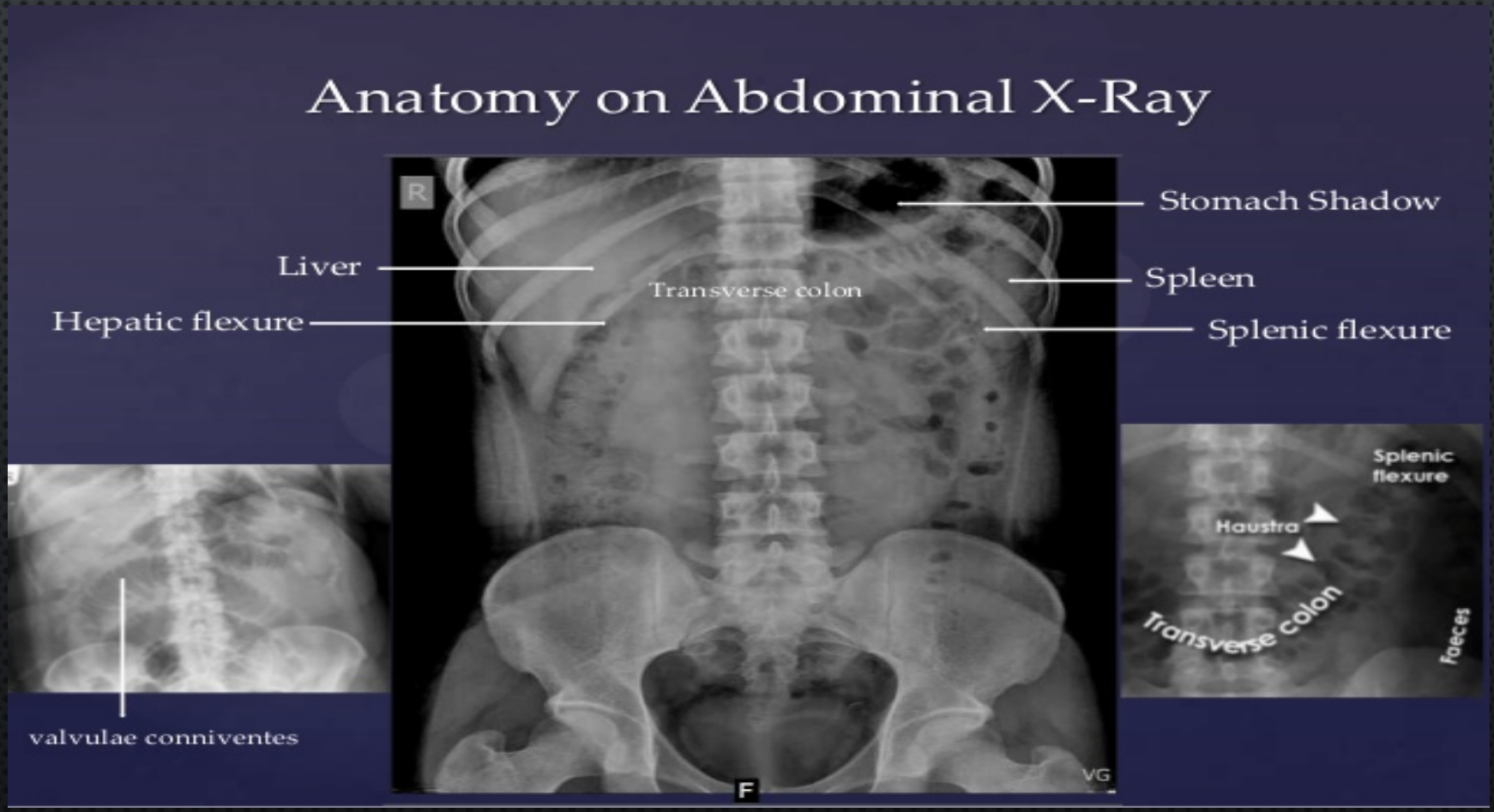
ABDOMEN X-RAY

- ✔ *Plain abdomen films still retain one of the most useful initial investigations.*
- ✔ *Abdomen x-ray is sometimes abbreviated to AXR and is usually taken with the patient lying in a supine position.*
- ✔ *In an erect abdomen x-ray, normally two or three air-fluid levels are possible, but more than three are abnormal.*
- ✔ *The maximum diameter of the small bowel is 3cm.*
- ✔ *The maximum diameter of the large bowel is 6cm, except for the caecum and rectum up to 8cm.*

NORMAL ABDOMINAL X RAY



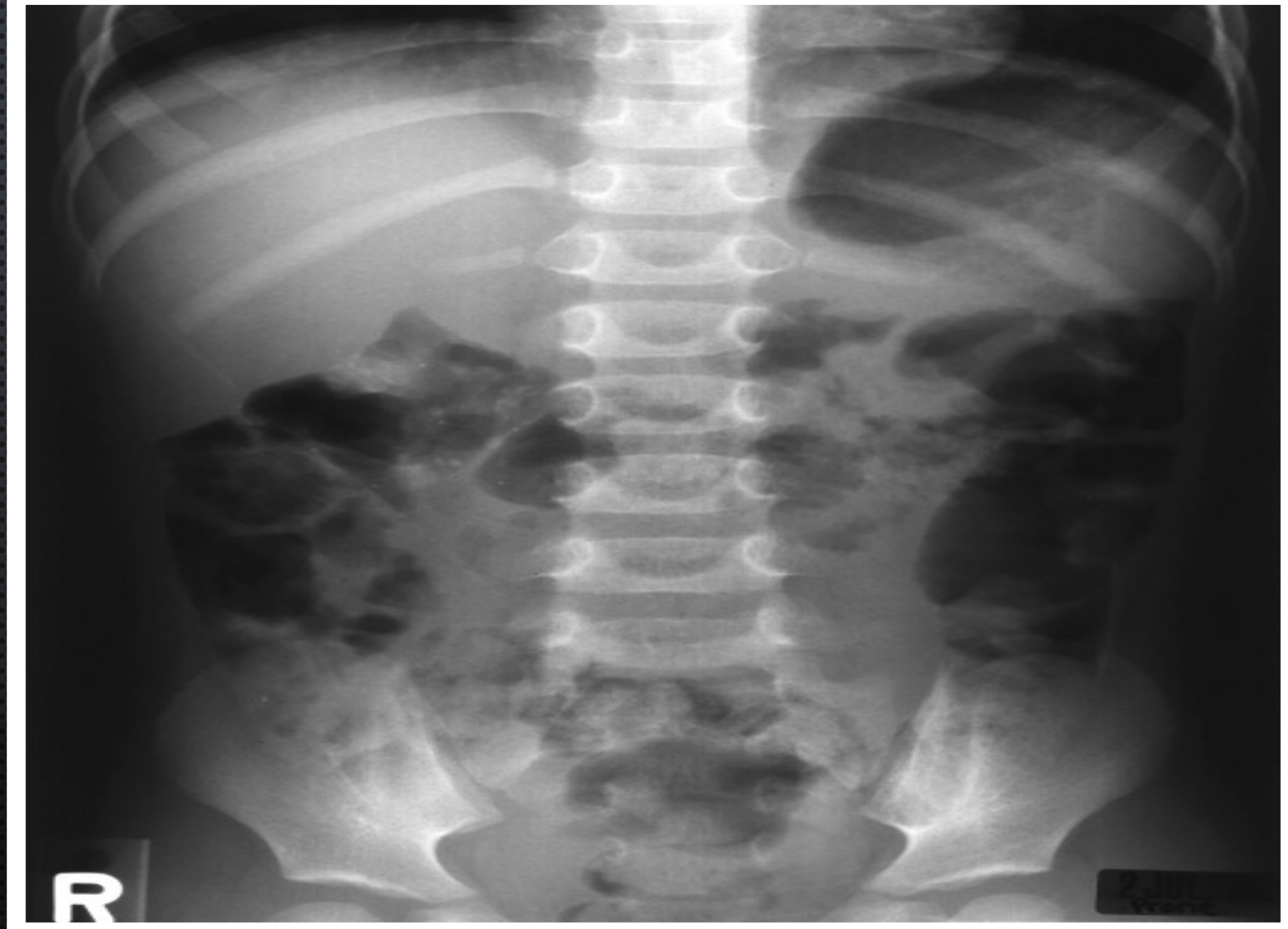
ABDOMEN X-RAY / 2

- ***The following structures should be checked in abdomen x-ray:***
  - *Bowel gas pattern.*
  - *Radio-opaque stones or calcification.*
  - *Extra luminal free gas.*
  - *Soft tissue masses.*
  - *Signs of intestinal obstruction.*
  - *Skeletal abnormalities.*

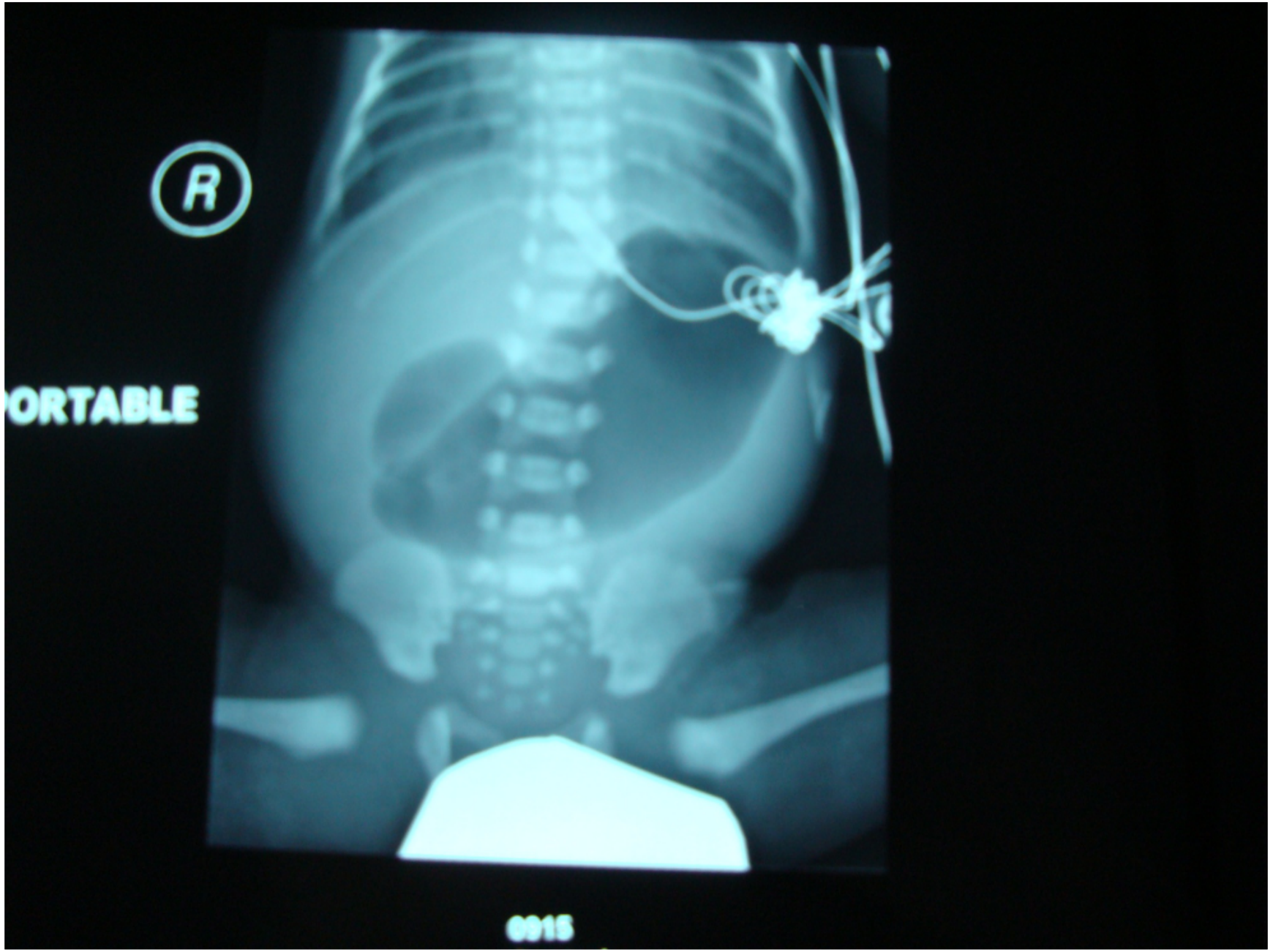
wilms tumor (kidny)
aortic anyorism
hydated cyst
ovarian tumor

REMEMBER :

1. *Radiopaque (white) :Stone , Fluid.*
2. *Radiolucent (black) : Gas .*
3. *X-ray is not enough, you must consider the clinical presentation and physical examination.*


R


SUPINE
R
09

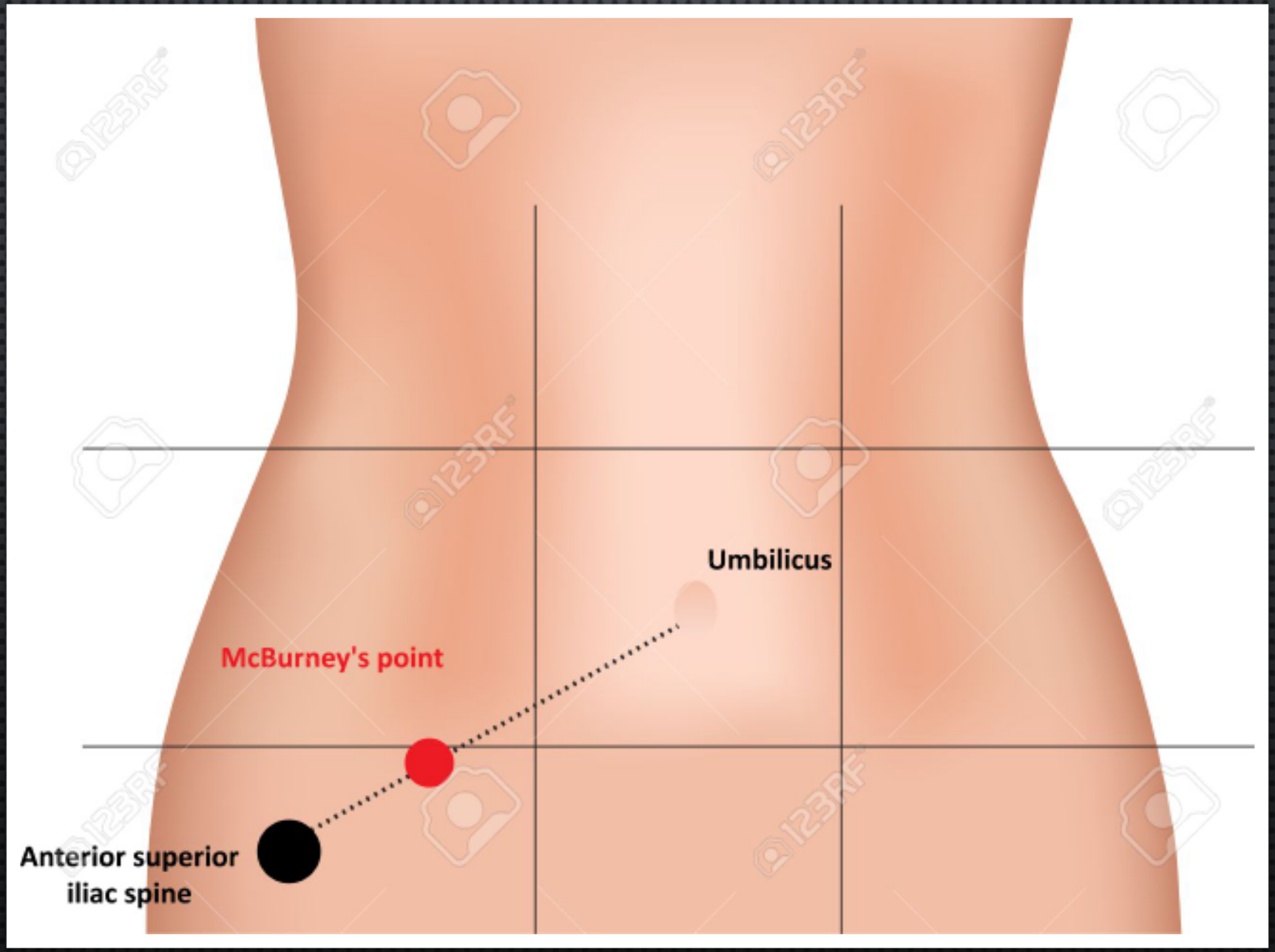

R
ORTABLE
0915

ACUTE APPENDICITIS

- *Acute appendicitis is an acute inflammation of the Appendix.*
- *The vermiform appendix is a tubular structure attached to the base of the caecum. It is approximately 5-10 cm long in adults .*
- *Appendicitis happens when the appendix gets blocked .*
- *Appendicitis is the most common abdominal emergency and accounts for more than 40 000 hospital admissions in England every year*

CLINICAL PRESENTATION

- *The classical presentation consists of periumbilical pain (referred) which within a day or later localizes to McBurney point with associated fever, nausea, and vomiting.*
- *Children are often present with vague and non-specific signs and symptoms.*
- *Deep tenderness at McBurney's point, known as McBurney's sign*


Umbilicus
McBurney's point
Anterior superior
iliac spine

IMAGING

One of the biggest challenges of imaging the appendix is finding it.

- *Plain Films of the Abdomen*

- *Plain Films of the Abdomen are UNABLE to give the diagnosis, however, are useful for identifying FREE GAS, and may show an APPENDICOLITH in 7-15% of cases. Finding an appendicolith makes the possibility of acute appendicitis up to 90%.*

- *Small Bowel Obstruction pattern with small bowel dilatation and air-fluid levels is present in ~40% of perforations.*

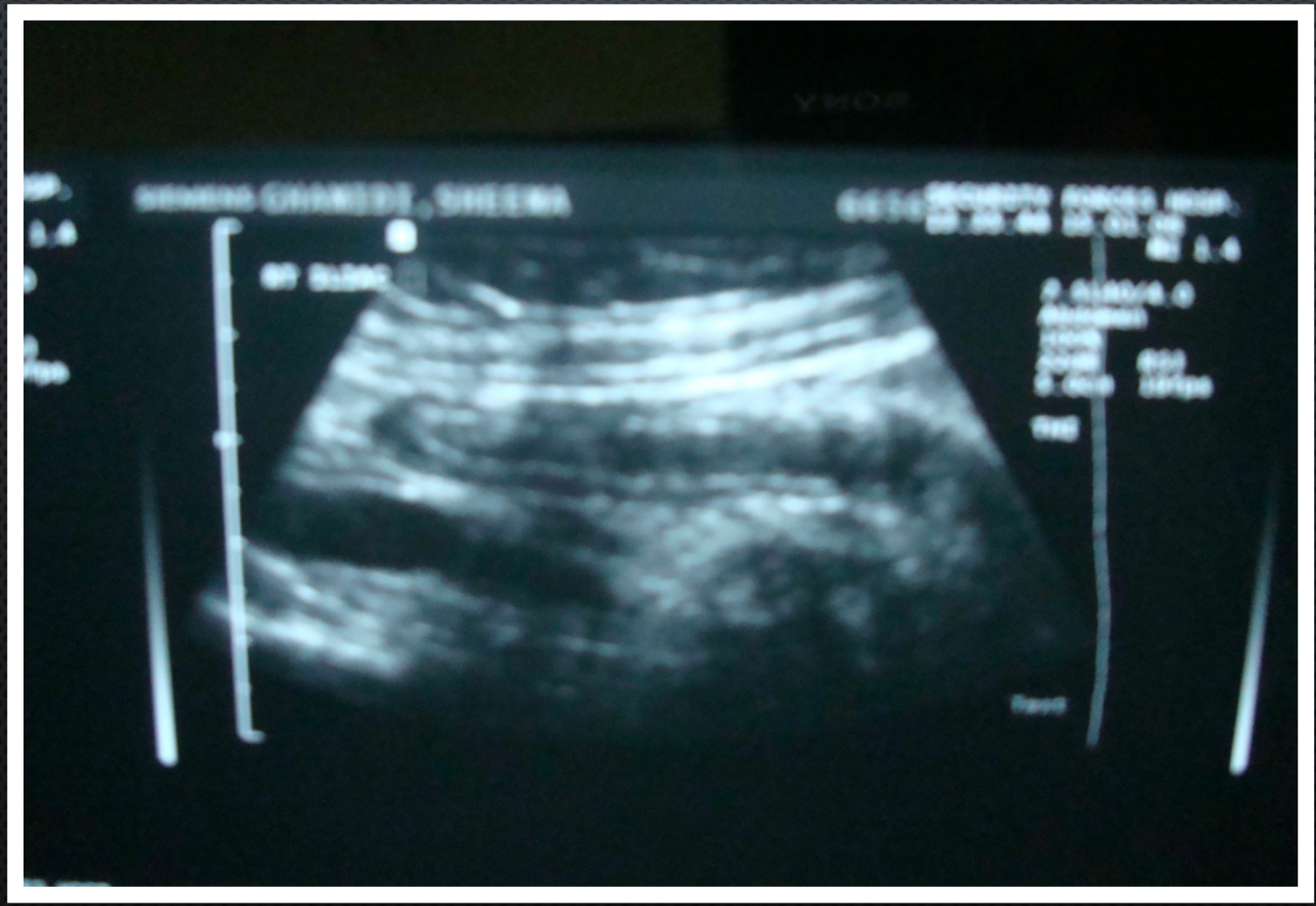
ACUTE APPENDICITIS IN ULTRASOUND

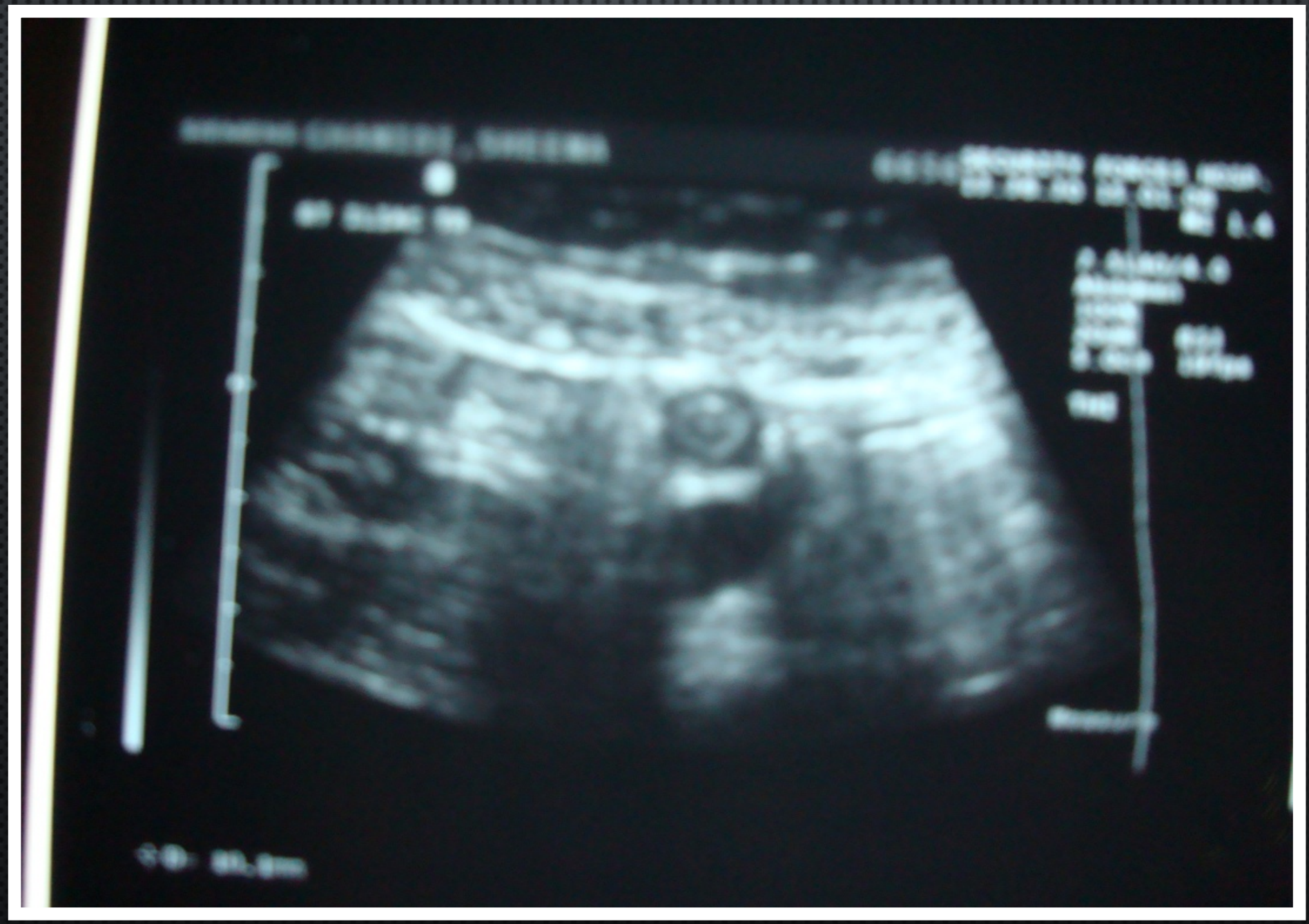
Ultrasound with its lack of ionizing radiation should be the investigation of choice in young thin patients.

Findings supportive of the diagnosis of appendicitis include :

- *Aperistaltic, blind-ending non-compressible, dilated appendix (>6 mm outer diameter).*
- *Hyperechoic appendicolith with posterior acoustic shadowing.*
- *Echogenic prominent pericaecal and periappendiceal fat.*
- *Periappendiceal fluid collection.*
- *target appearance (axial section).*
- *wall thickening (3 mm or above).*

ACUTE APPENDICITIS IN ULTRASOUND





CT SCAN

- 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.

CT FINDINGS INCLUDE :

- *appendiceal dilatation (>6 mm diameter)*
- *wall thickening (>3 mm) and enhancement*
- *thickening of the cecal apex: cecal bar sign.*
- *periappendiceal inflammation*
  - *fat stranding*
  - *extra luminal fluid*
  - *phlegmon (inflammatory mass)*
  - *Abscess*

- *Less specific signs may be associated with appendicitis:*
- *appendicolith*
- *periappendiceal reactive nodal enlargement*

RECOGNIZED COMPLICATIONS INCLUDE :

perforation: in 10-20% of cases

most specifically suggested by appendiceal abscess or extraluminal gas, but commonly also seen as periappendiceal phlegmon and fluid

generalized peritonitis due to free perforation

pylephlebitis: infective thrombophlebitis of the portal circulation

hepatic abscess

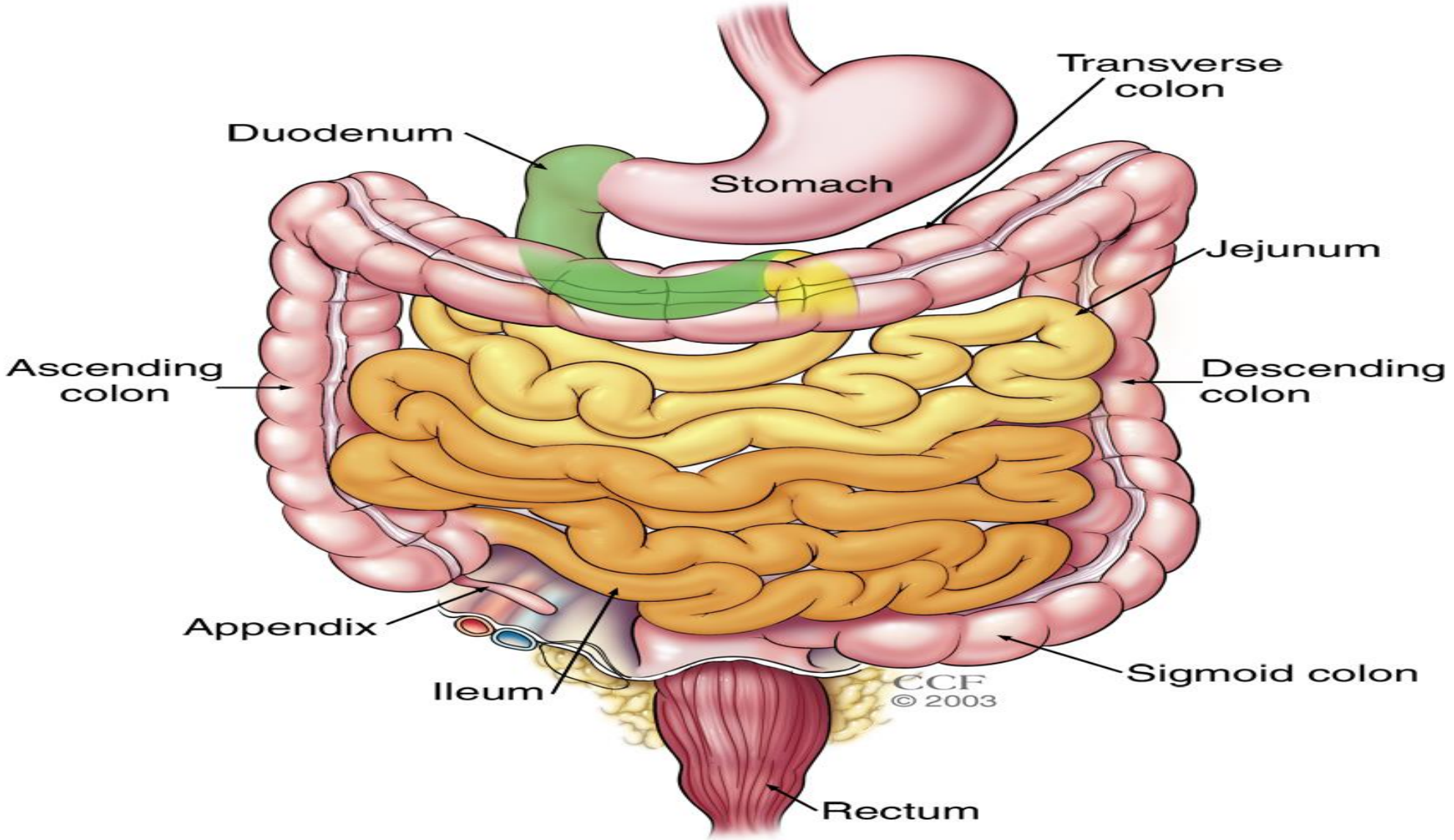
When a complication occurs, it is said to be "complicated appendicitis".

SUMMARY POINTS

- *Appendicitis is the most common abdominal surgical emergency*
- *Not all patients present with typical signs and symptoms*
- *Patients at the extremes of age have increased mortality because of late presentation or subtle signs*
- *Specialist investigations should not delay definitive treatment*
- *Computed tomography scanning is more sensitive and specific than ultrasonography when diagnosing acute appendicitis*

SMALL BOWEL OBSTRUCTION

- *Small bowel obstruction is a partial or complete blockage of the small intestine.*
- *An obstruction in the small bowel can partly or completely block contents from passing through.*
- *Gas and fluid accumulate proximal to the site of obstruction causing progressive dilatation of the small bowel.*


Transverse colon
Duodenum
Stomach
Jejunum
Ascending colon
Descending colon
Appendix
Ileum
Sigmoid colon
CCF
© 2003
Rectum

THERE ARE TWO TYPES OF SMALL BOWEL OBSTRUCTION:

- *functional — there is no physical blockage, however, the bowels are not moving food through the digestive tract*
- *mechanical — there is a blockage preventing the movement of food.*

WHAT CAUSES SMALL BOWEL OBSTRUCTION?

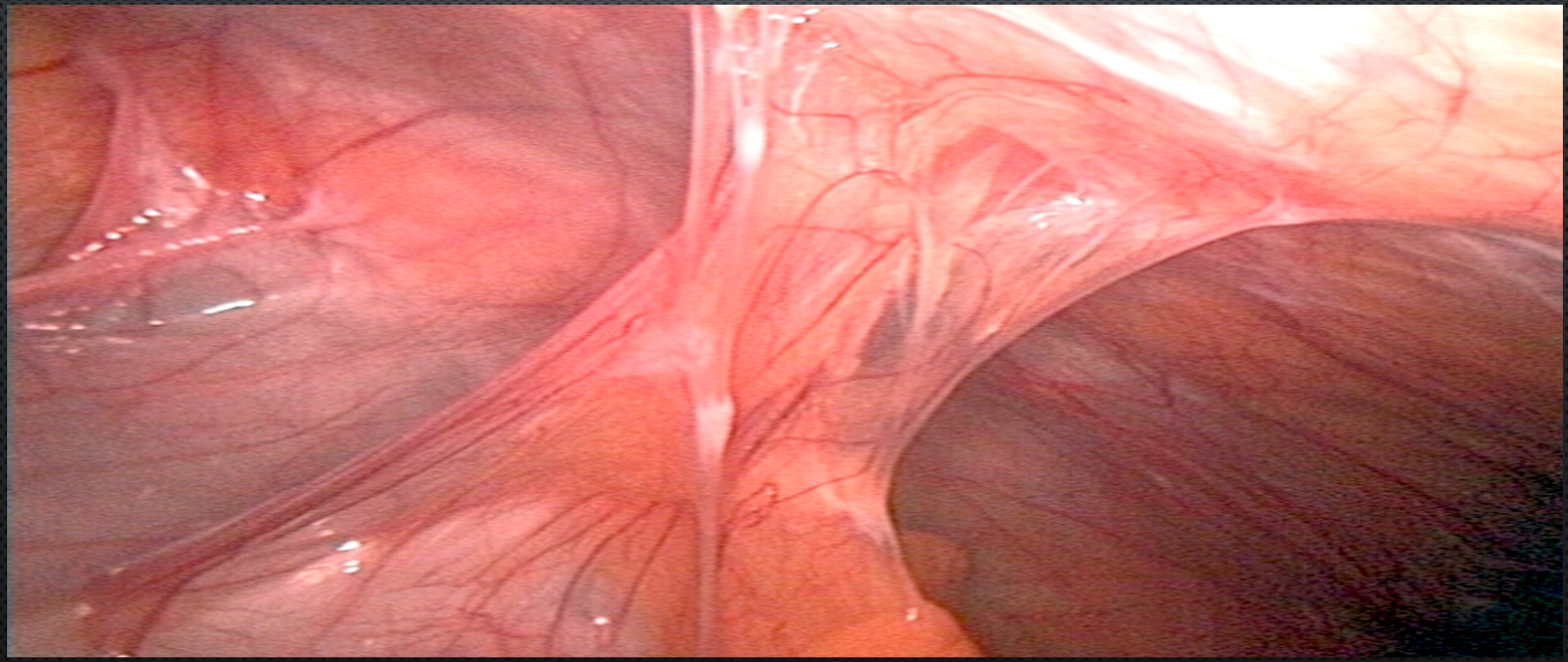
Functional SBO :

- *Bacteria or viruses that cause intestinal infections (gastroenteritis)*
- *Chemical, electrolyte, or mineral imbalances (such as decreased potassium level)*
- *Abdominal surgery*
- *Decreased blood supply to the intestines (Mesenteric ischemia)*
- *Infections inside the abdomen, such as appendicitis*
- *Kidney or lung disease*
- *Use of certain medicines, especially narcotics*

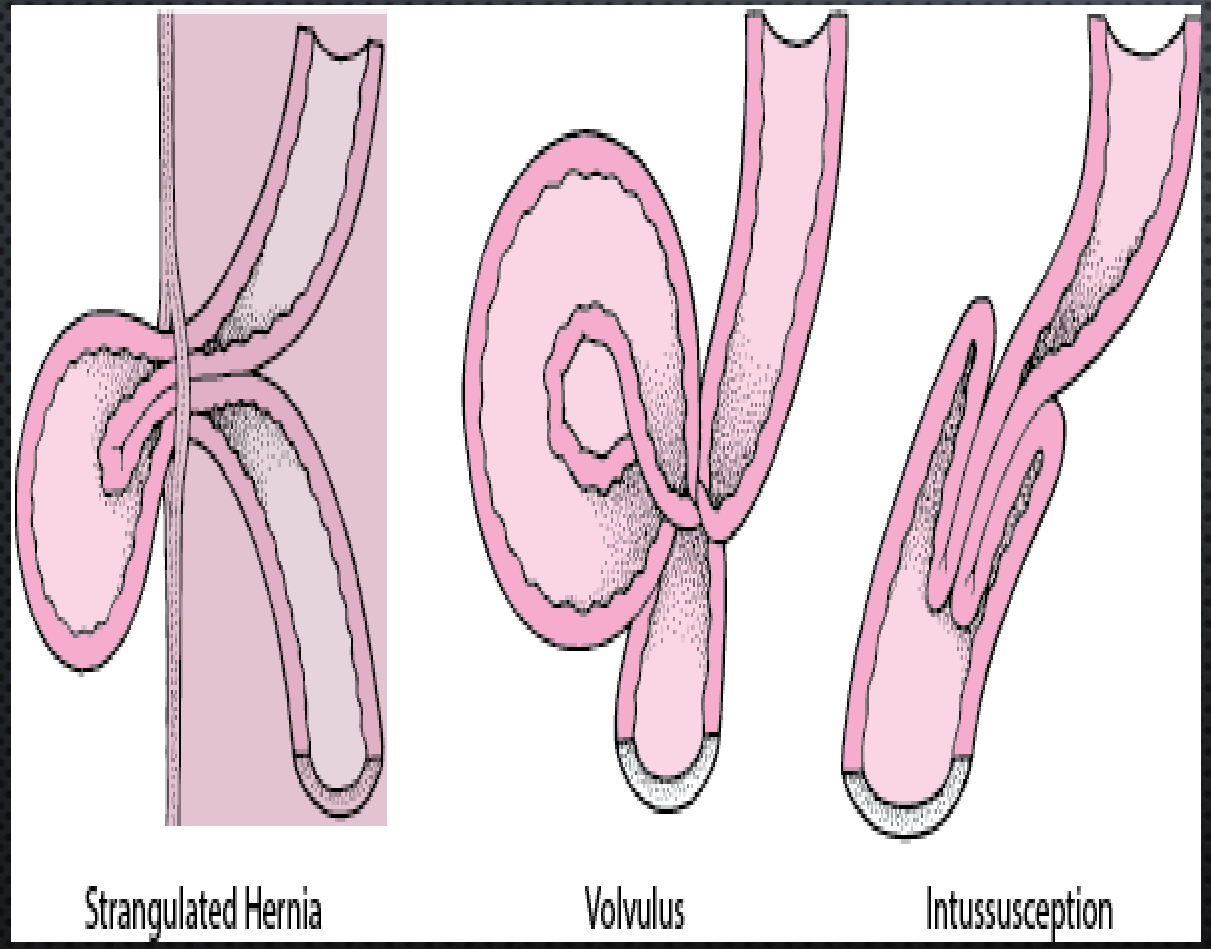
MECHANICAL SBO

- *Adhesions: is the most common cause, about 70% of cases. These are bands of scar tissue that may form after abdominal or pelvic surgery.*
- *Hernias : Hernias are the second most common cause of small bowel obstruction in the United States.*
- *Inflammatory disease: Inflammatory bowel disorders such as Crohn's disease or diverticulitis can damage parts of the small intestine. Complications may include narrowing of the bowel (strictures) or abnormal tunnel-like openings (fistulas).*
- *Malignant (cancerous) tumors: Cancer accounts for a small percentage of all small bowel obstructions.*

SMALL BOWEL ADHESIONS



CAUSES OF INTESTINAL OBSTRUCTION



CLINICAL PRESENTATION

- *The classical presentation is cramping abdominal pain and abdominal distension with nausea and vomiting.*
- *Severe constipation: In cases of complete obstruction, a person will not be able to pass stool (feces) or gas.*

IMAGING :

- *The initial radiological investigation for suspected small bowel obstruction is supine and erect plain abdominal films.*

Radiological findings of small bowel obstruction

- *Multiple dilated loops of the small bowel, usually centrally placed in the abdomen.*
- *Multiple air-fluid levels.*
- *Absence of gas in the colon.*
- *Valvulae conniventes or small bowel folds (the mucosal folds of the small intestine) are visible*

SBO Erect

SBO Supine

Fluid levels with gas above; **'stepladder pattern'.** Ileal obstruction by adhesions; patient erect.

Supine radiograph from a patient with complete small bowel obstruction shows **distended small bowel loops** in the central abdomen with **prominent valvulae conniventes** (small white arrow)

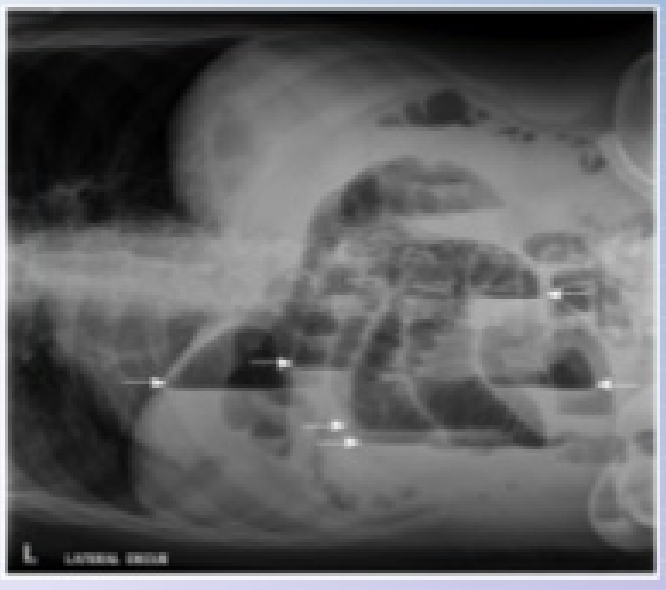
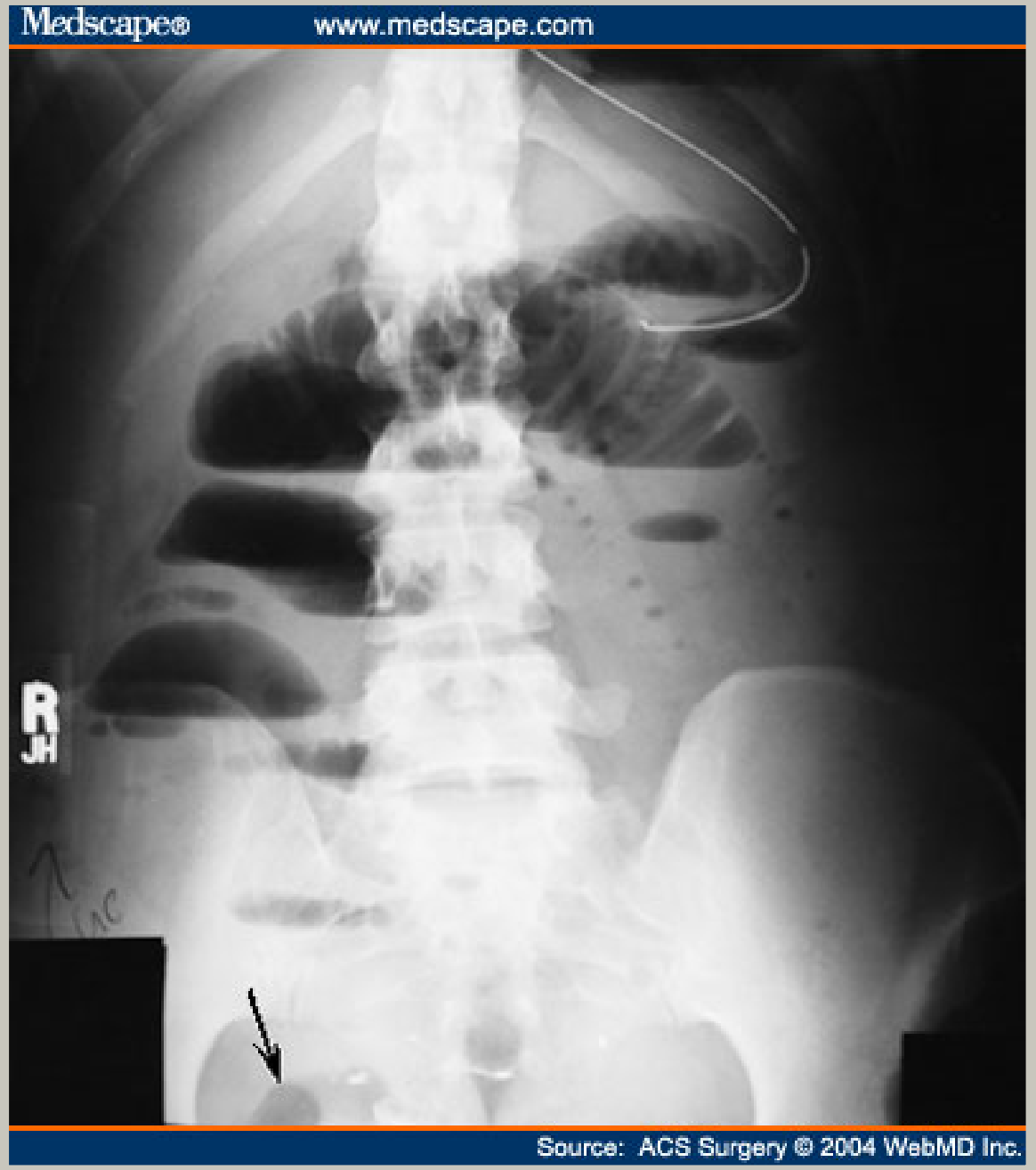


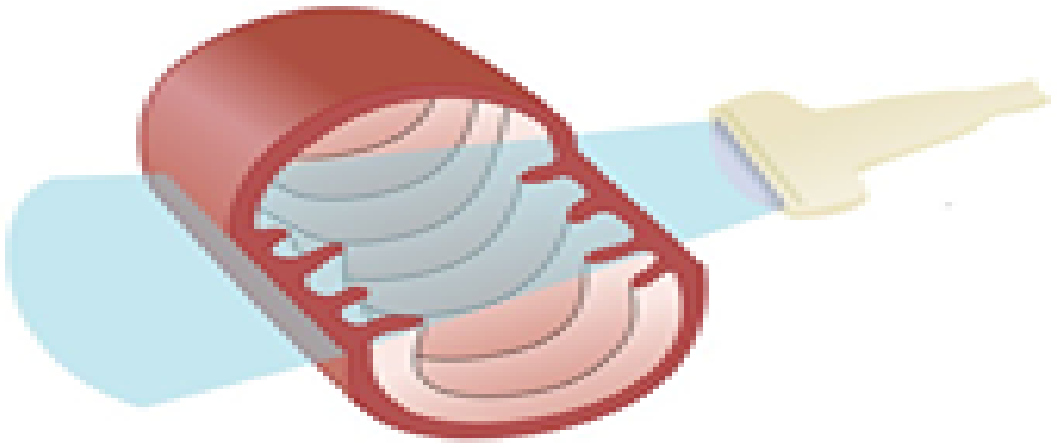
Figure 3. Lateral decubitus view of the abdomen, showing air-fluid levels consistent with intestinal obstruction *Gross wa 2*

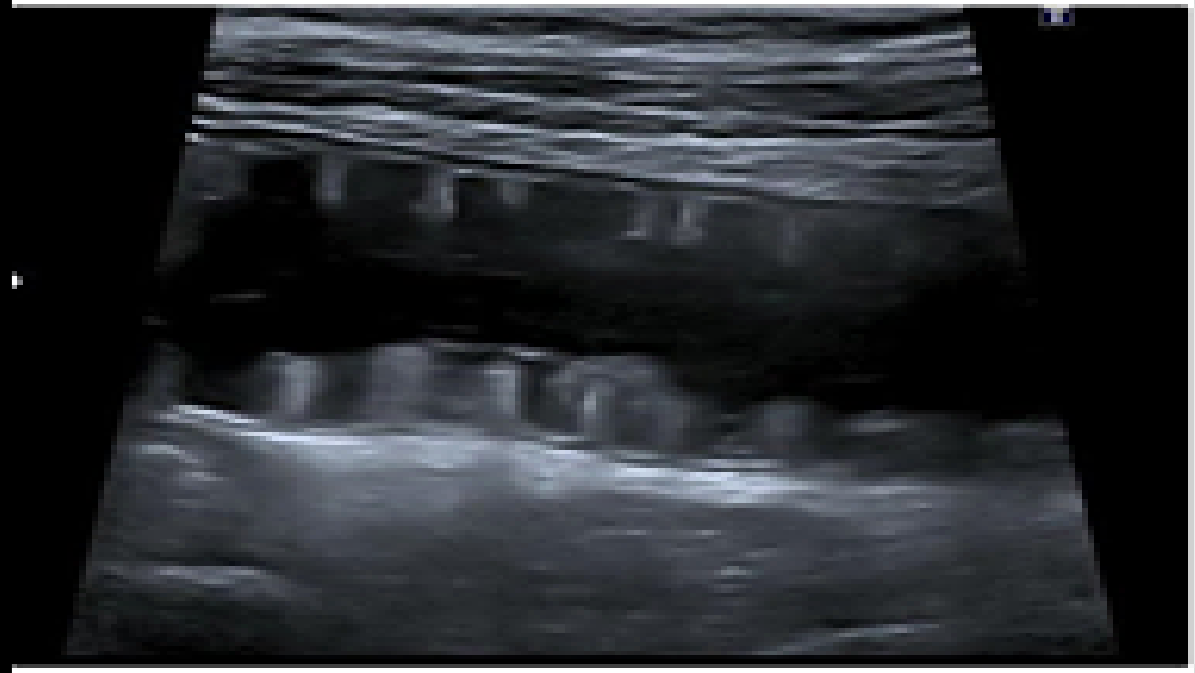
FRONTAL ABDOMINAL
X-RAY
DILATATION OF SMALL BOWEL LOOPS- 1
MORE THAN 5 CM
-2
AIR-FLUIDAIR FLUID
LEVEL
-3
ABSENCE OF GAS IN
THE COLON
-4
VALVULAE CONNIVENTES ARE VISIBLE

NORMAL SKELETAL/NO MASS/NO FREE GAS(NO PERFORATION)

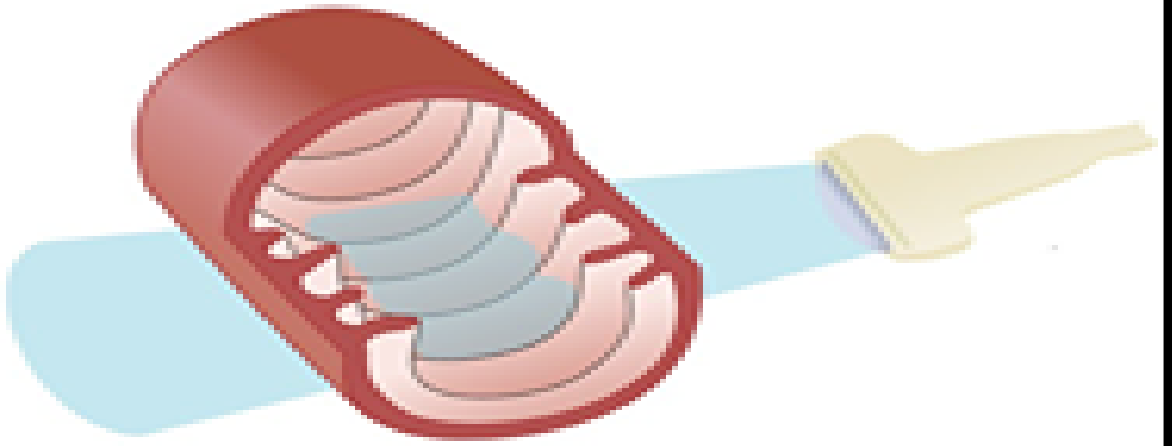


Keyboard sign



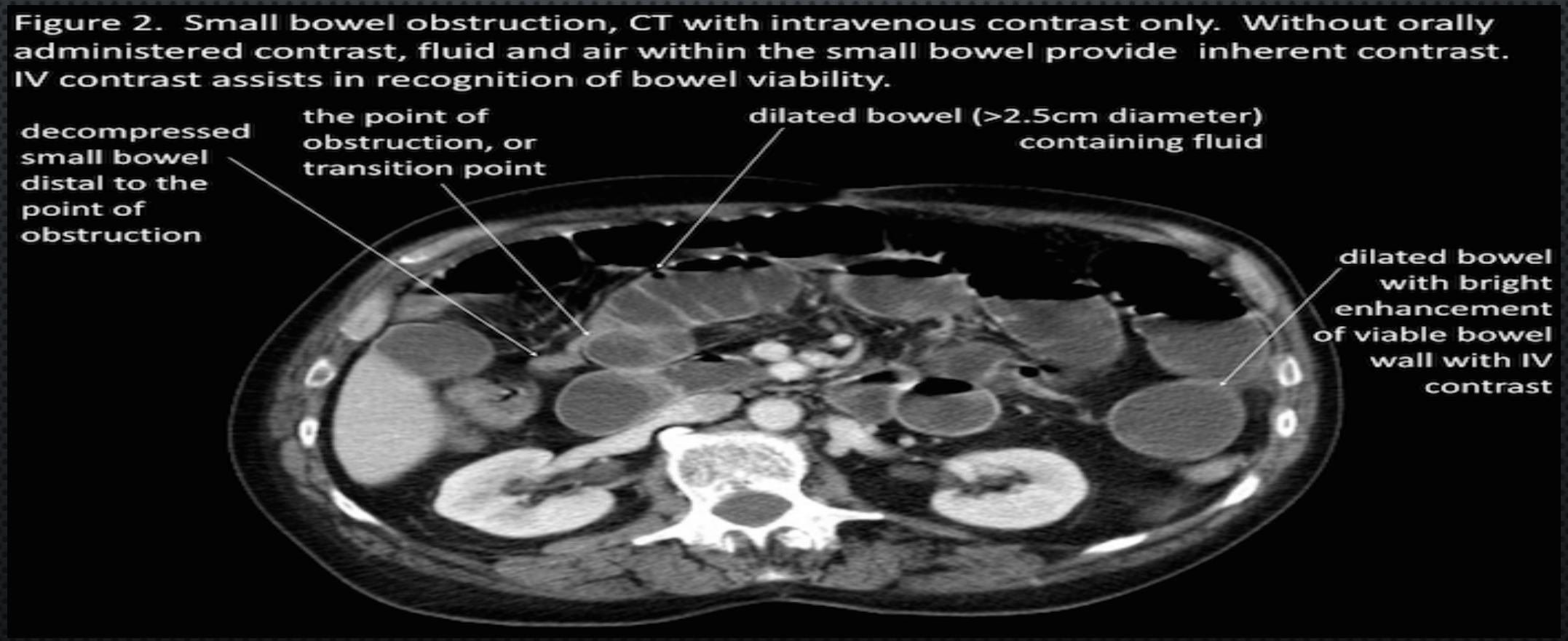


Stepladder pattern



CT SCAN

- *CT is more sensitive than Plain Films of the Abdomen and will demonstrate the cause in ~80% of cases*



LARGE BOWEL OBSTRUCTION

- **Large bowel obstruction (LBO)** is often impressive on imaging, on account of the ability of the large bowel to massively distend.
- Large bowel obstructions are far less common than small bowel obstructions, accounting for only 20% of all bowel obstructions.

CLINICAL PRESENTATION

- The classic presentation is with abdominal pain, distension, and failure of passage of flatus and stool.
- As dilatation of the colon increases, the risk of perforation also increases.

LARGE BOWEL OBSTRUCTION

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- Large bowel obstructions are far less common than small bowel obstructions, accounting for only 20% of all bowel obstructions.

MOST COMMON CAUSES OF LBO ARE:

- The most common cause is Colonic Cancer (50-60%), typically in the sigmoid .
- The second most common cause in adults is acute diverticulitis (involving the sigmoid colon).
- Sigmoid volvulus (3-8%)

IMAGING :

Large bowel obstructions are characterized by colonic distension proximal to the obstruction, with collapse distally.

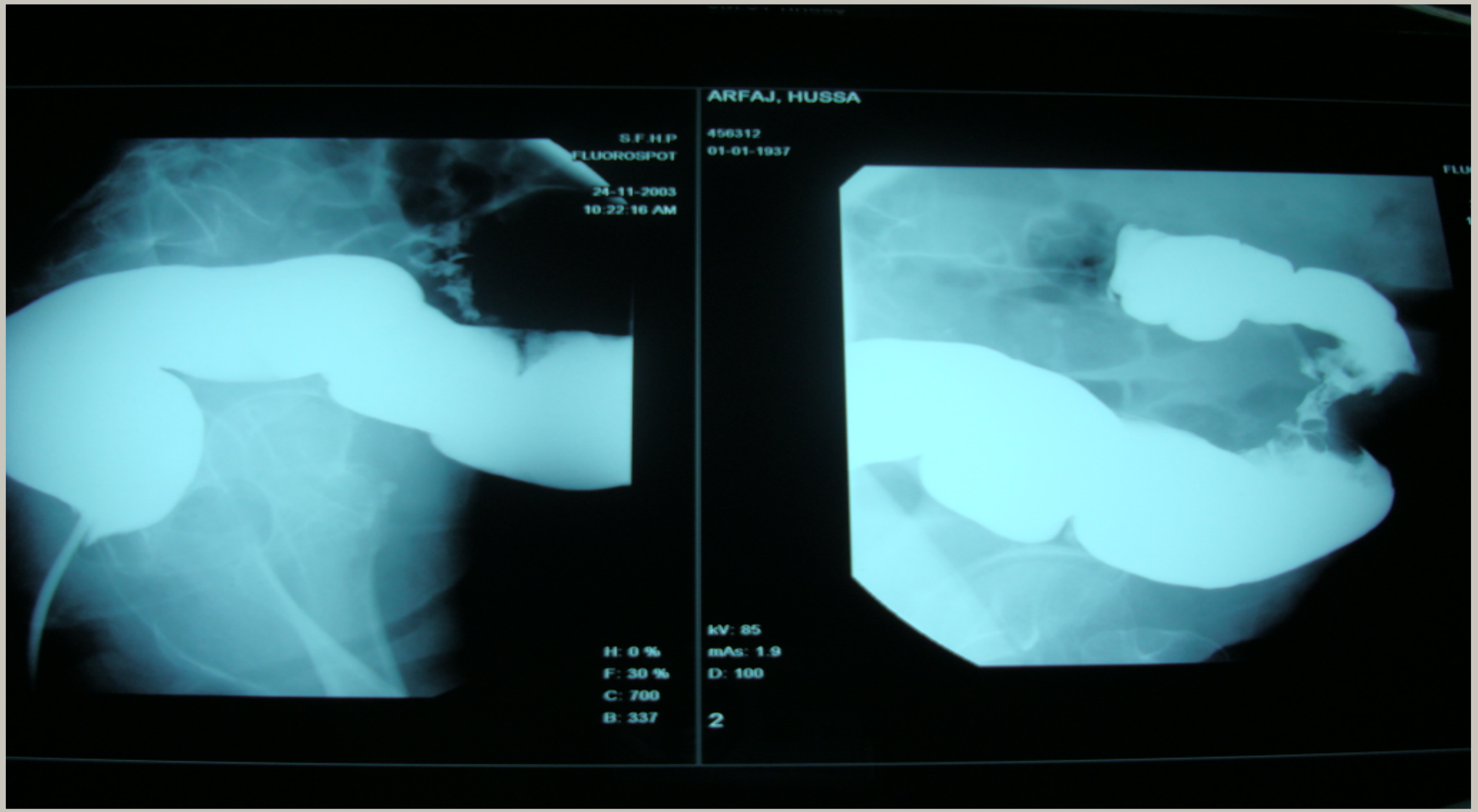
Plain Abdominal Films.

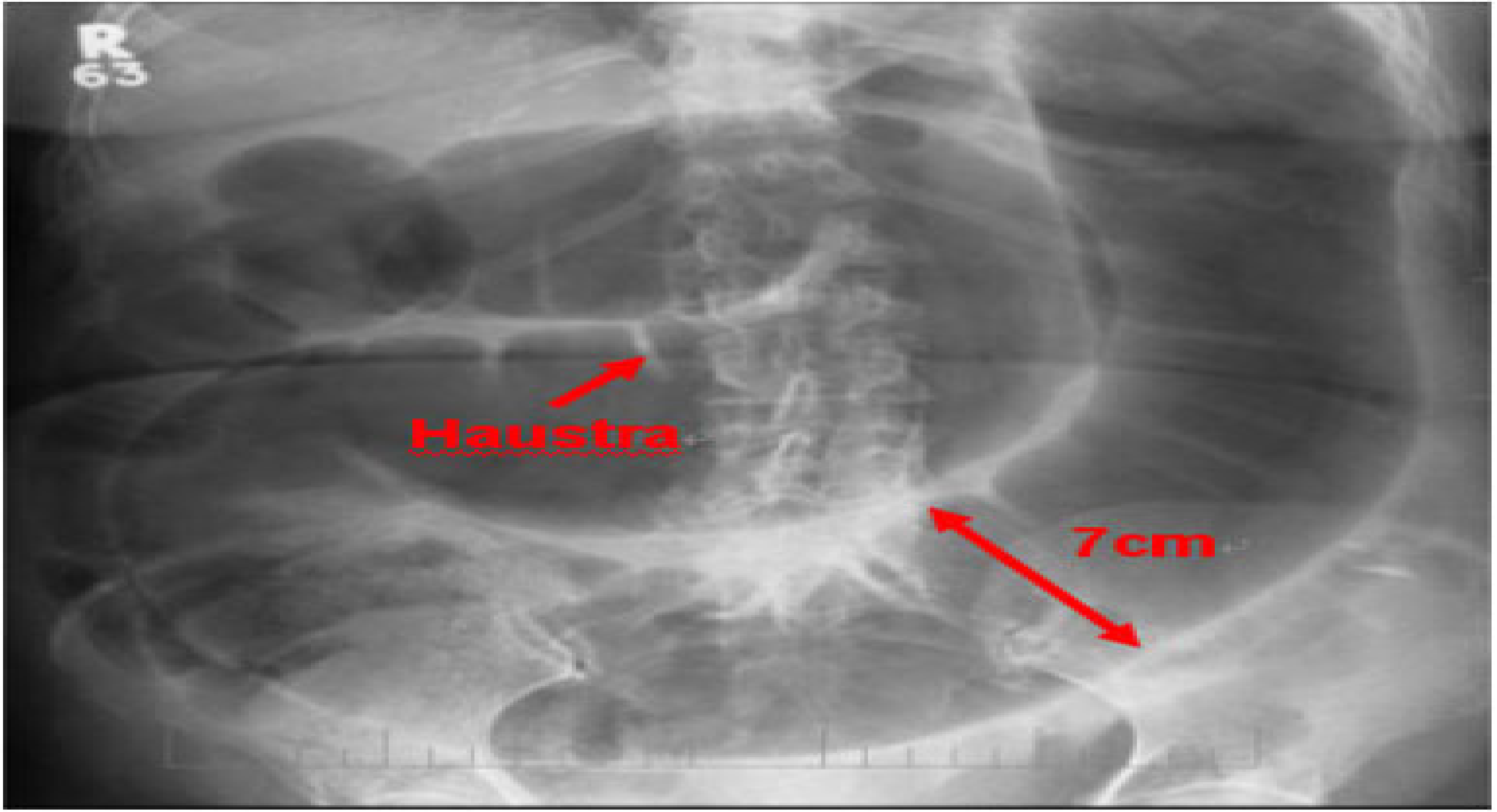
The plain abdominal film is useful for the diagnosis of large bowel obstruction.

- Colonic distension.
- Collapsed distal colon.
- Small bowel dilatation.
- Rectum has little or no air.

DISTINCTION BETWEEN SMALL AND LARGE BOWEL DILATATION

	Small bowel	Large bowel
Distribution of loops	Central	Peripheral
Number of loops	Many	Few
Diameter	2.5-3 cm	6 cm
Haustra	Absent	Present
Valvulae conniventes	Present in jejunum	Absent
Solid feces	Absent	Present


S.F.H.P
FLUOROSPOT
24-11-2003
10:22:16 AM
H: 0 %
F: 30 %
C: 700
B: 337
ARFAJ, HUSSA
456312
01-01-1937
kV: 85
mAs: 1.9
D: 100
2


R
63
Haustra
7cm

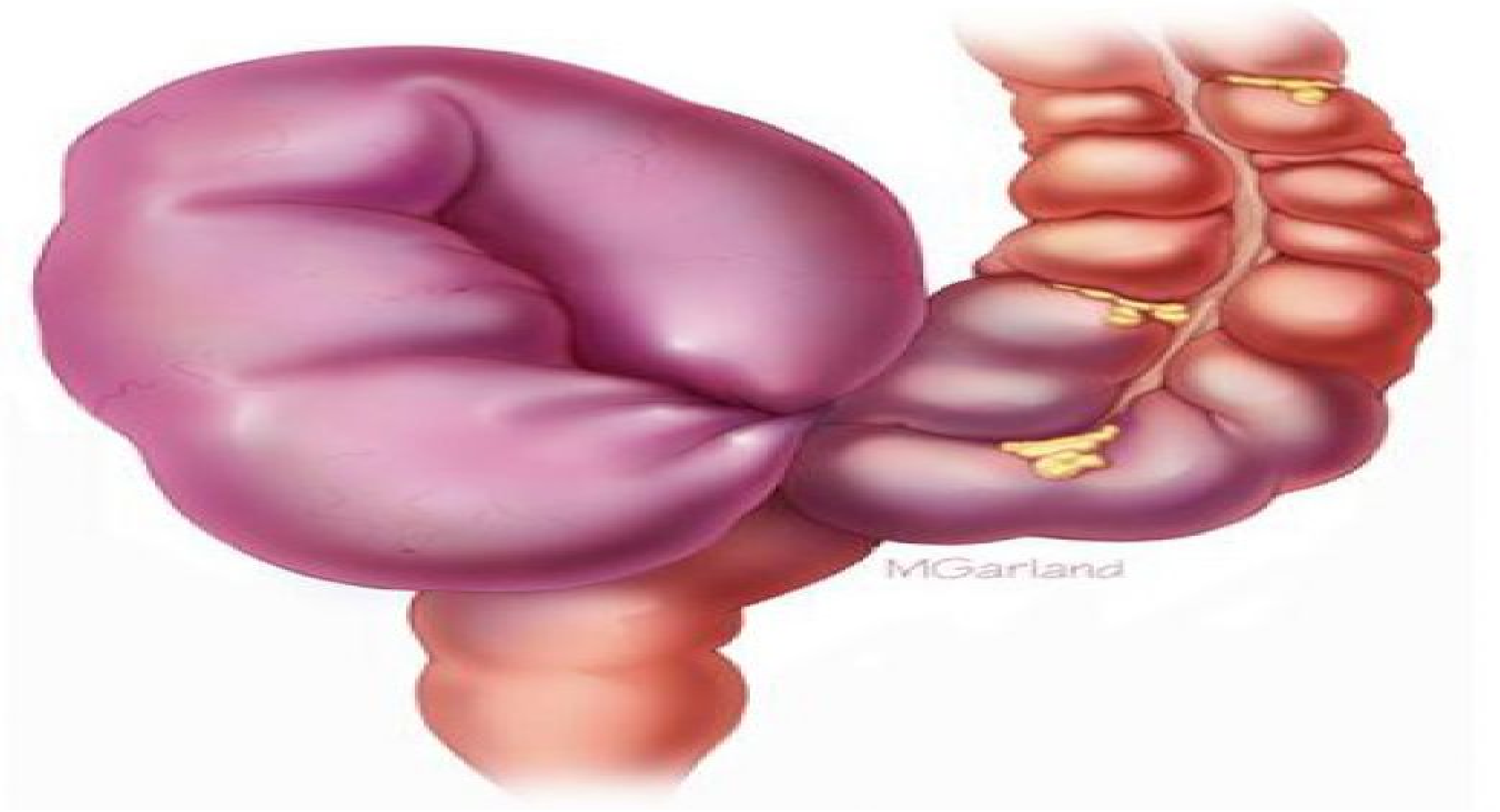

SUPINE

CT SCAN

- CT is currently the most widely used modality for assessment of large bowel obstructions and is not only able to confirm the diagnosis and localize the location of obstruction but in most cases also is able to identify the cause.
- The large bowel will be distended with a thinned stretched wall but should enhance (unless ischemic).

SIGMOID VOLVULUS

- **Sigmoid volvulus** is a cause of large bowel obstruction and occurs when the sigmoid colon twists on its mesentery, the sigmoid mesocolon .
- The **sigmoid mesocolon** is a fold of peritoneum that attaches the sigmoid colon to the pelvic wall.
- It is more common in the elderly


MGarland

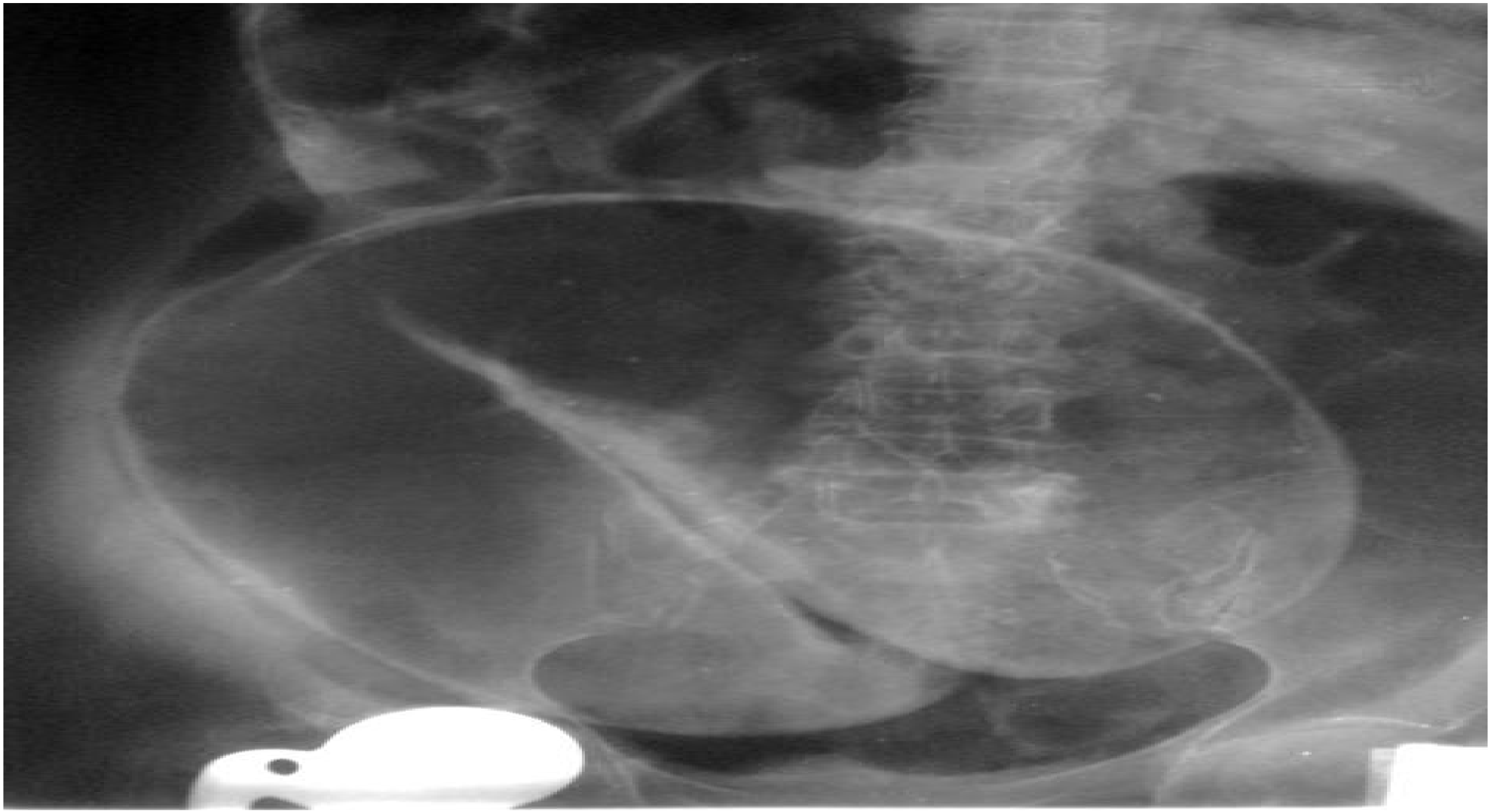
CLINICAL PRESENTATION

- Symptoms are that of large bowel obstruction: constipation, abdominal bloating, nausea and/or vomiting. Onset may be acute or chronic.
- **Etiology**
- There is a wide range of causes; some are geographically specific :
- Chronic constipation and/or laxative abuse
- Fiber-rich diet (especially in Africa)

PLAIN ABDOMINAL FILMS

- Dilated loop of the colon that almost fills the entire abdomen, often with a few gas-fluid levels.
- Double- loop obstruction (50% of patients).

  Coffee bean sign or Omega sign: inverted U shaped appearance of distended sigmoid loop (the bowel loop points to right upper quadrant).
- Loss of haustra.




R

PNEUMOPERITONEUM

- is pneumatosis (abnormal presence of air or other gas) in the peritoneal cavity, a potential space within the abdominal cavity.
- The **peritoneum** is a large complex serous membrane that forms a closed sac, the **peritoneal cavity**, within the abdominal cavity.

THE PERITONEAL CAVITY

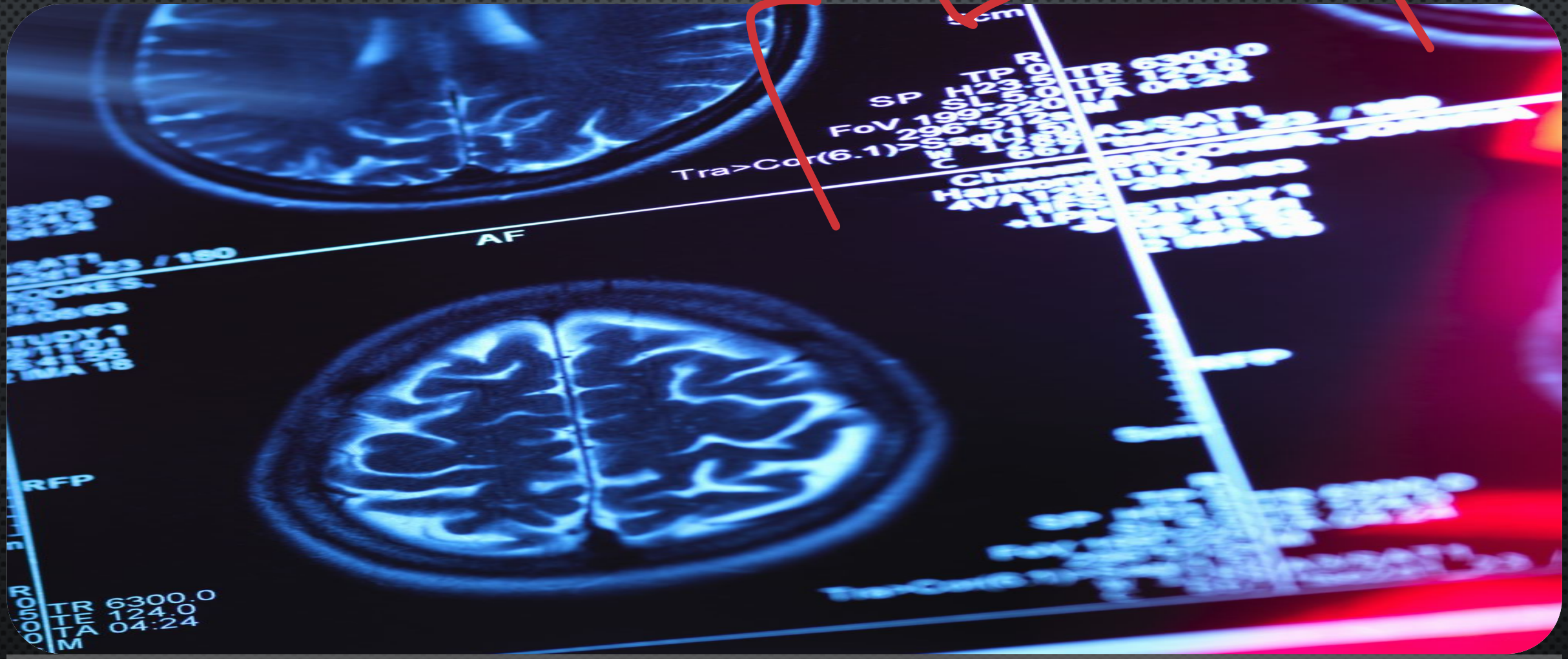
- is a potential space between the parietal peritoneum and the visceral peritoneum

- The parietal peritoneum lines the walls of the abdominal and pelvic cavities
- The visceral peritoneum covers the organs.

CAUSES OF PNEUMOPERITONEUM

- **Perforated hollow viscus**
  - peptic ulcer disease
  - ischemic bowel
  - bowel obstruction
  - necrotizing enterocolitis
  - appendicitis
  - diverticulitis
  - malignancy
  - inflammatory bowel disease
  - mechanical perforation
    - trauma
    - colonoscopy
    - foreign bodies
    - iatrogenic
- Postoperative free intraperitoneal gas.
- Peritoneal dialysis.
- Pneumomediastinum.
- Pneumothorax .

RADIOLOGICAL SIGNS

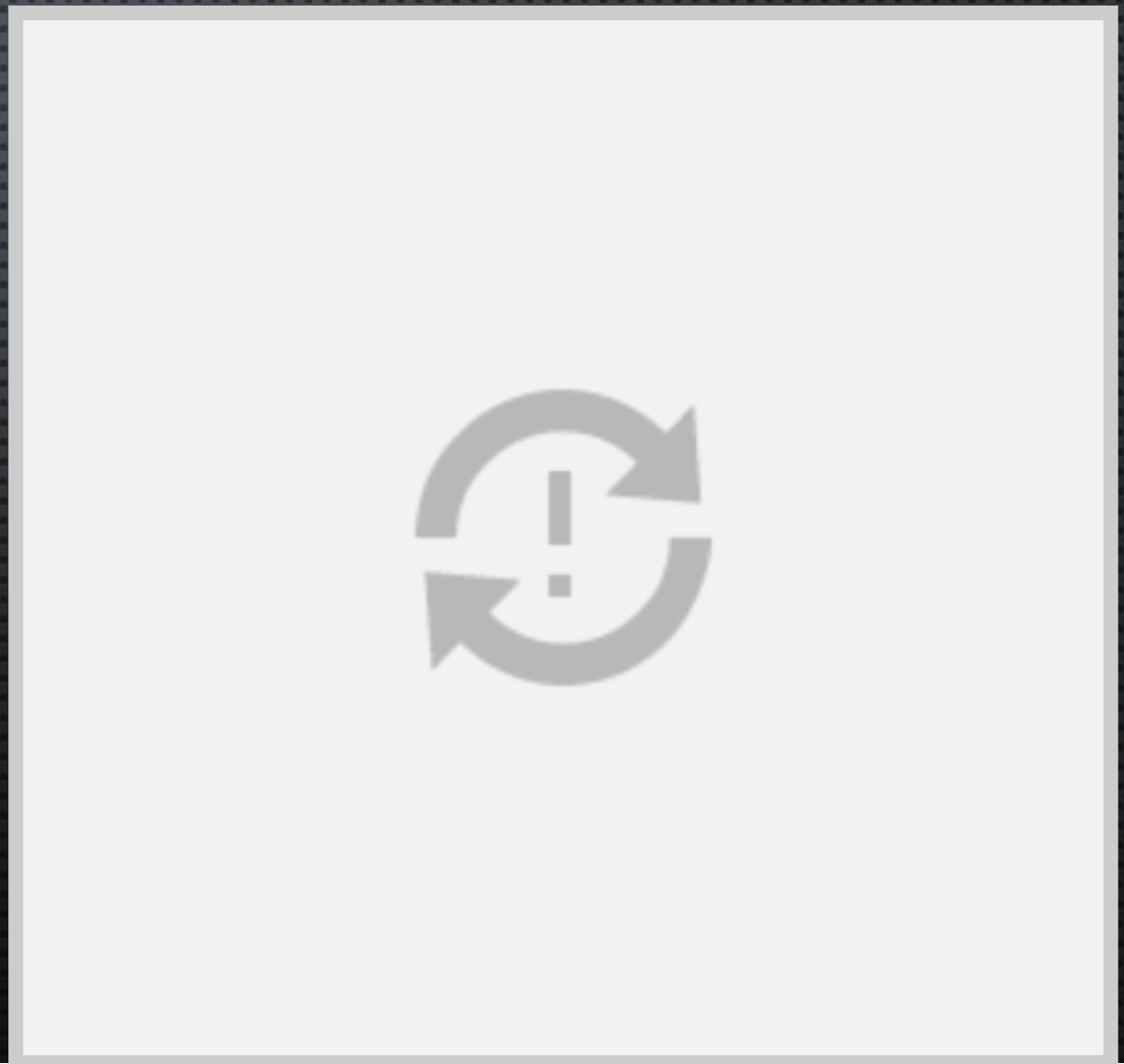


CRESCENT SIGN

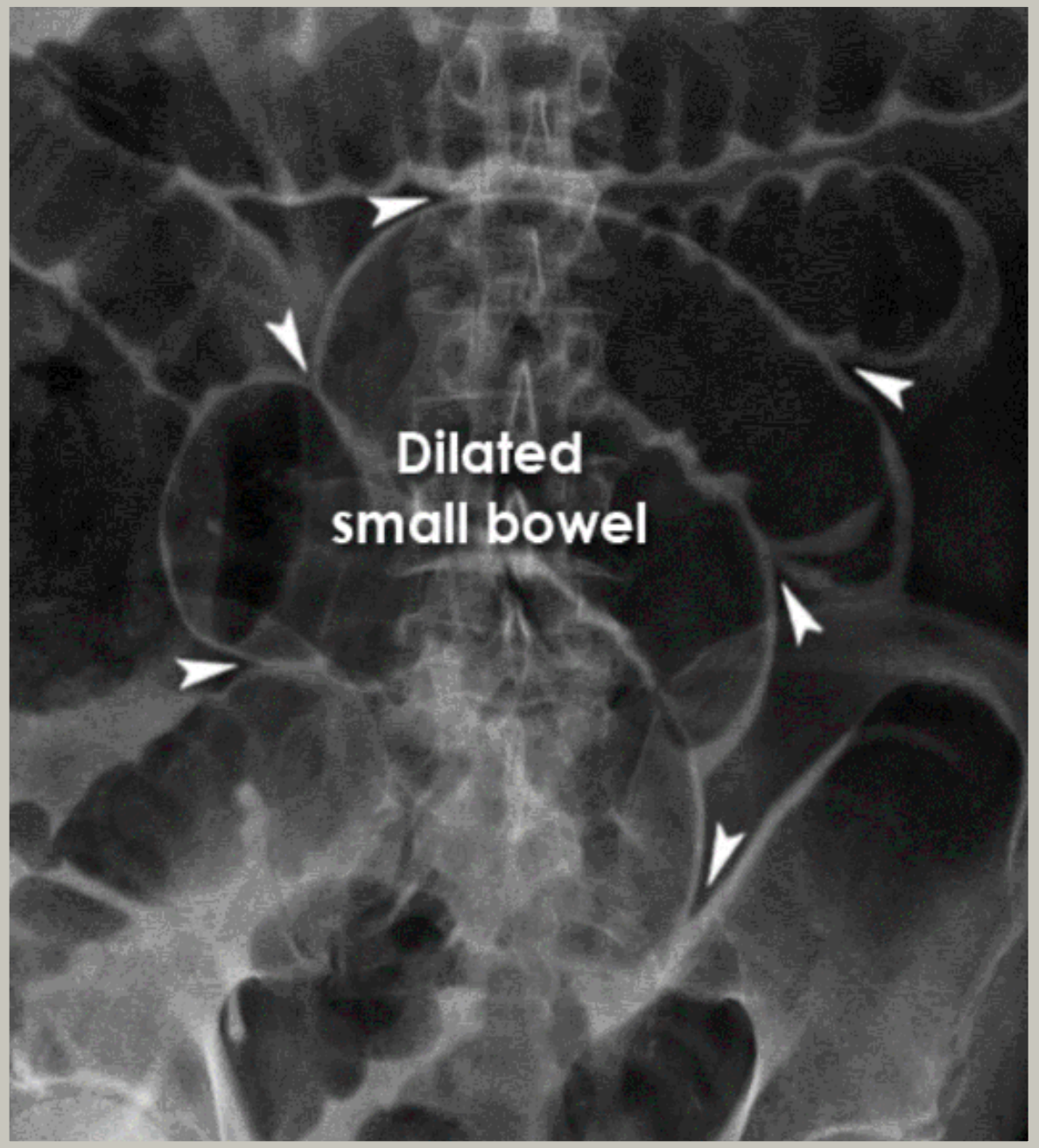
- This image shows a very large volume of gas under the diaphragm due to bowel perforation

RIGLER SIGN (DOUBLE WALL SIGN):

- If there is free intra-abdominal gas adjacent to a gas-filled loop of bowel then both sides of the bowel wall are well-defined. This is known as 'Rigler's sign'.

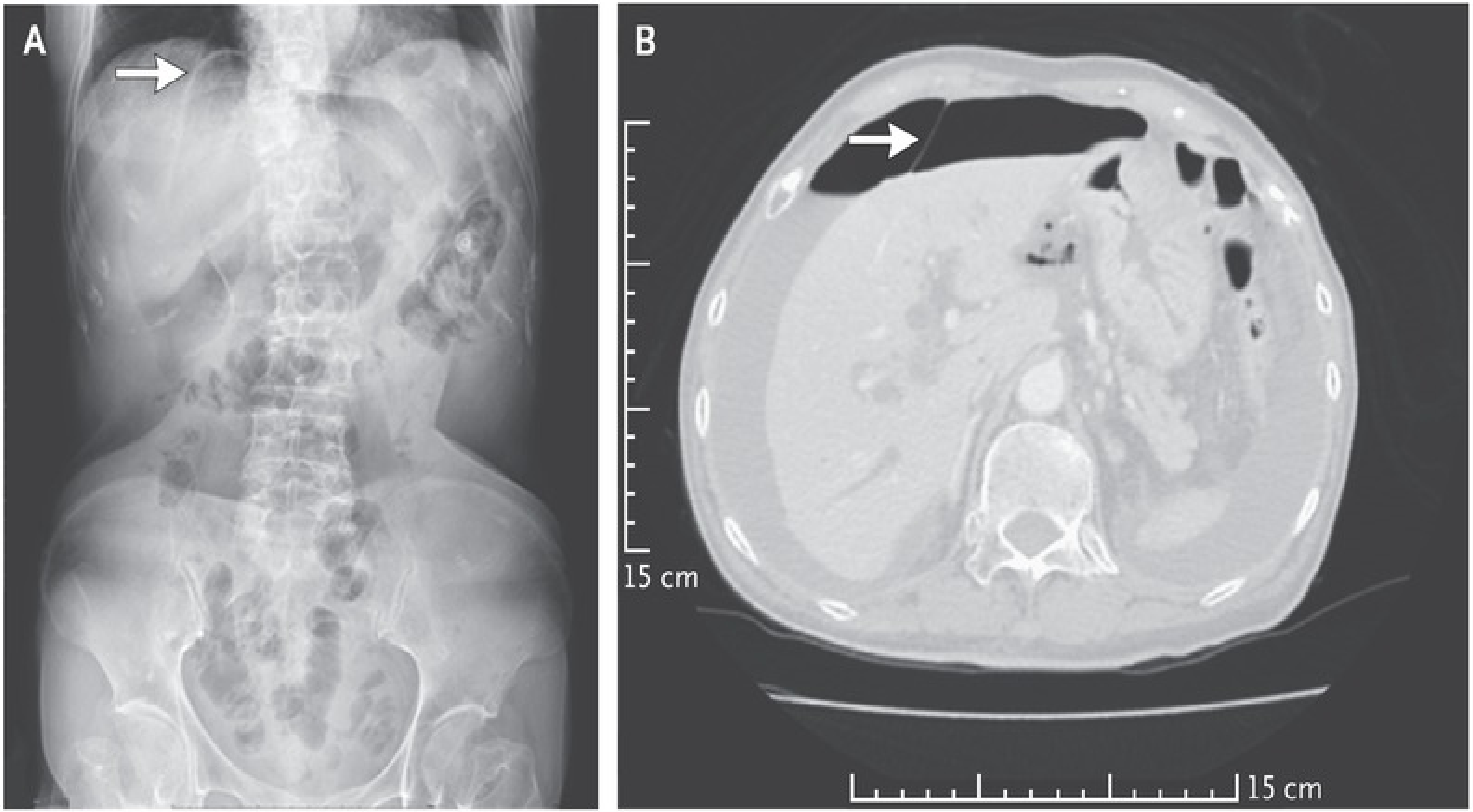


- The multiple loops of dilated gas-filled bowel indicate small bowel obstruction.
- Rigler's sign is visible, and so obstruction has been complicated by perforation.
- When gas surrounds multiple loops of bowel there may be formation of sharp points or triangles (arrowheads)



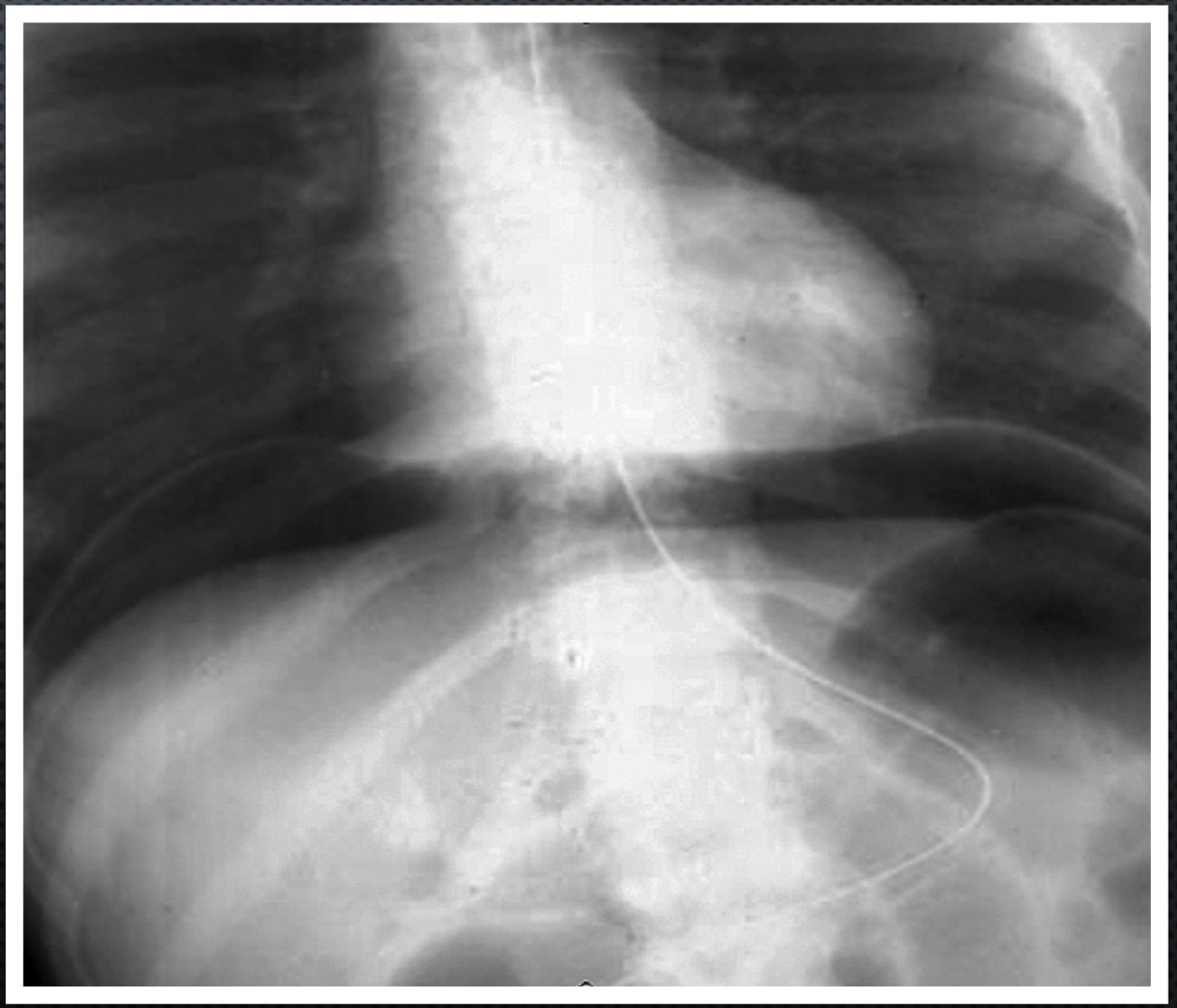
FALCIFORM SIGN OR (SILVER SIGN)

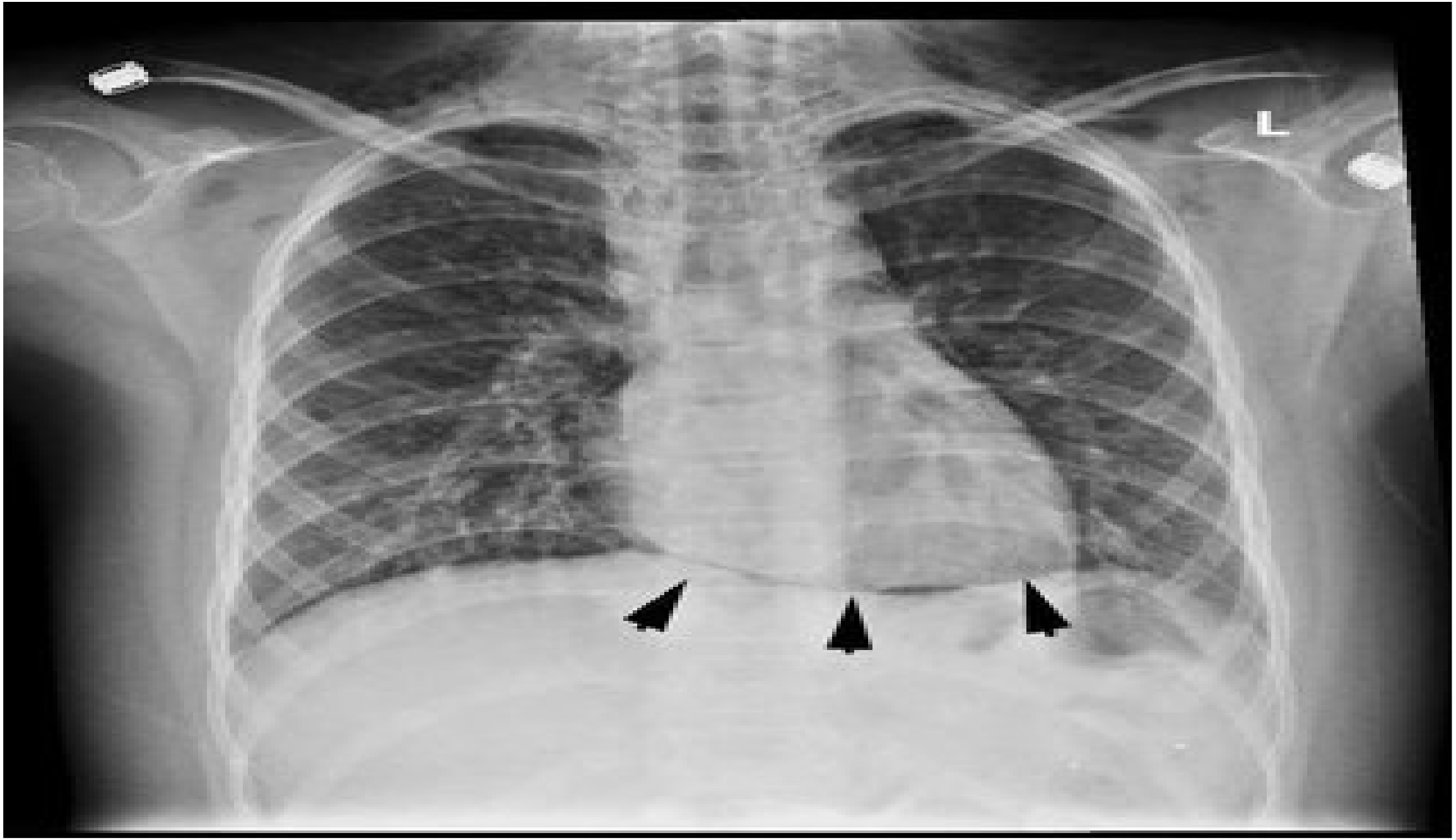
- Linear density of falciform ligament outlined by air in the upper right quadrant


A
B
15 cm
15 cm

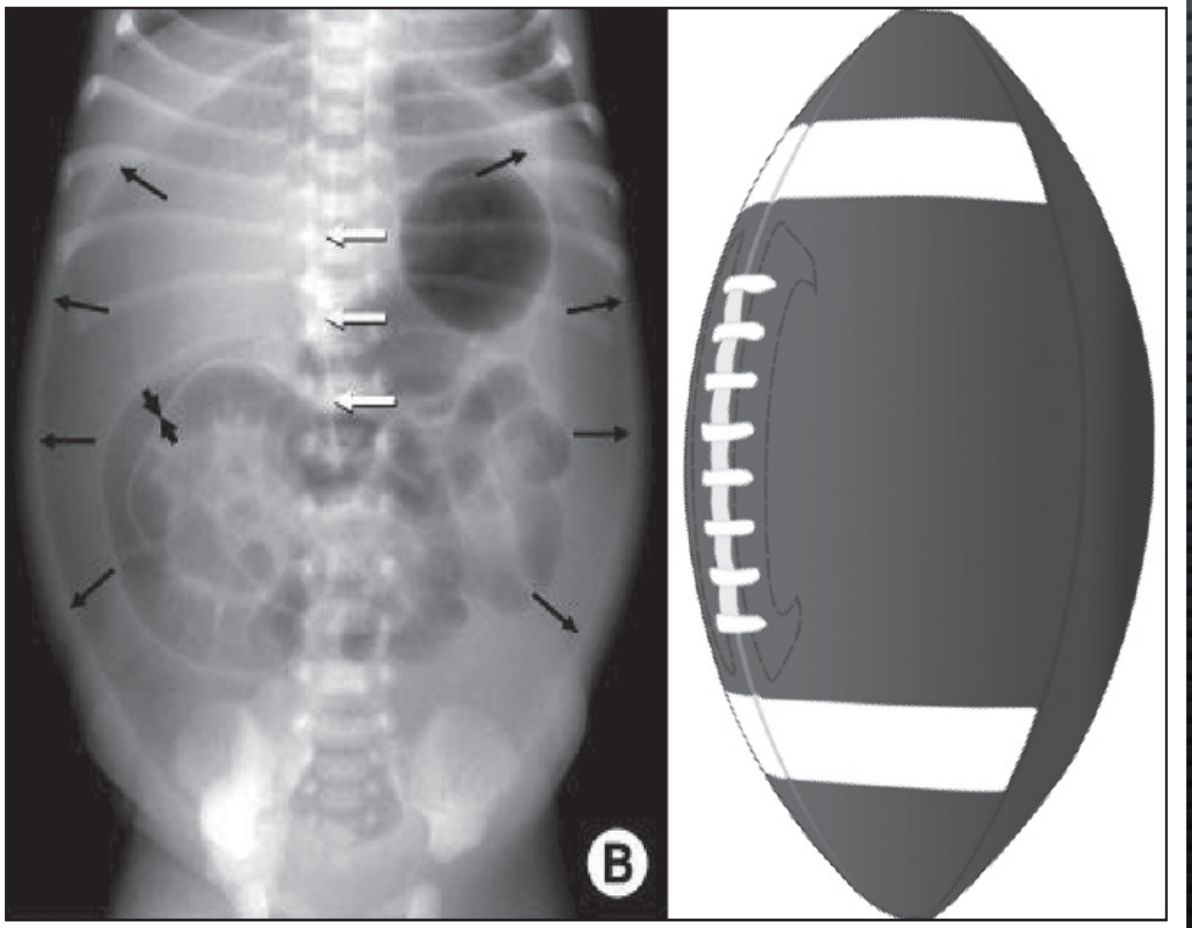
CONTINUOUS DIAPHRAGM SIGN:

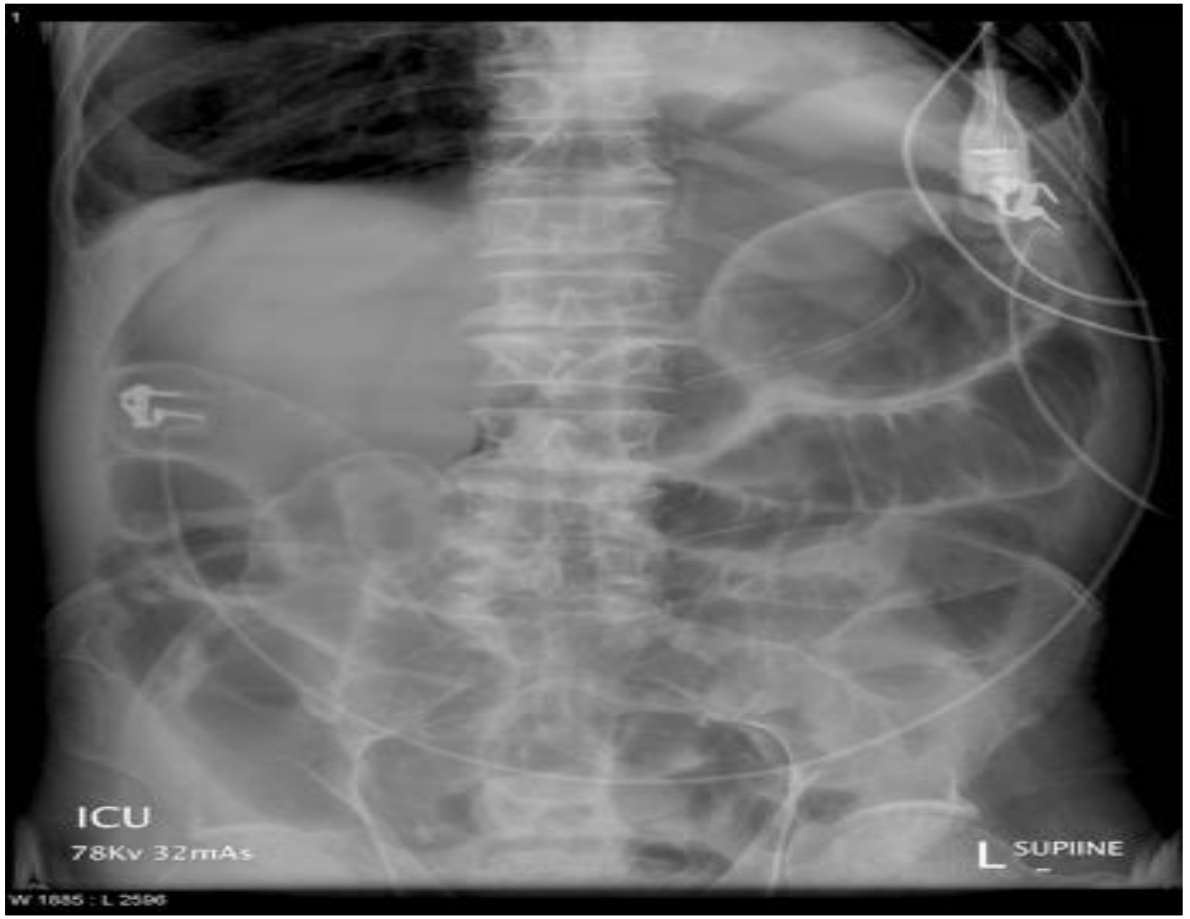
- Massive pneumoperitoneum- sufficient air beneath the diaphragm
- -right and left hemidiaphragms contrasted by free gas (appear as continuous structure)




L

FOOTBALL SIGN





FEW SPECIAL POINTS

DUODENAL ULCER PERFORATION	TOXIC MEGA-COLON	NECROTISING ENTERO-COLITIS
Its the most common cause , especially the anterior surface of the Duodenum	Its a complication of inflammatory bowel diseases mainly ulcerative colitis	Most common cause in children

GALLSTONES

What Are Gallstones?

- Gallstones are pieces of solid material that form in your gallbladder .
- The gallbladder is a small pouch that sits just under the liver. The gallbladder stores bile produced by the liver. After meals, the gallbladder is empty and flat, like a deflated balloon. Before a meal, the gallbladder may be full of bile and about the size of a small pear.
- **Stones in the gallbladder are relatively common and occur in approximately 10% of population.**

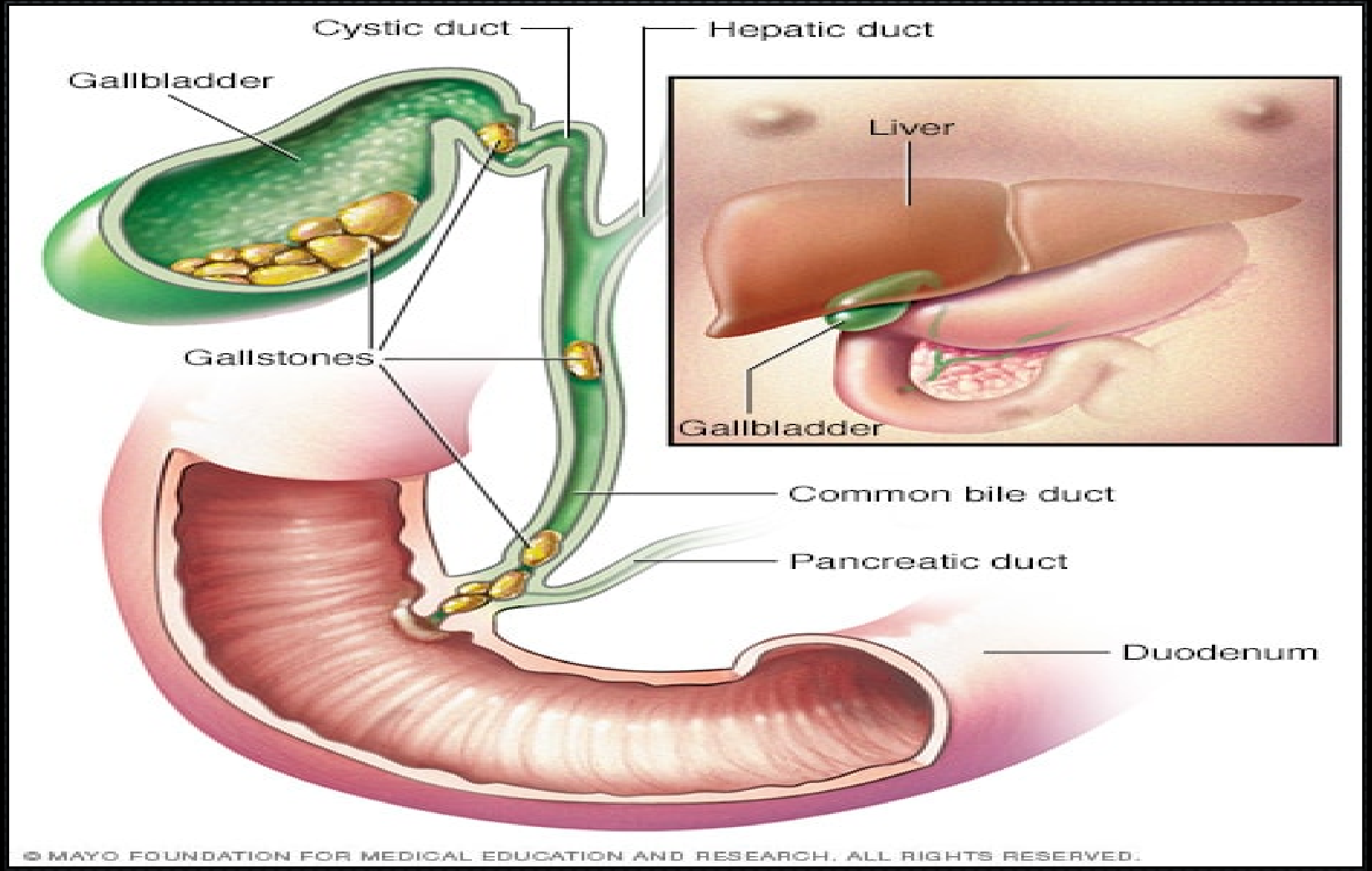
GALLSTONE TYPES

The two main kinds of gallstones are:

- **Cholesterol and mixed stones.** These are usually yellow-green. They're the most common, making up 80% of gallstones.
- **Pigment stones.** These are smaller and darker. They're made of bilirubin .

RISK FACTORS

- female sex (F: M = 2:1).
- middle age
- obesity
- positive family history
- recent rapid weight loss



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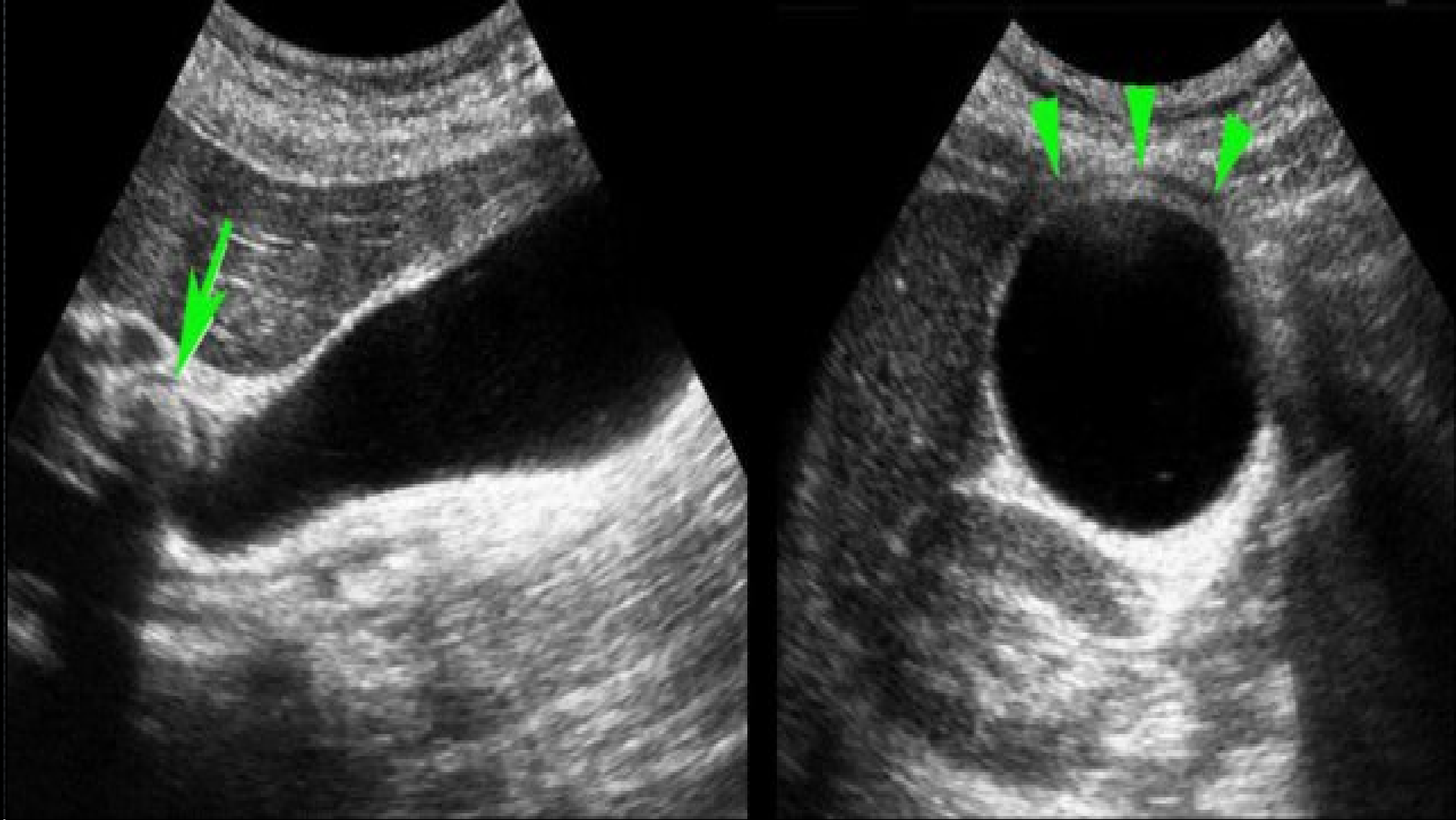
WHAT IS THE MAIN CAUSE OF GALLSTONES?

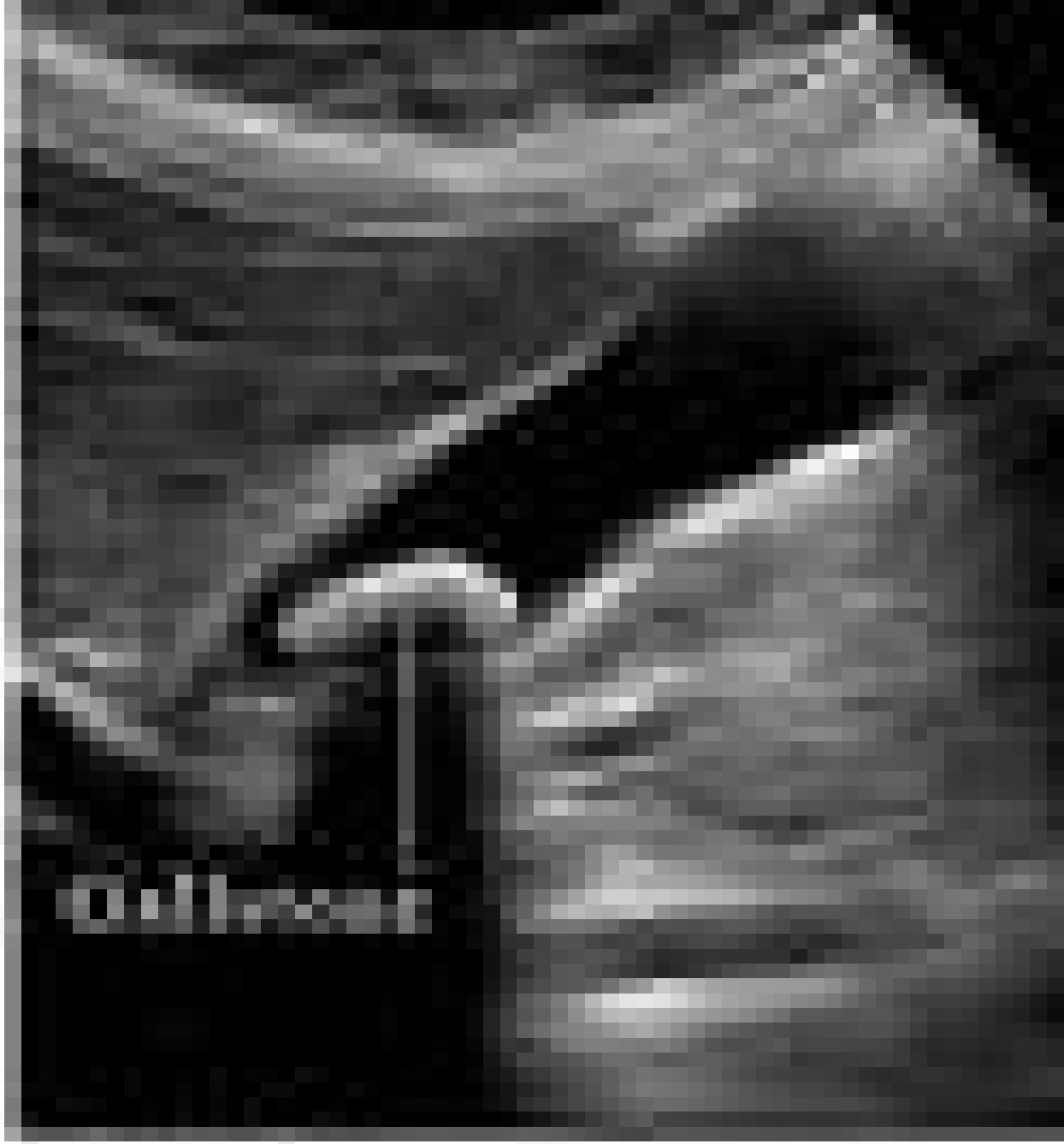
- As much as 75% of the gallstones healthcare providers discover are made up of excess cholesterol. So, we could say that having excess cholesterol in your blood is the leading cause of gallstones.
- You might have extra cholesterol for a variety of reasons. Some of the most common reasons include metabolic disorders, such as obesity and diabetes.

IMAGING :

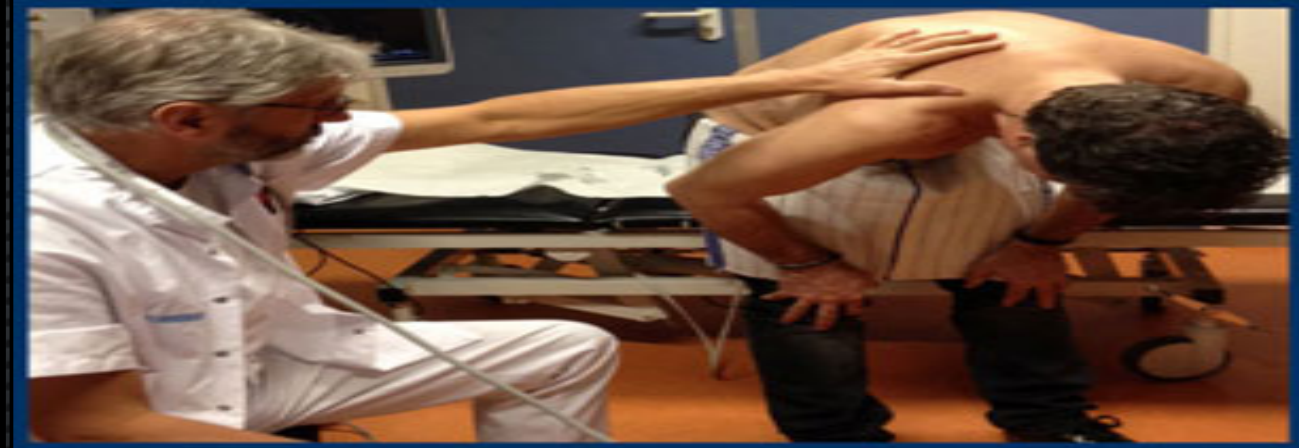
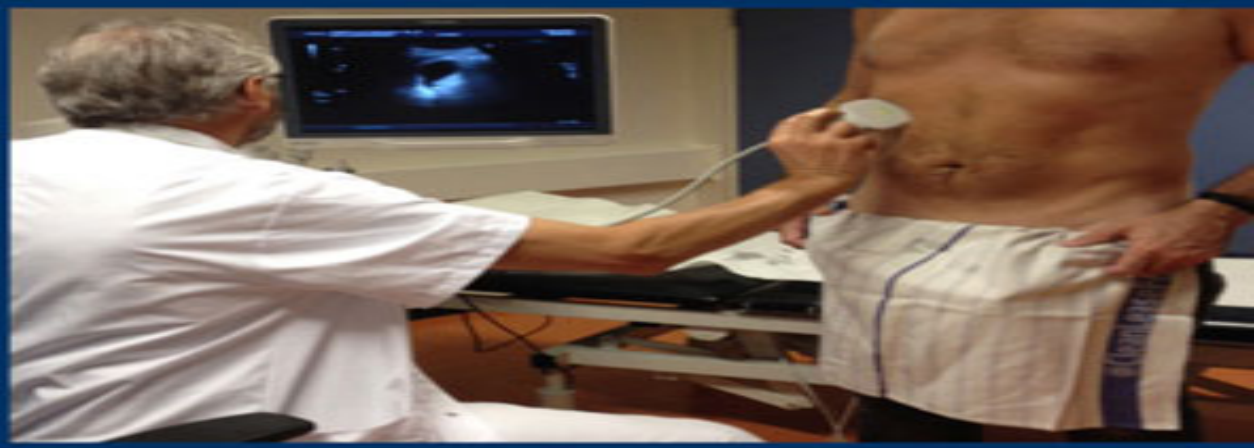
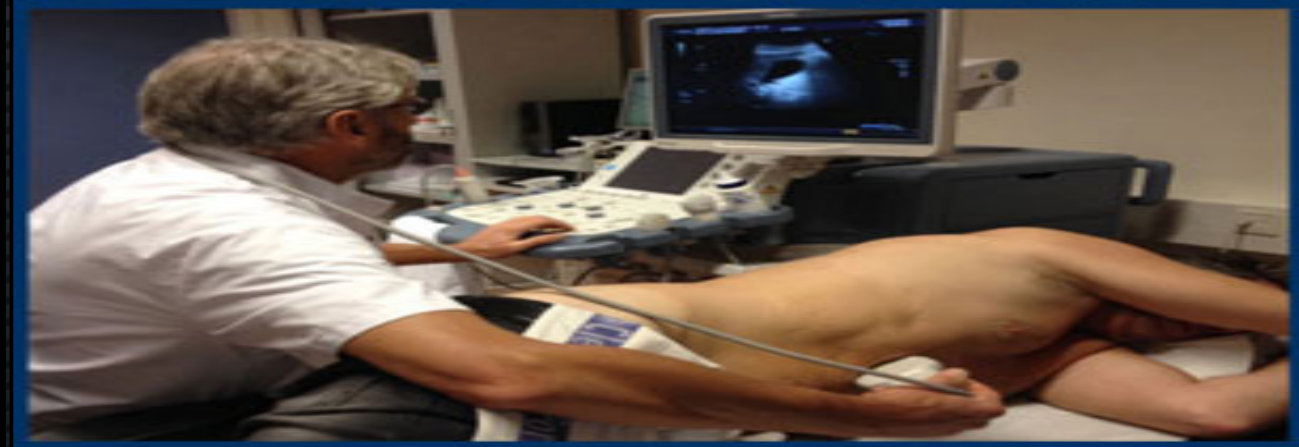
Ultrasound

- Ultrasound is considered the **gold standard** for detecting gallstones .
- A gallstone on ultrasound is echogenic, it appears as a white structure that casts a dark shadow behind it.





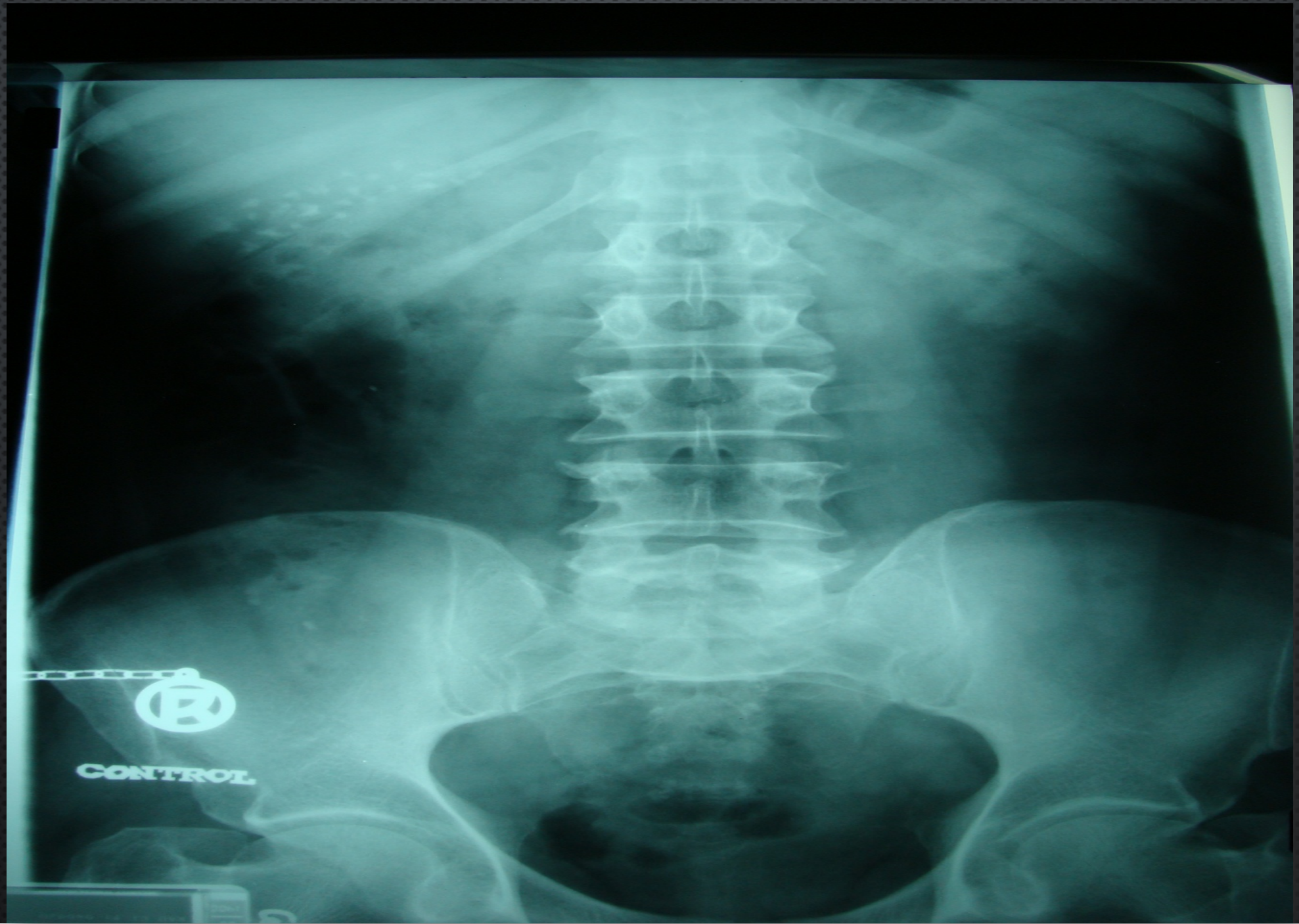



Demonstration of an impacted stone

PLAIN ABDOMINAL FILMS

- Some radiopaque gallstones may be seen on plain film:
- gallstones are radiopaque only in 15-20% of cases
- may show a Mercedes-Benz sign .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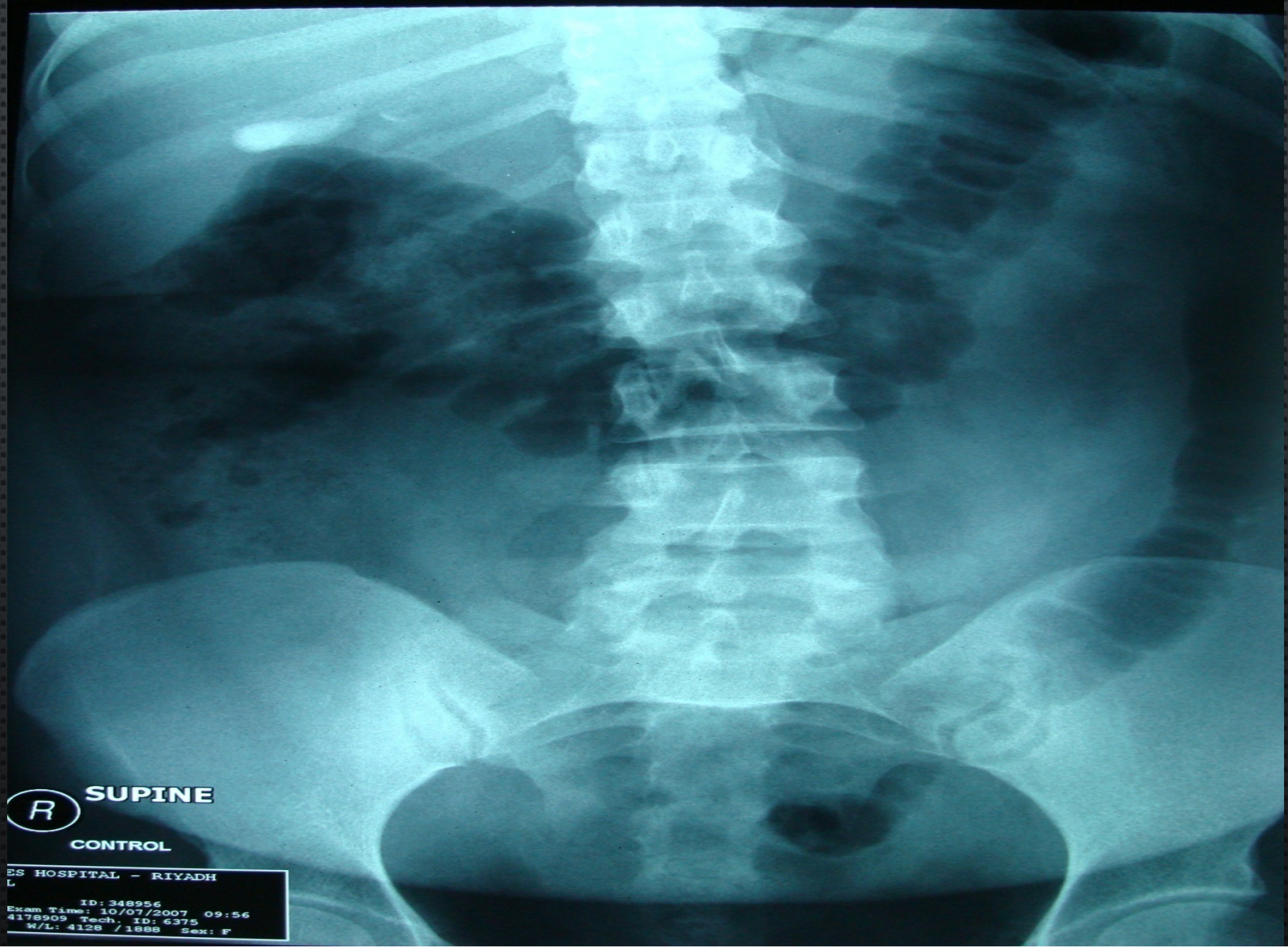
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ACUTE CHOLECYSTITIS

- **Acute cholecystitis** refers to the acute inflammation of the gallbladder.
- It is the primary complication of **Gallstones** and the most common cause of acute pain in the right upper quadrant (RUQ).
- Acute cholecystitis is a common cause of hospital admission and is responsible for approximately 3-10% of all patients with abdominal pain.

CLINICAL PRESENTATION

- Constant right upper quadrant pain that can radiate to the right shoulder.
- Pain typically persists for more than six hours .
- Nausea, vomiting, and fever are also often reported.

PATHOLOGY

90-95% of cases are due to gallstones (i.e. acute calculous cholecystitis) with the remainder being acute acalculous cholecystitis .

The development of acute calculous cholecystitis follows a sequence of events:

- gallstone obstruction of the gallbladder neck or cystic duct.
- inflammation from chemical injury of the mucosa by bile salts.
- reactive production of mucus, leading to increased intraluminal pressure and distention
- increased luminal distention restricting blood flow to the gallbladder wall (gallbladder hydrops or **mucocele**).
- increasing wall thickness from edema and inflammatory changes.
- secondary bacterial infection in ~66% of patients.

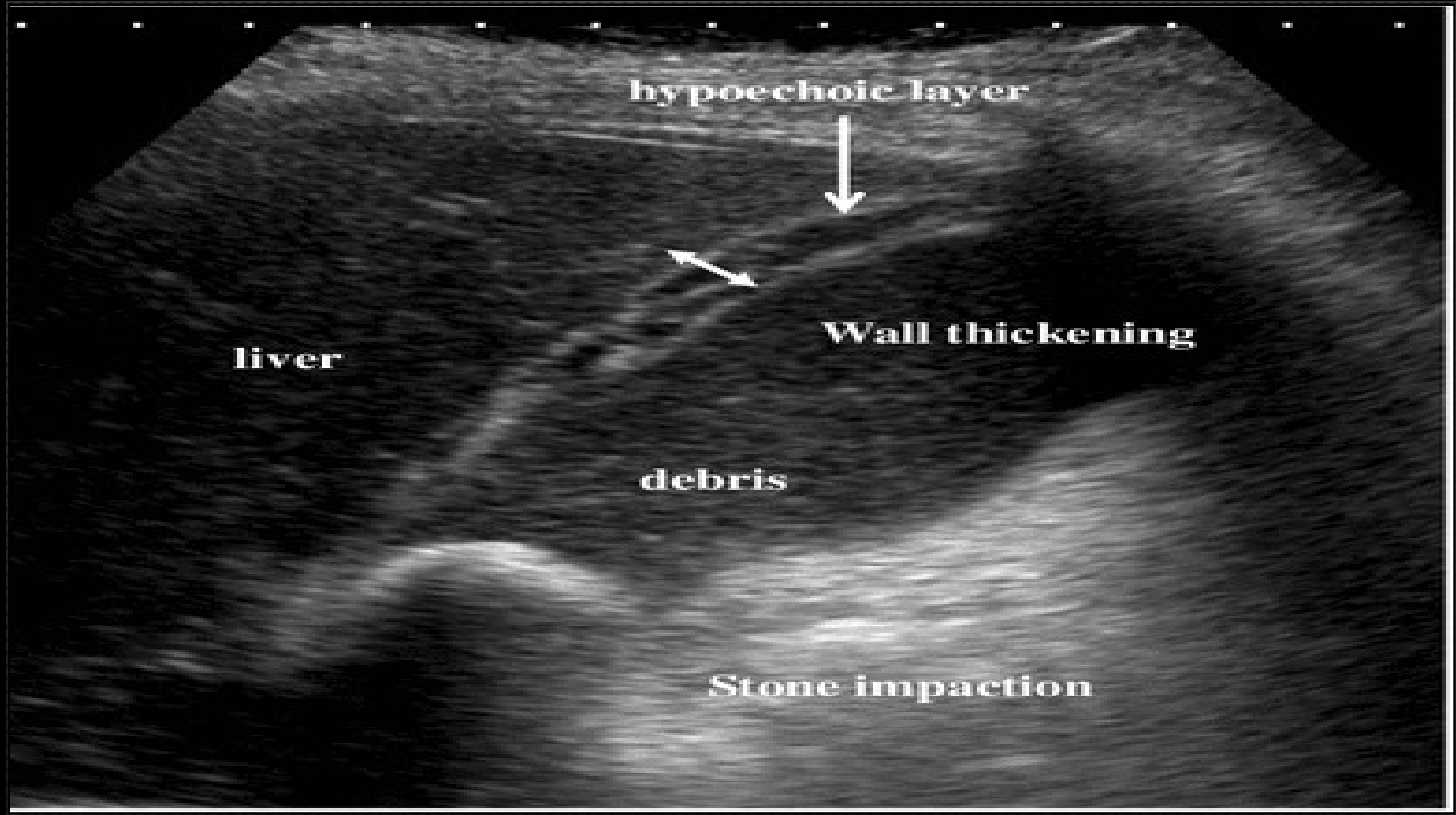
ULTRASOUND

Ultrasound (US) is the initial modality in the investigation of gallstones and the diagnosis of acute cholecystitis .

The most sensitive US finding in acute cholecystitis is the presence of gallstone in combination with the sonographic Murphy sign.

gallbladder wall thickening (>3 mm) and pericholecystic fluid .

Other findings include gallbladder distension and sludge.


hypoechoic layer
Wall thickening
liver
debris
Stone impaction

Thank You