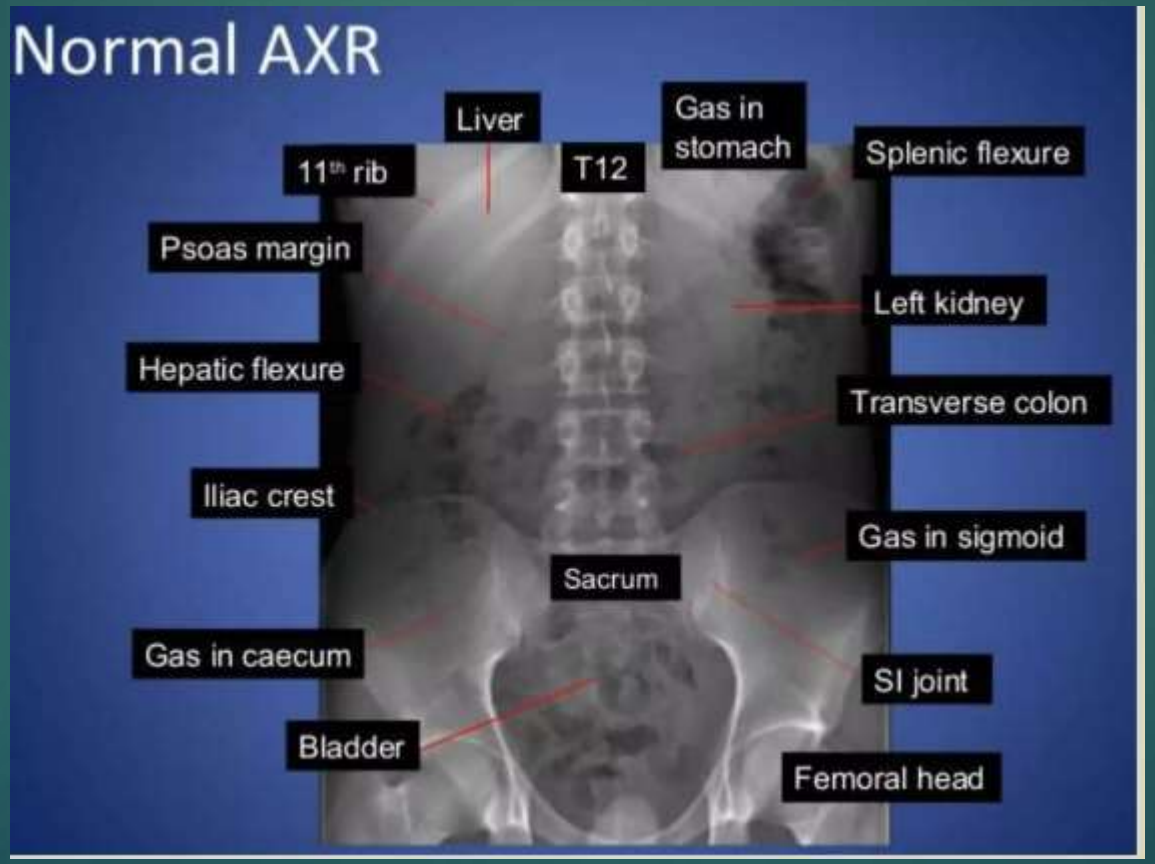
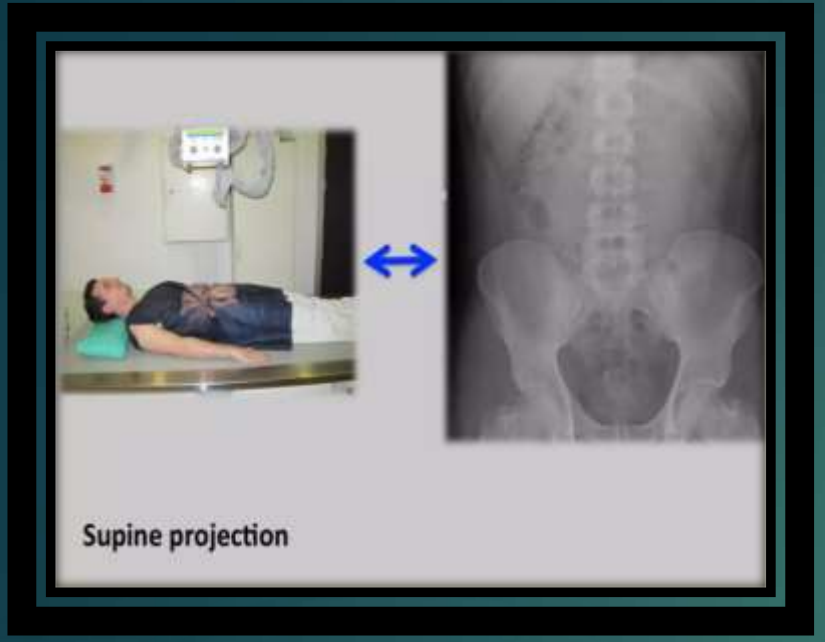
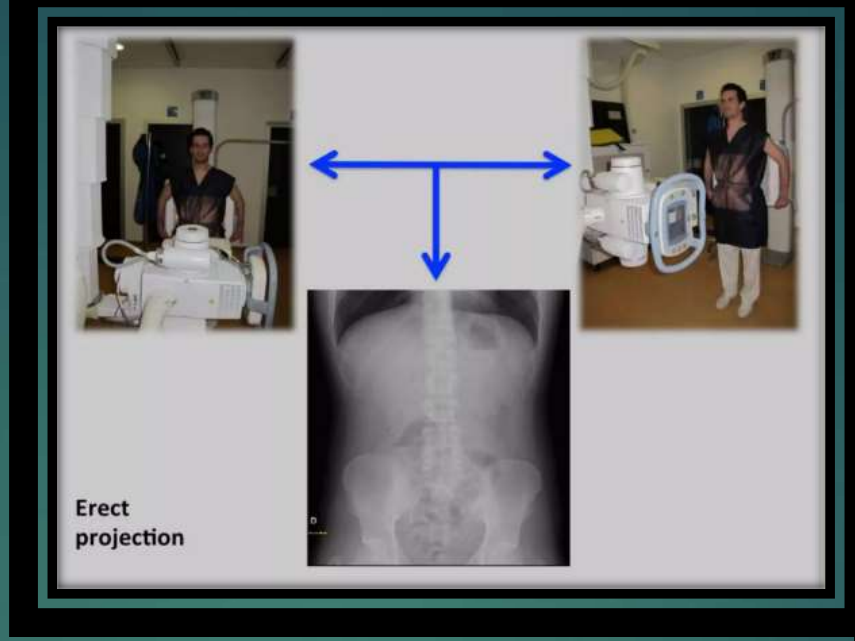
Abdomen radiology

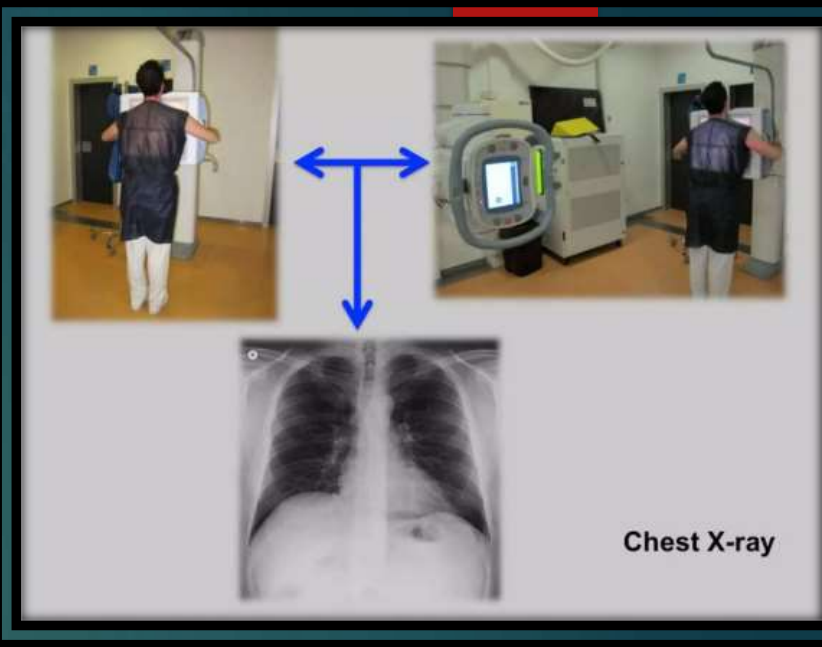
2024-2025

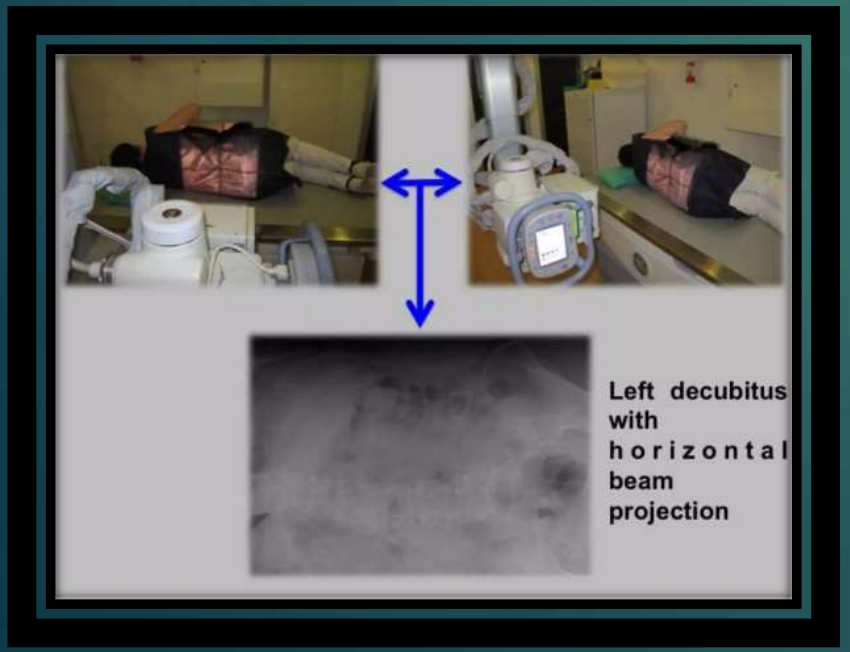
Normal abdomen xray

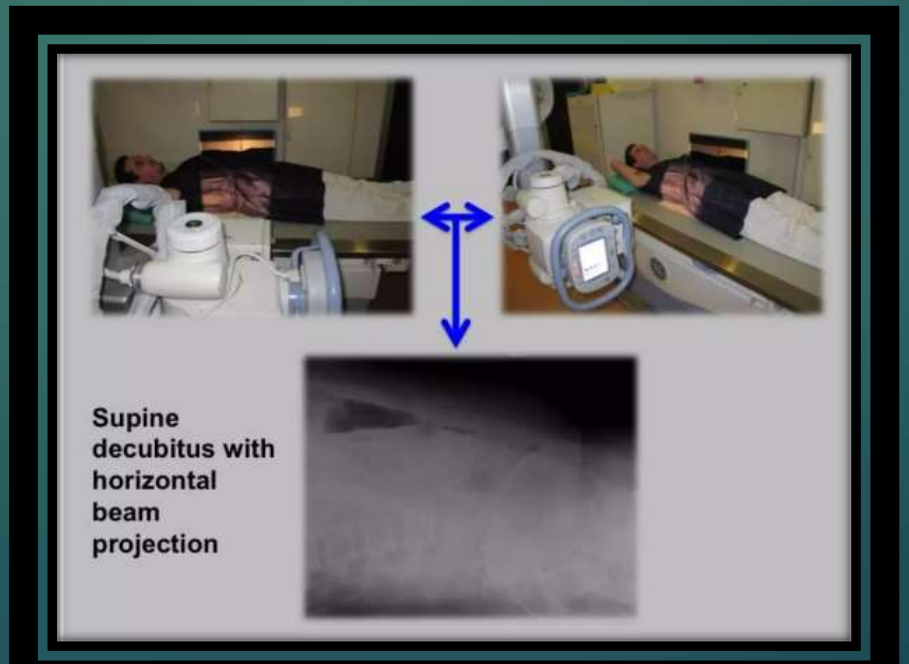












Positions of abdomen x-r

Pathology

ABCDE approach:

A-Air in a wrong place.

B-Bowel loops.

C-Calcifications.

D-Dense structures like soft tissue and bones densities.

E-Everything as foreign bodies.

A

Looking for Air in a wrong place

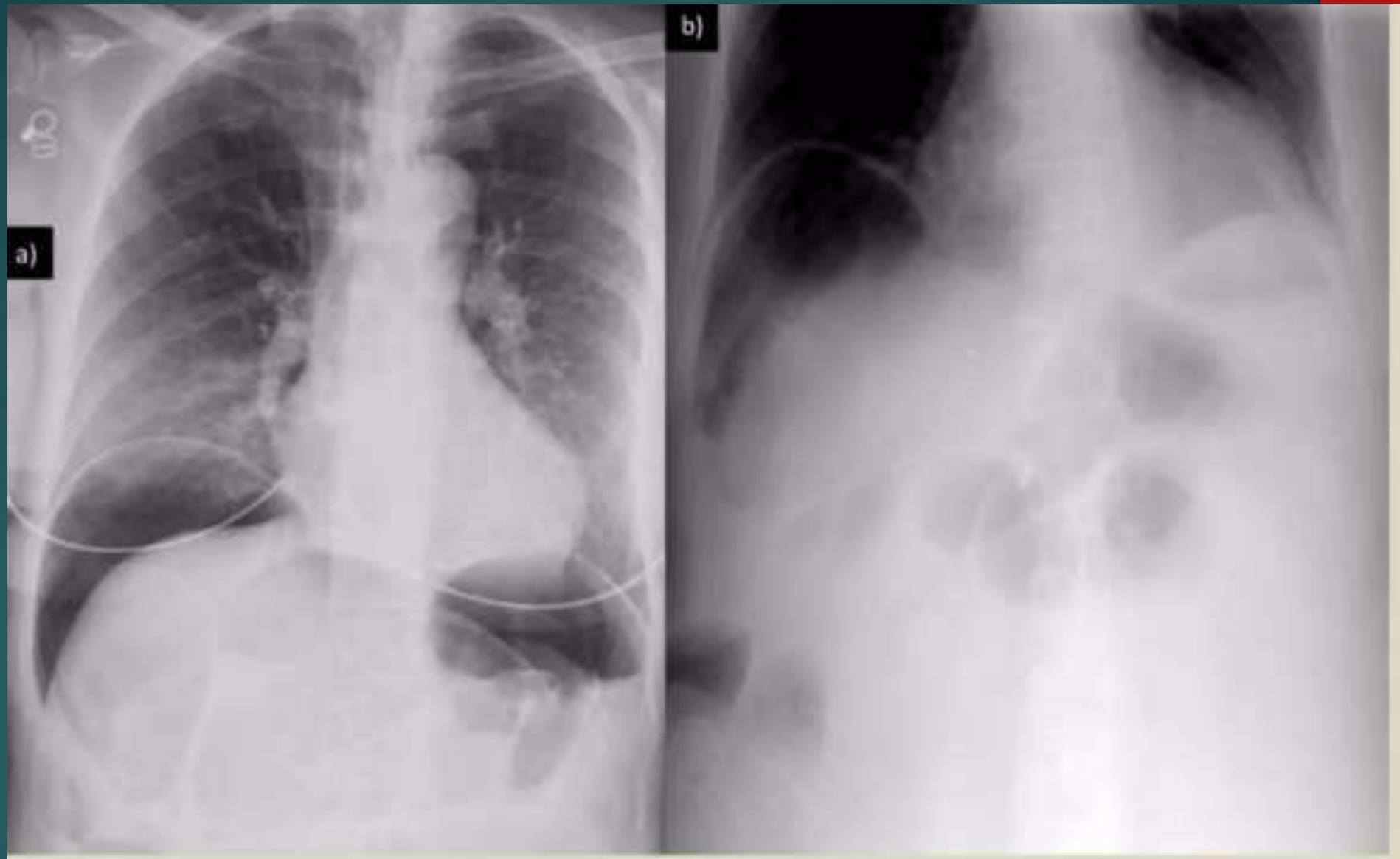
1-pneumoperitoneum(air at peritoneal cavity).

2-Pneumoretroperitoneal(air at the retroperitoneal space).

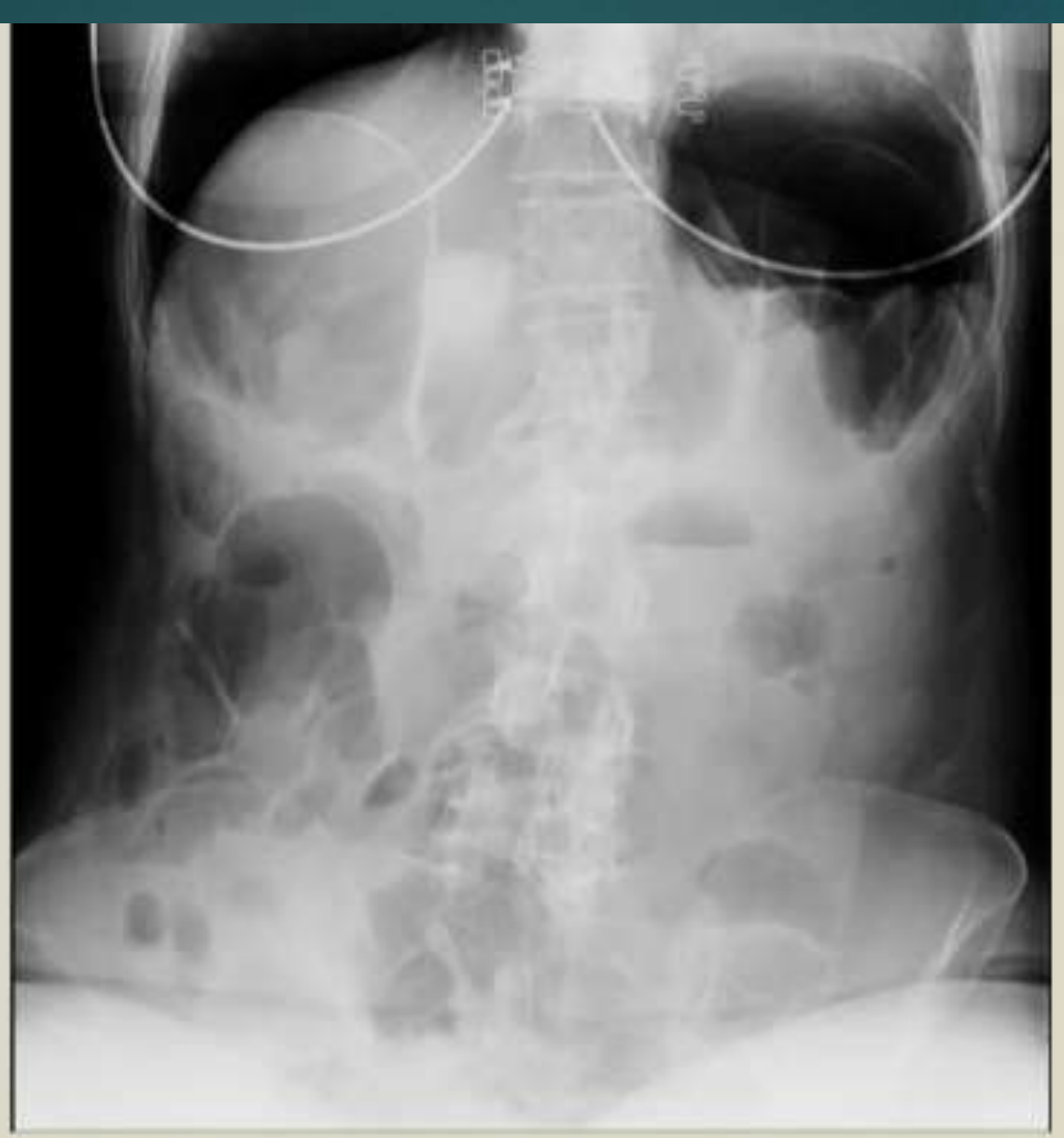
3-Pneumatosis intestinalis(Air along the bowel wall).

4-Pneumobilia(air at the biliary tree).

5-Portal venous air(air at the portal vein).



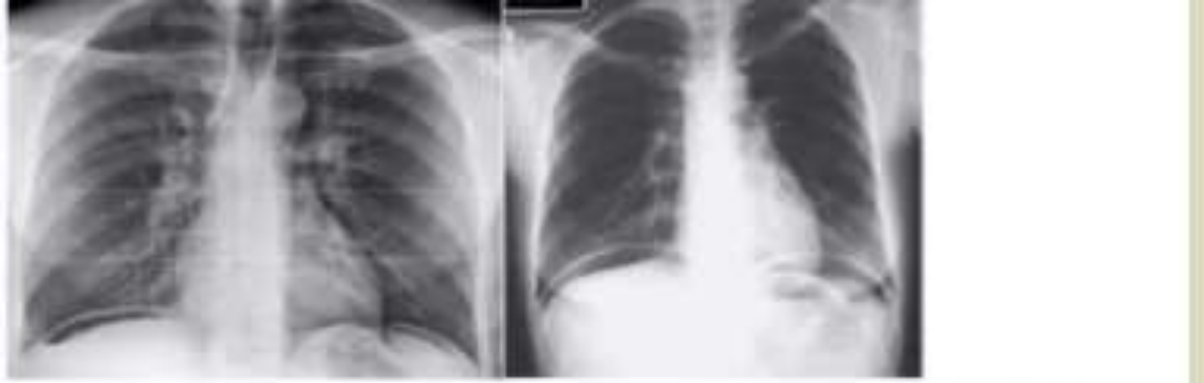
Crescent Sign: plain film showing appearance of a sliver of air usually beneath the both hemidiaphragms in pneumoperitoneum. b) Chilaiditi's Sign: plain film showing interposition of bowel gas between the liver and the right hemidiaphragm.

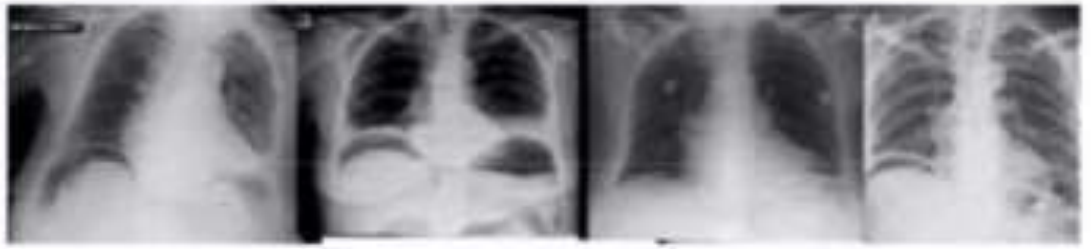


Crescent Sign: ***abdominal radiography showing air beneath both hemidiaphragms, in relation with pneumoperitoneum.***

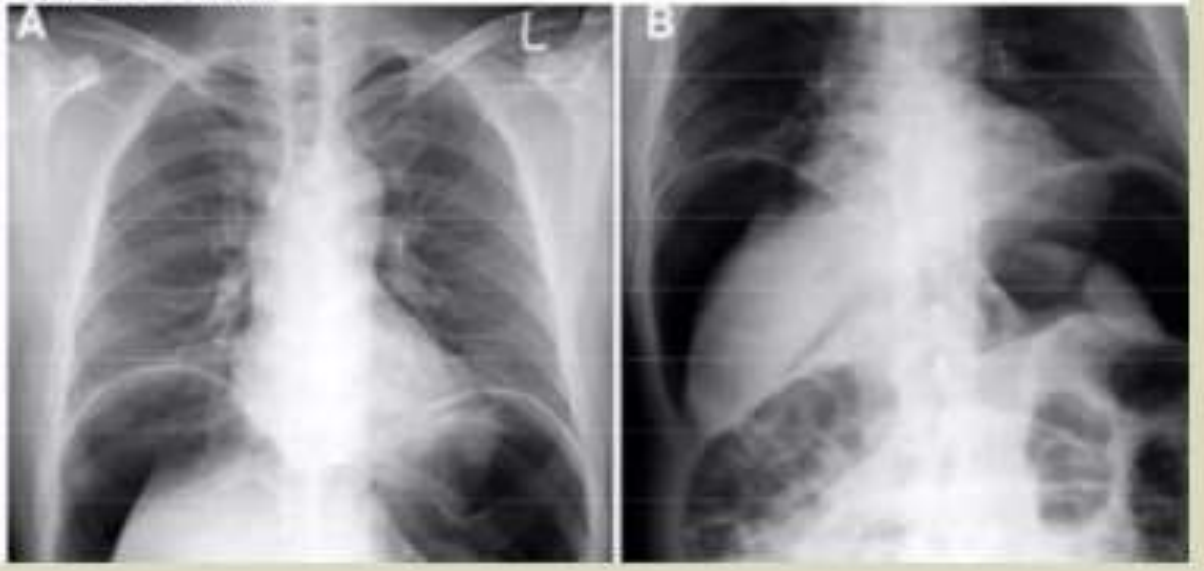
Crescent Sign:

plain film showing appearance of a sliver of air usually beneath the both hemidiaphragms in pneumoperitoneum



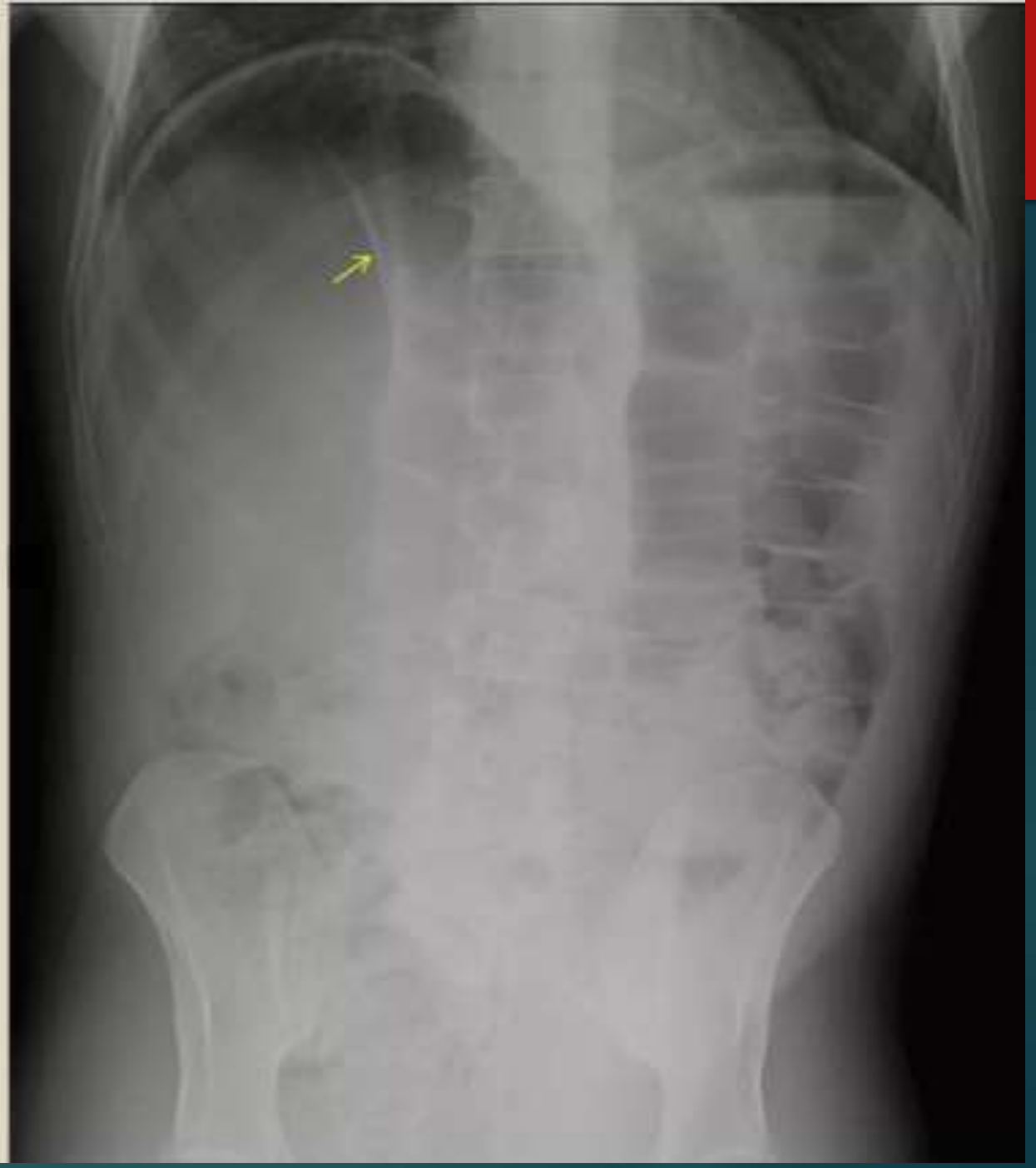


Plain film of the chest X-ray (A) and simple abdomen (B). After colon perforation, free air under the bot diaphragm were noted.



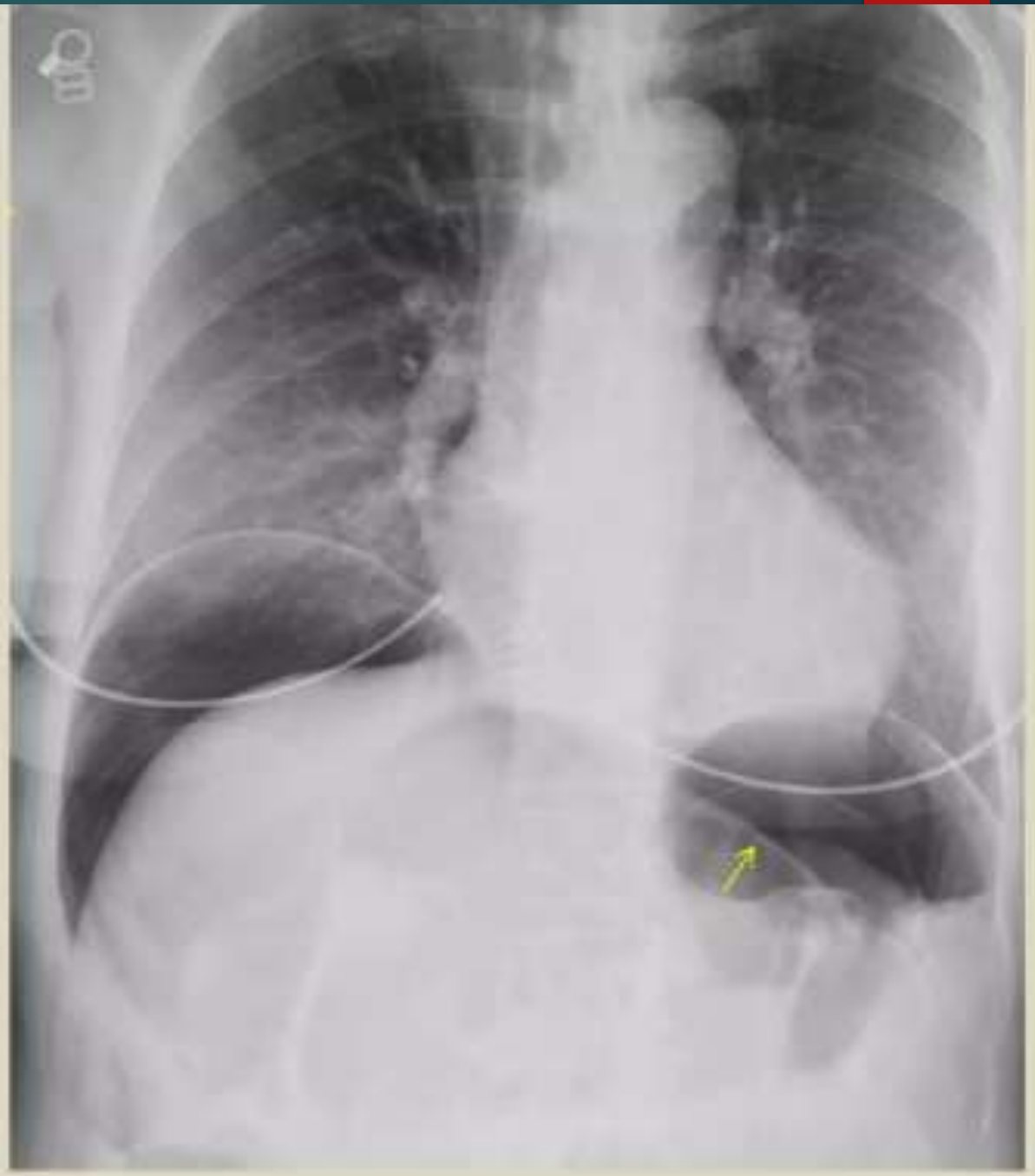
Falciform Ligament Sign

- *abdominal radiography showing the falciform ligament from surrounding air, in pneumoperitoneum.*

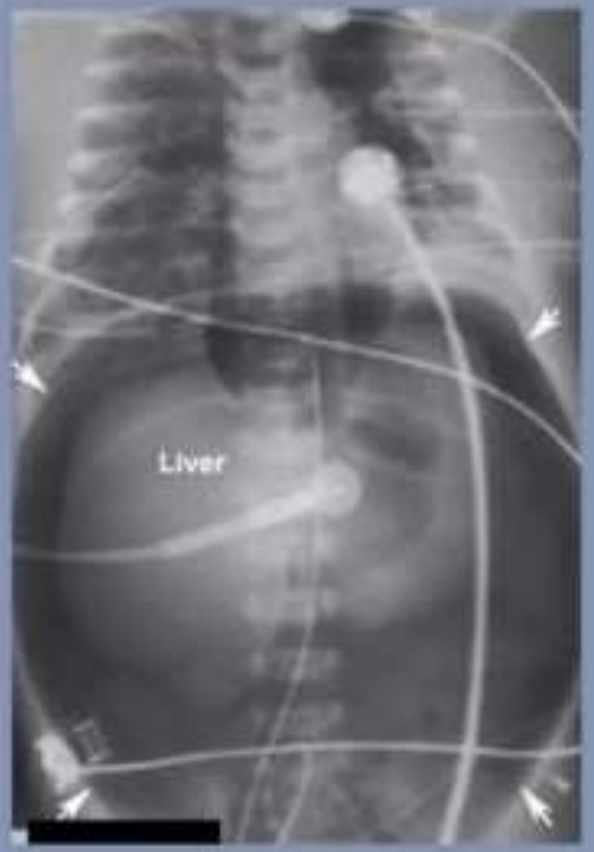


Cupola sign:

abdominal radiography showing free intraperitoneal air under the central diaphragmatic tendon.



Football Sign

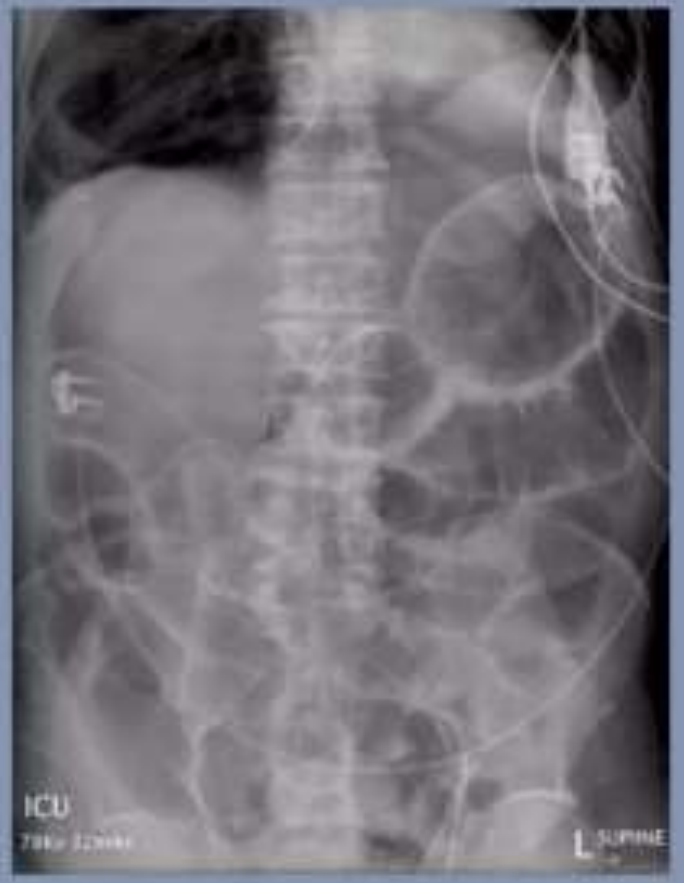


Paediatric

Seen with massive pneumoperitoneum

Most often in children with necrotising enterocolitis

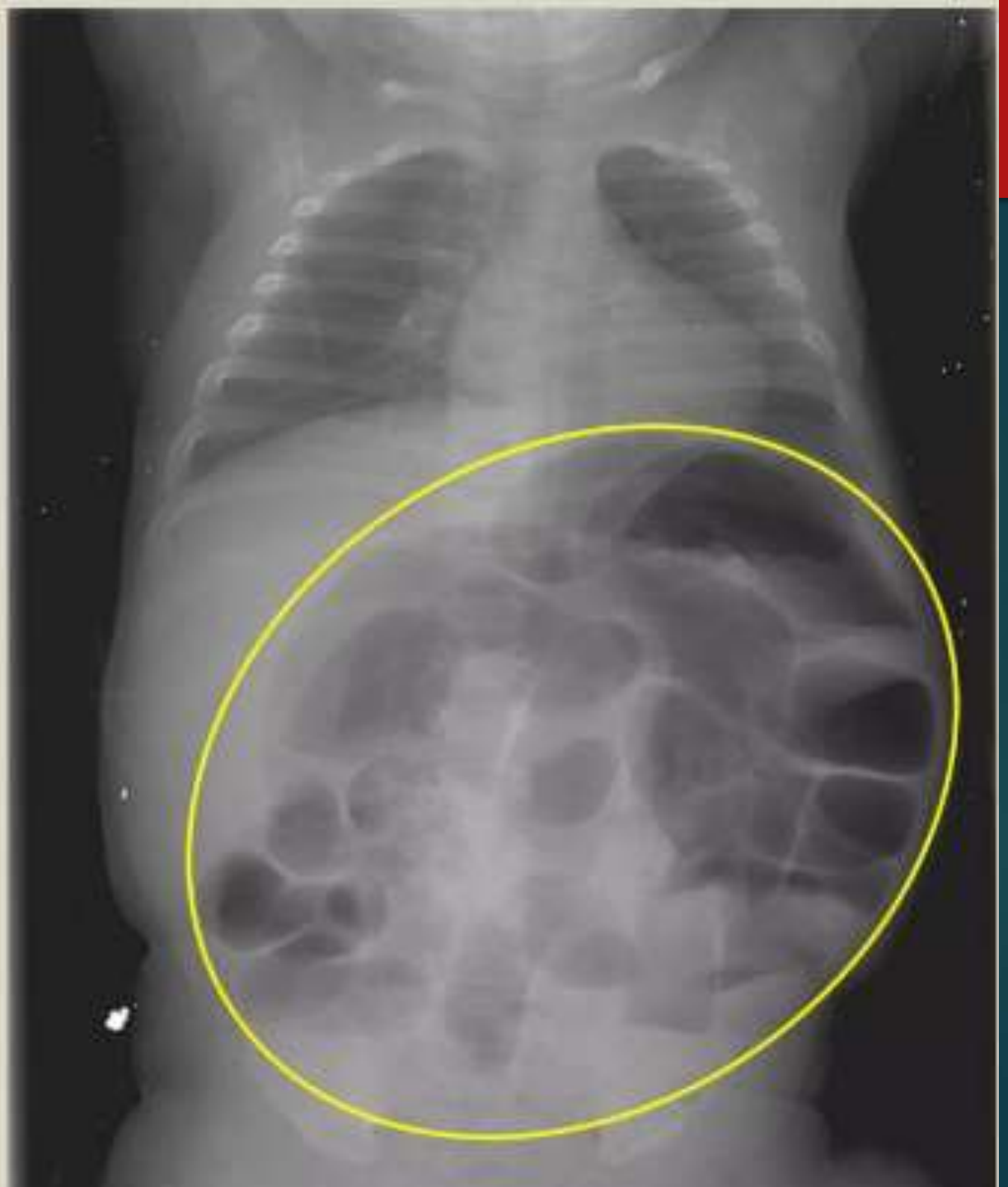
In supine position air collects anterior to abdominal viscera

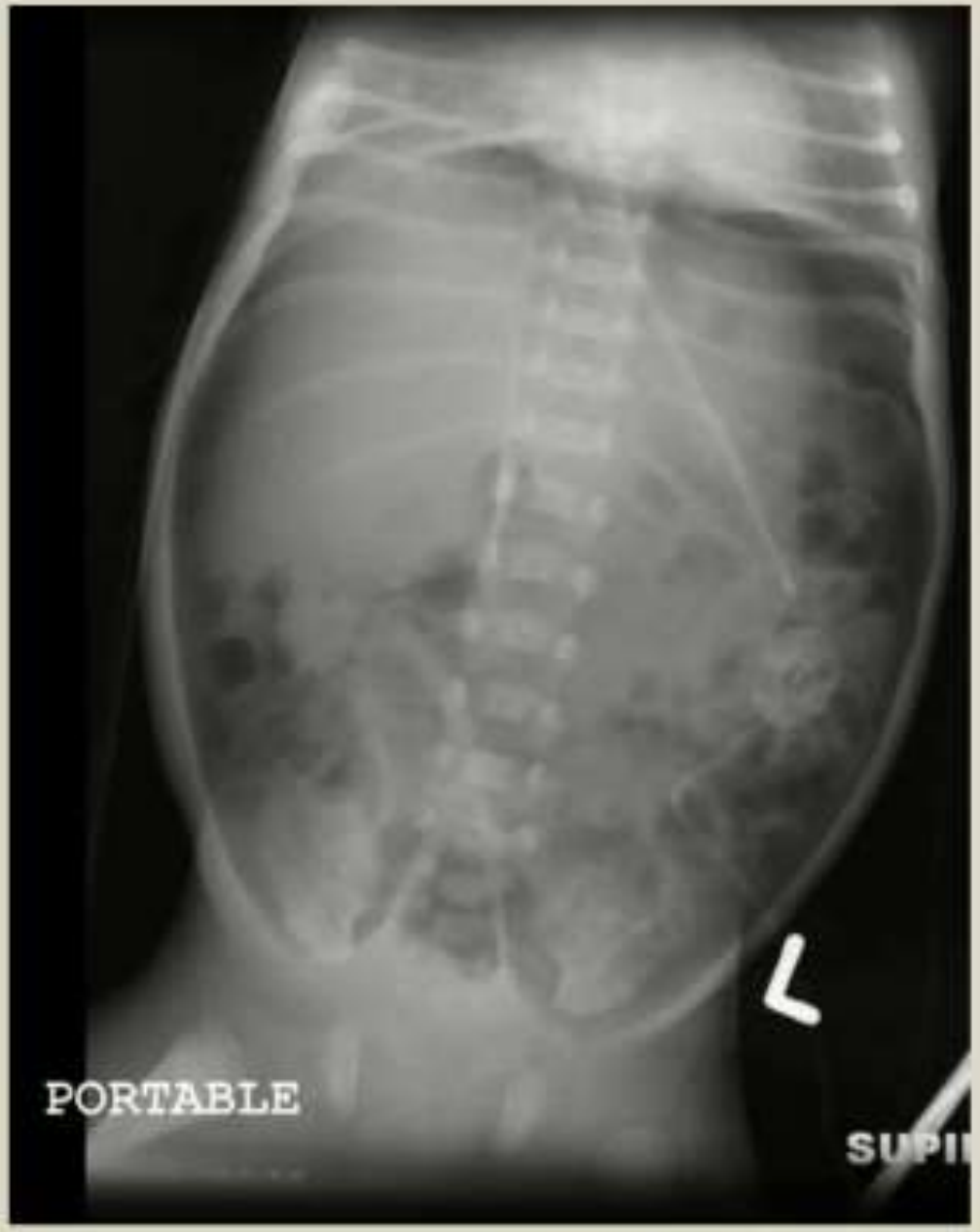


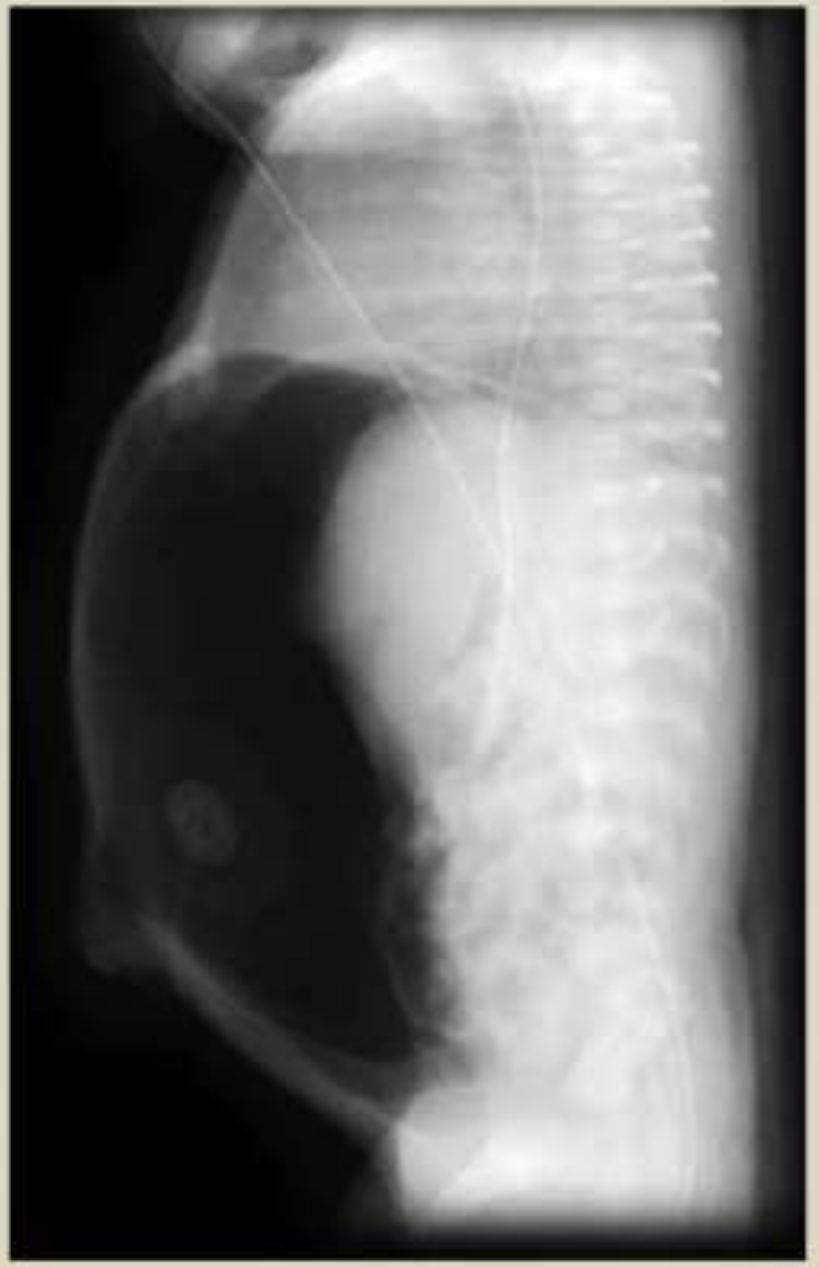
Adult

Football Sign -

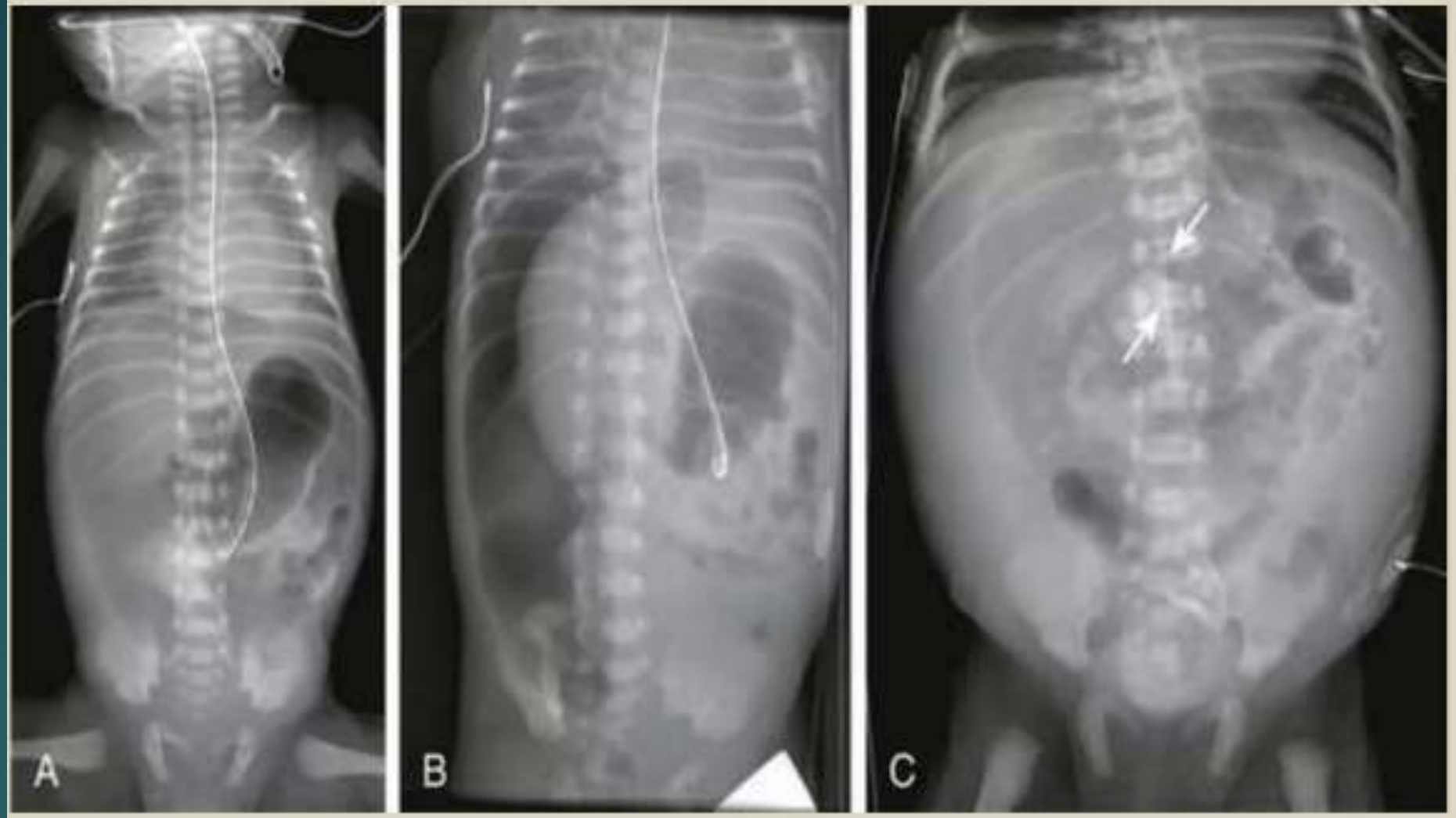
abdominal radiography showing a large oval radiolucency demarcated by the parietal peritoneum of the abdominal wall.



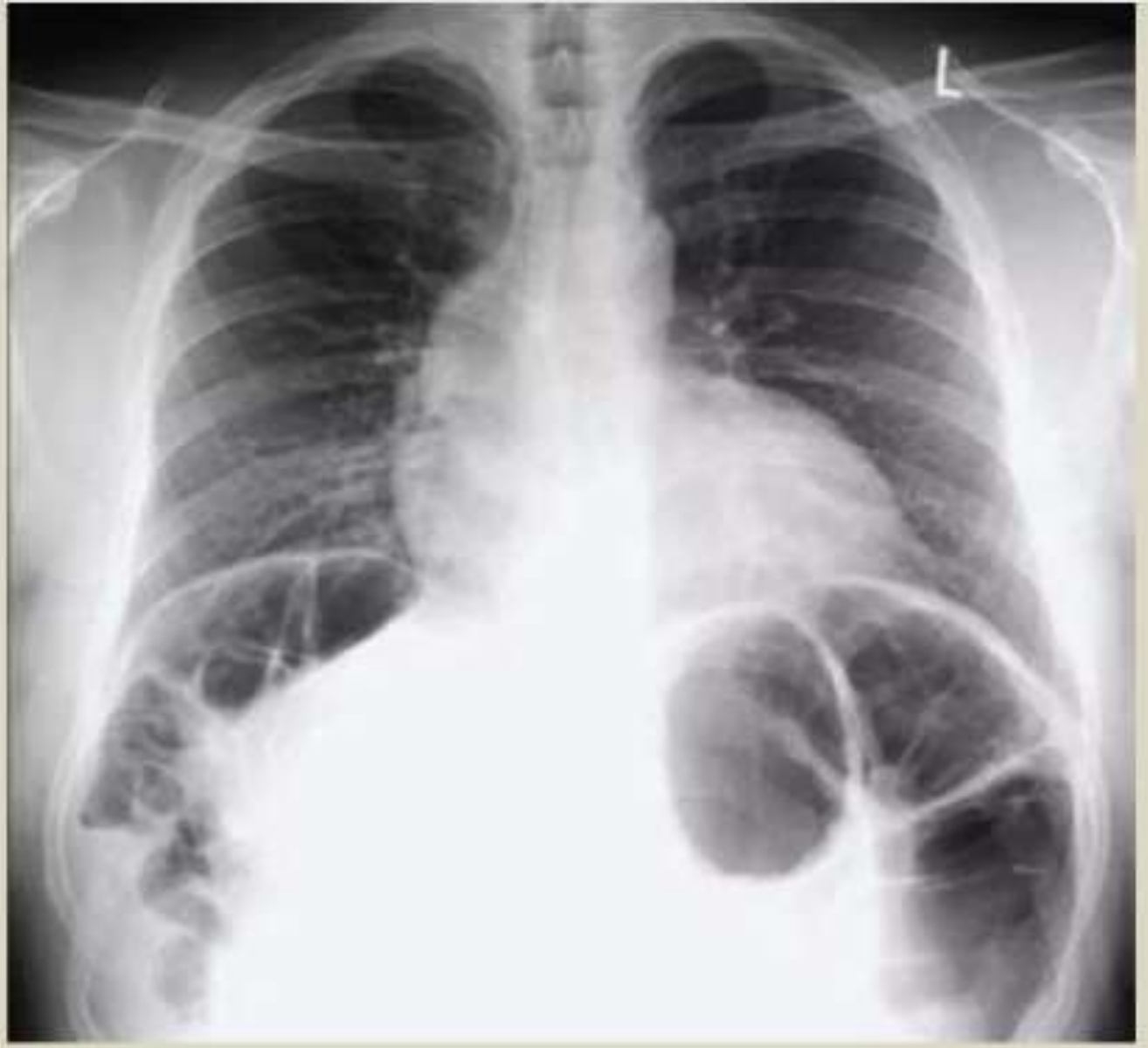




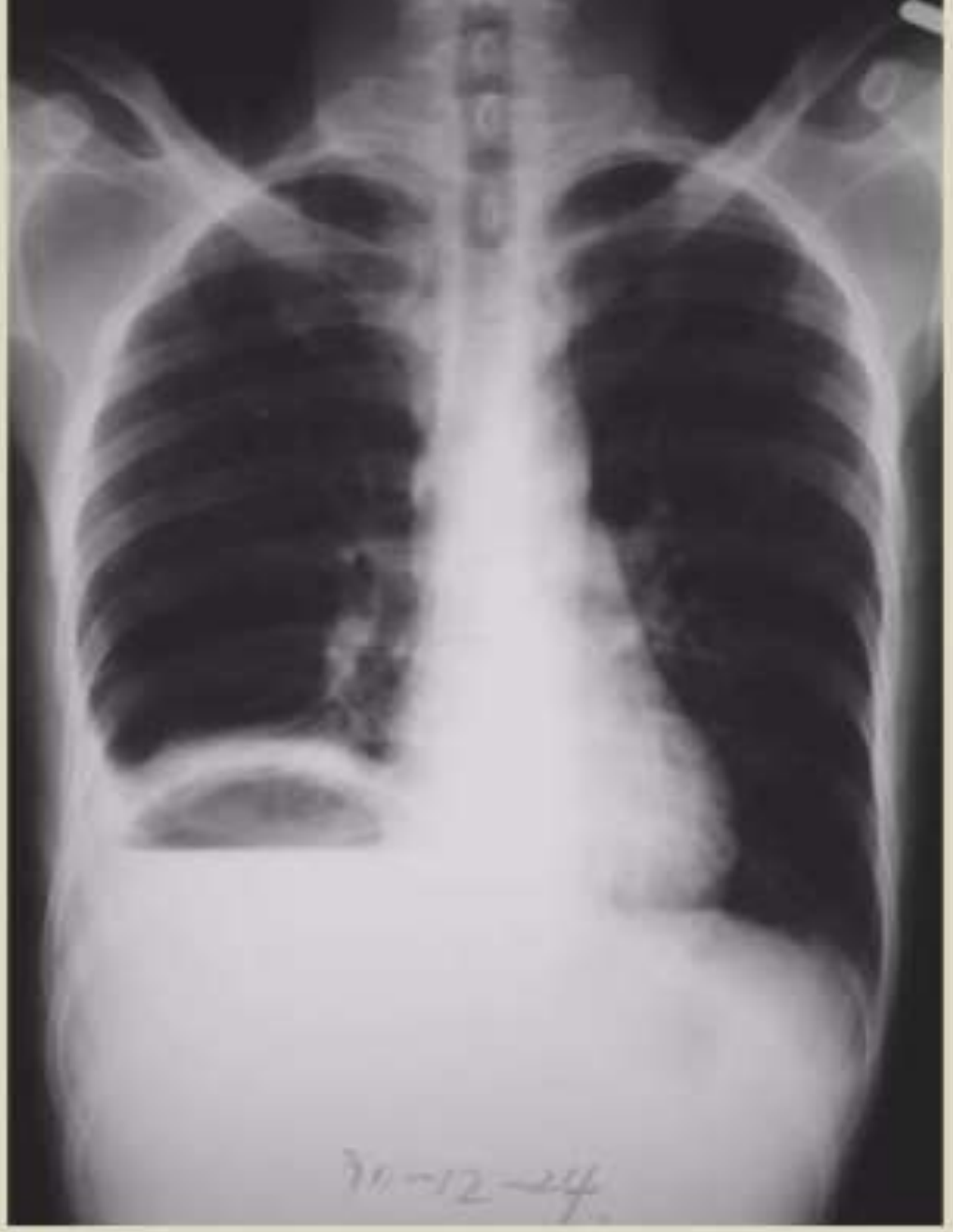
Football sign (*pneumoperitoneum*)



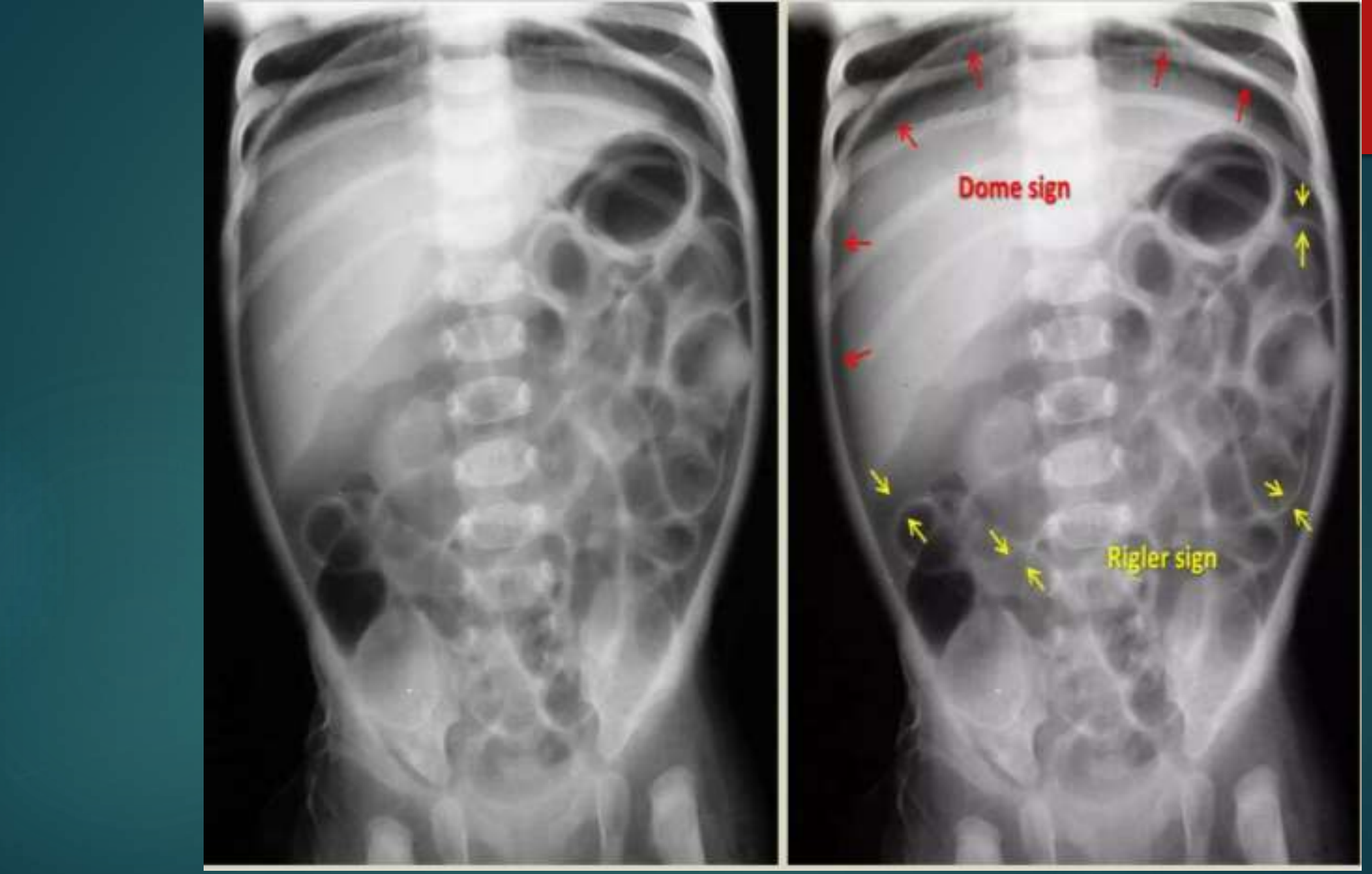
Pneumoperitoneum with "football sign." A, Supine radiograph in a 5-day-old 30-week-gestation premature infant shows a large lucency over the entire abdomen. B, Decubitus view in the same infant confirms the large pneumoperitoneum. Multiple intestinal perforations were found at surgery. C, Another patient with pneumoperitoneum demonstrates the classic football sign on abdominal imaging. Gas outlines the falciform ligament (arrows), and a large lucency overlies the upper abdomen centrally as the gas accumulates anteriorly. At surgery, this patient was found to have a colonic perforation.

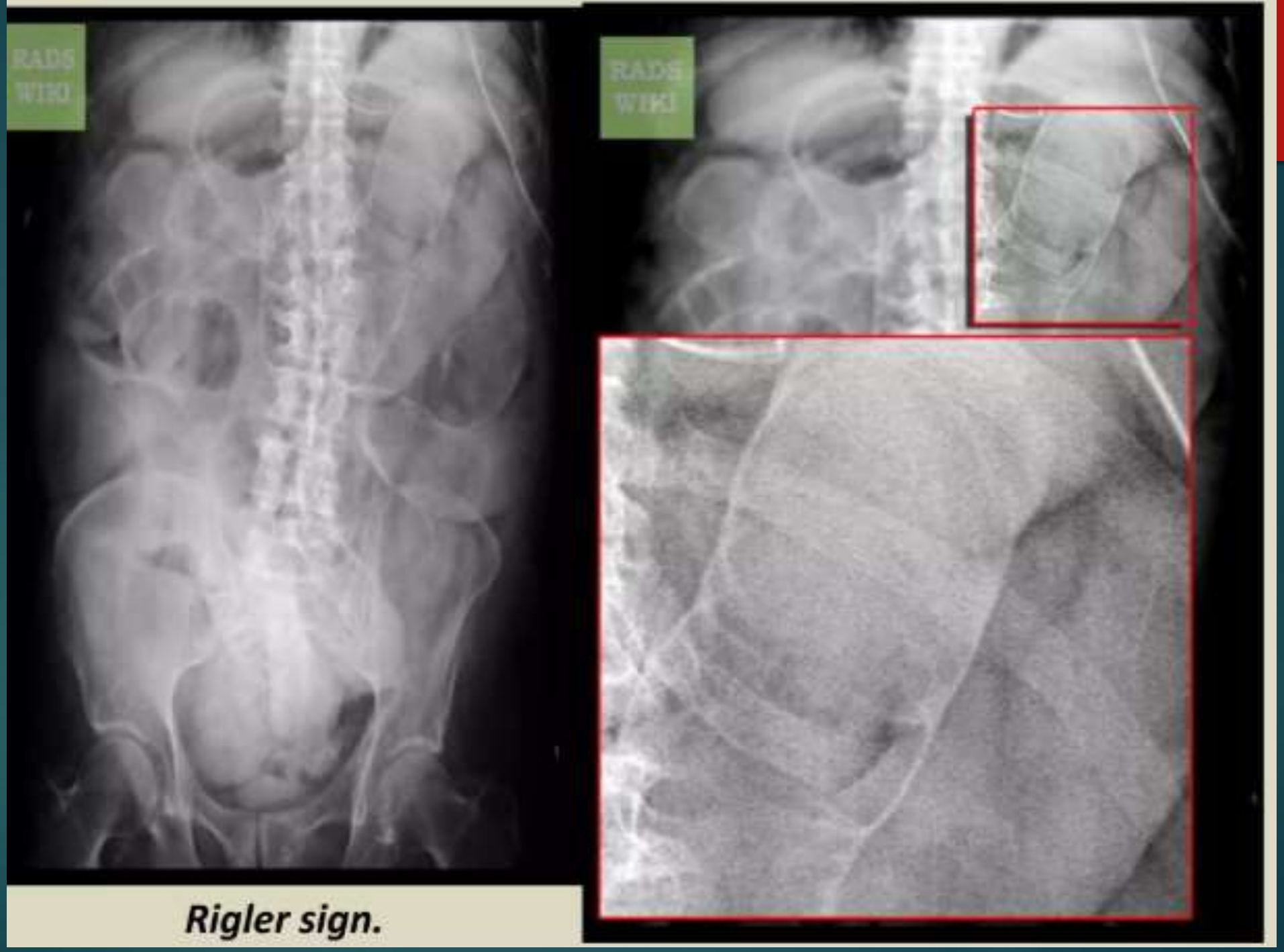


Plain X-ray of the chest and upper abdomen displaying obvious Chilaiditi's sign, or presence of gas in the right colic angle between the liver and right.



Subphrenic abscess


Dome sign
Rigler sign



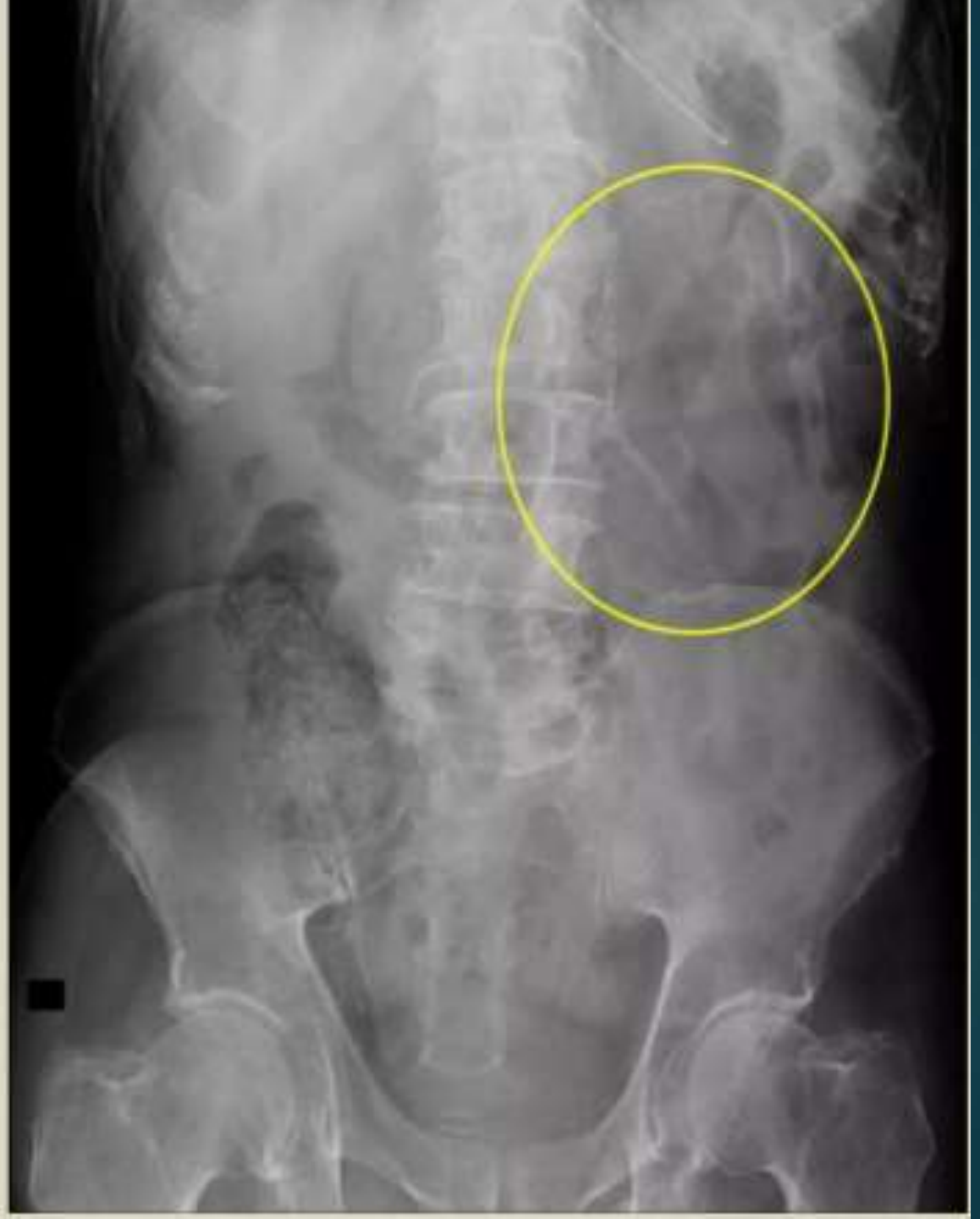
Rigler sign.

The Rigler sign,

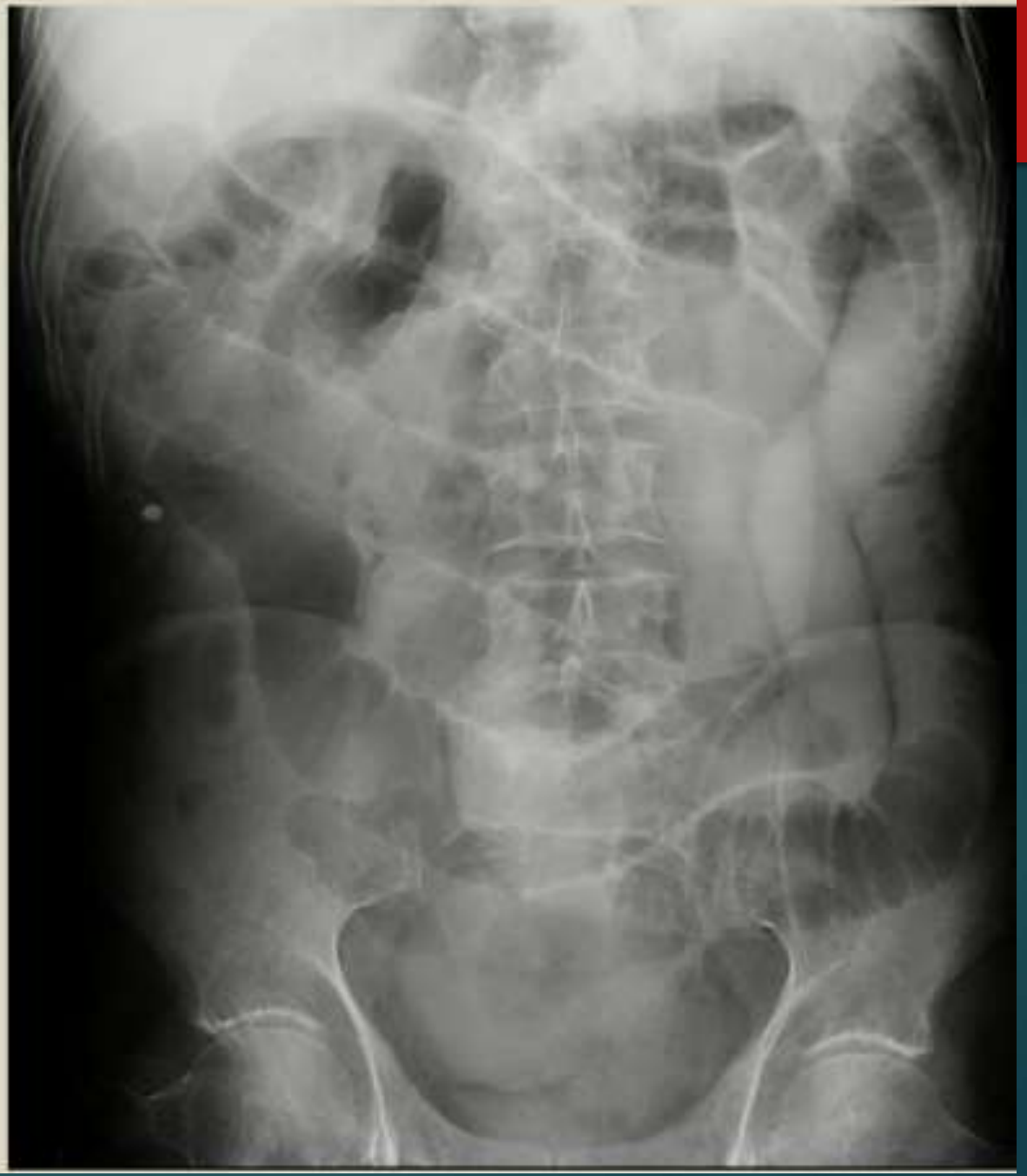
also known as the double wall sign, is seen on a radiograph of the abdomen when the air is present on both sides of the intestine, i.e. when there is air on both the luminal and peritoneal side of the bowel wall.

Rigler sign -

abdominal radiography showing free air outlining the small bowel wall, indicating pneumoperitoneum.



Pseudo-Rigler's Sign - *abdominal radiography showing both sides of bowel wall with dilated loops of bowel abut each other(overlapping bowel mimic Rigler sign).*



Pneumoretroperitoneum.

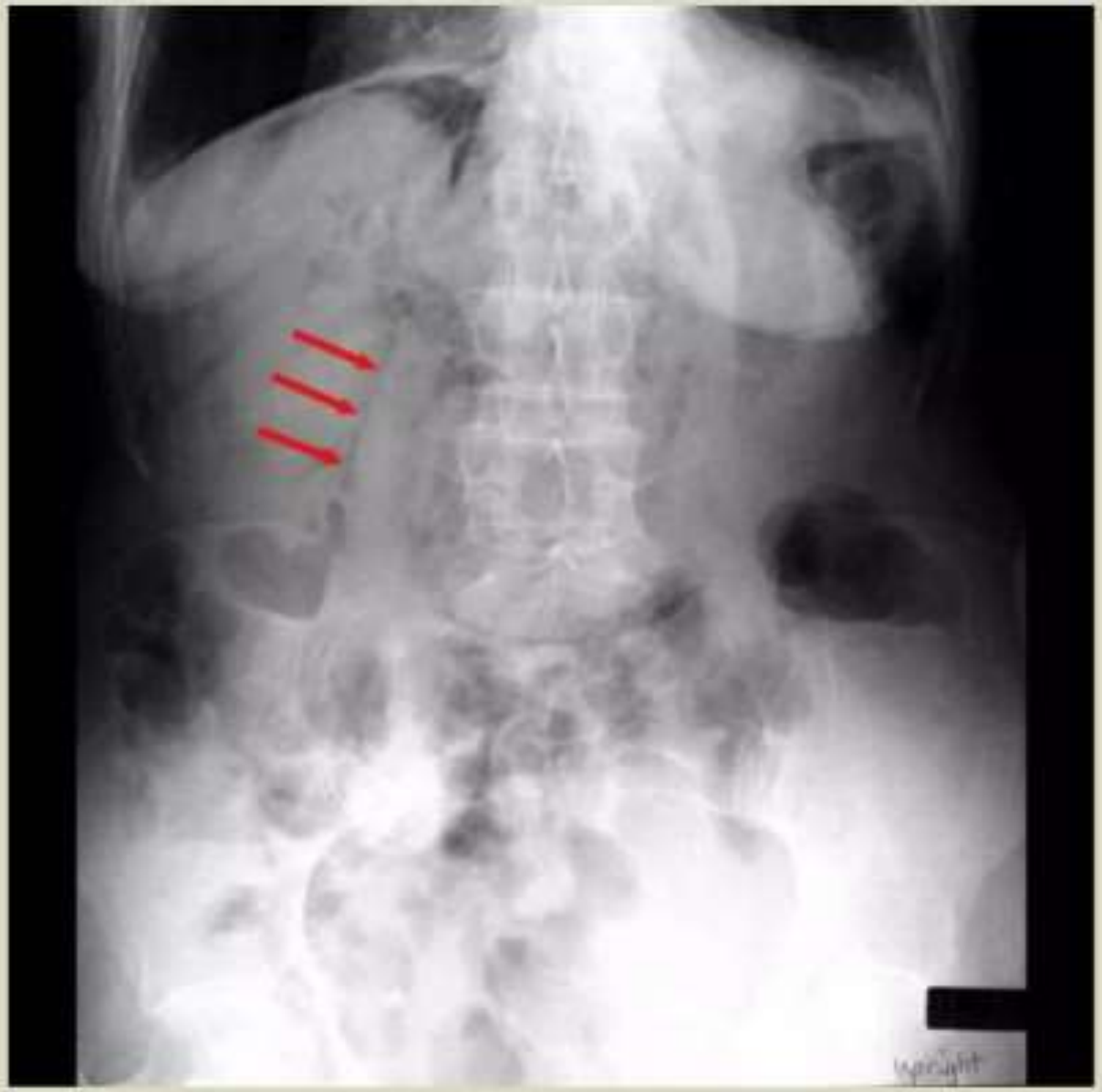
Clinical

The most common cause of pneumoretroperitoneum is perforation of the second, third, or fourth portion of the duodenum or retroperitoneal colon secondary to trauma, diverticulitis, or ulceration.

Post-surgical(Post-urology or adrenal surgery).

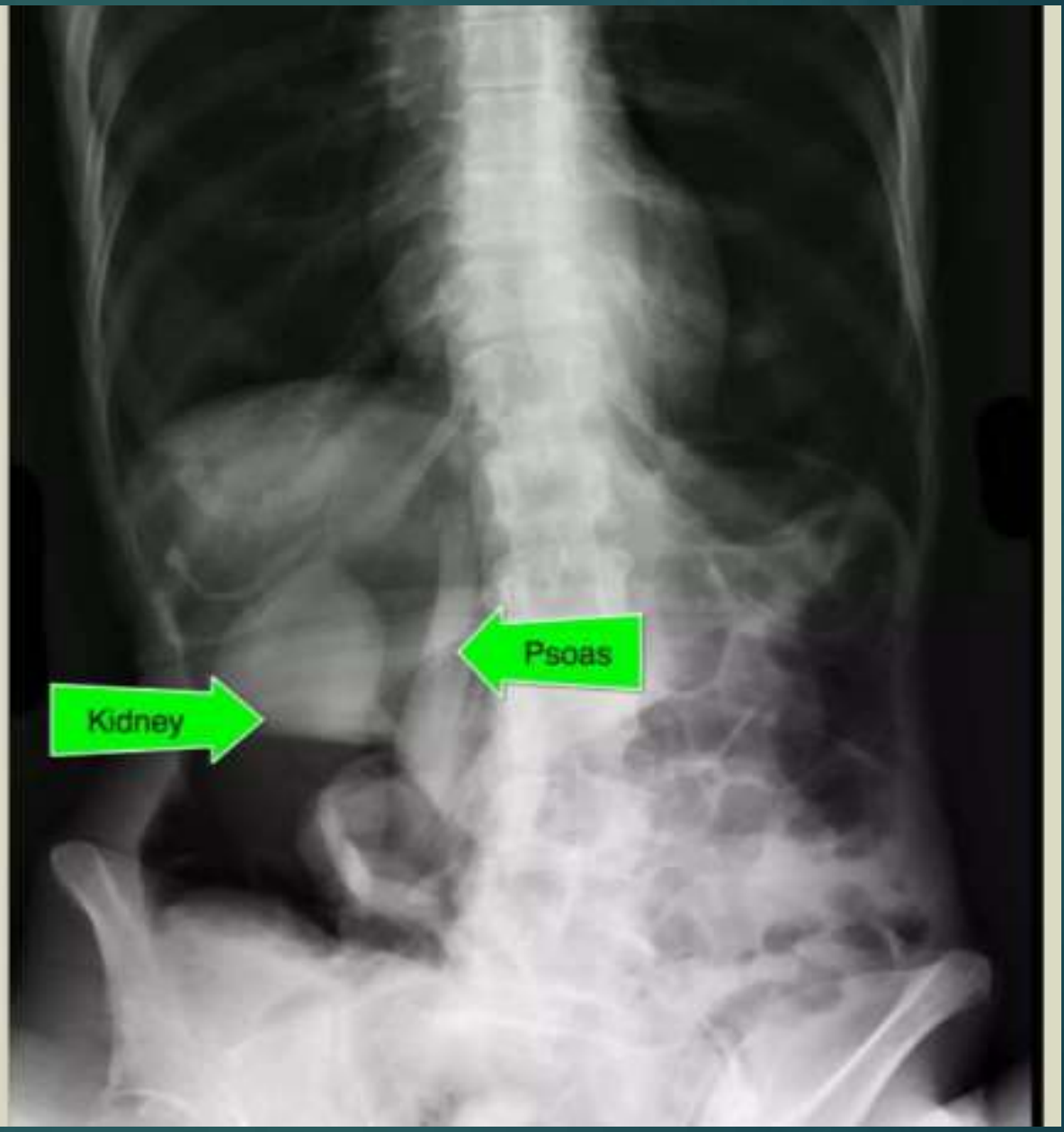
Radiological findings

Pneumoretroperitoneum is most often seen on the right side where the air can outline the right kidney and the undersurface of the liver. In contrast to pneumoperitoneum, air in the retroperitoneum does not move freely with change in position. The gas can extend up into the mediastinum or neck because there is no barrier between them.

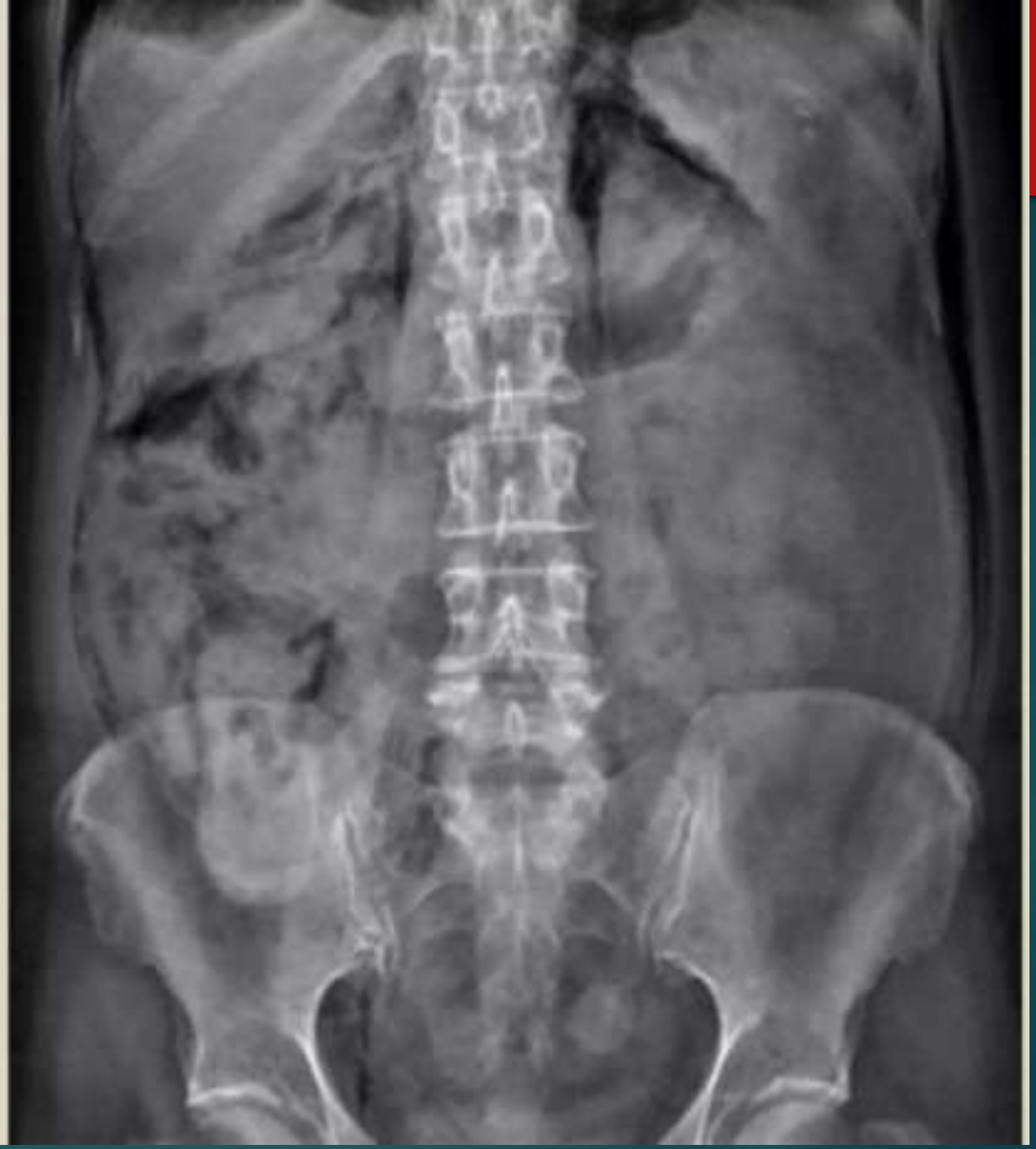


This plain film demonstrates pneumoretroperitoneum with gas outlining the right psoas major (arrows).

Massive retroperitoneal Air.



Pneumoretroperitoneum
- presence of gas within the retroperitoneal space. Typically the air outlines structures like the kidneys, psoas muscles and retroperitoneal portions of the bowel

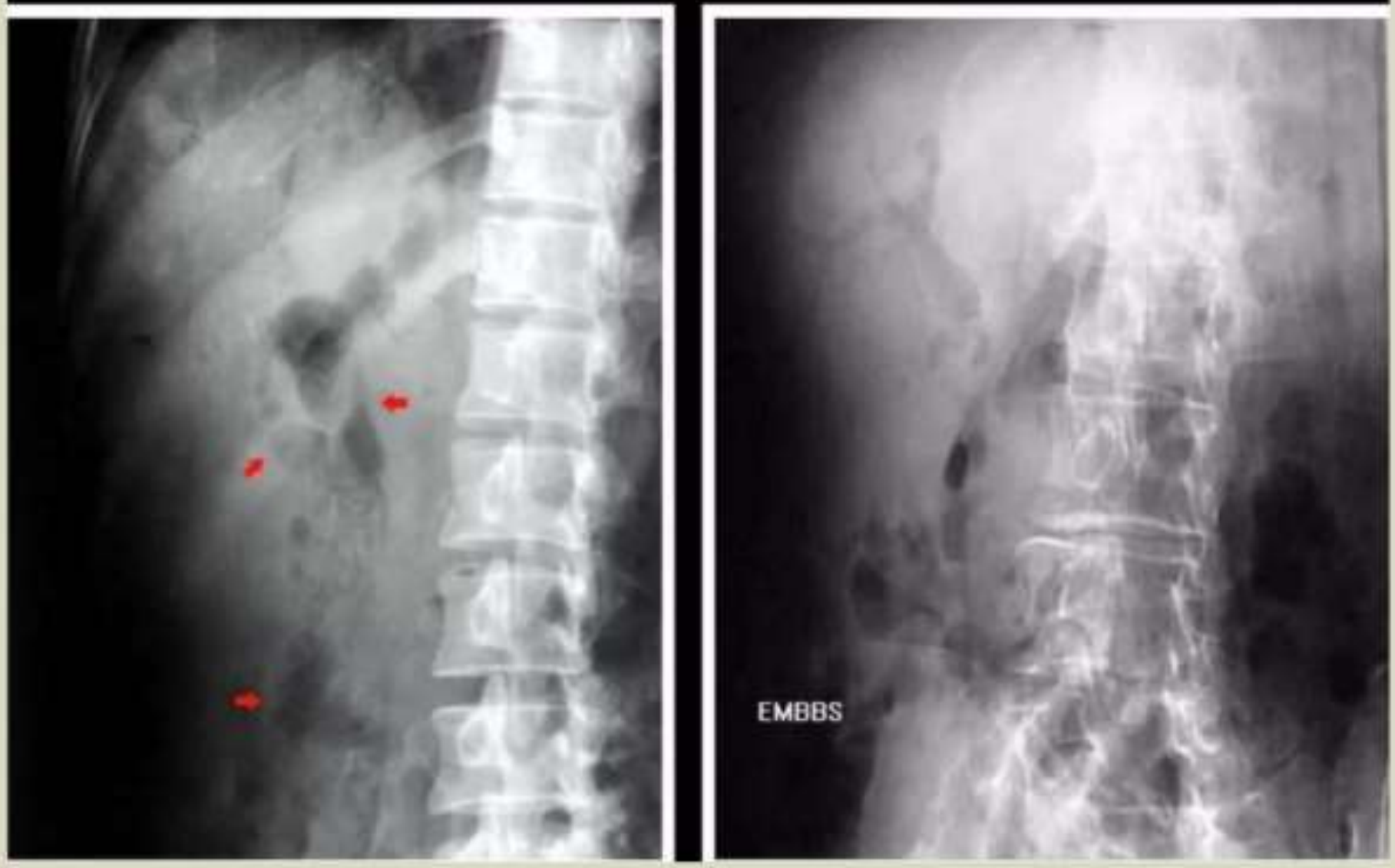


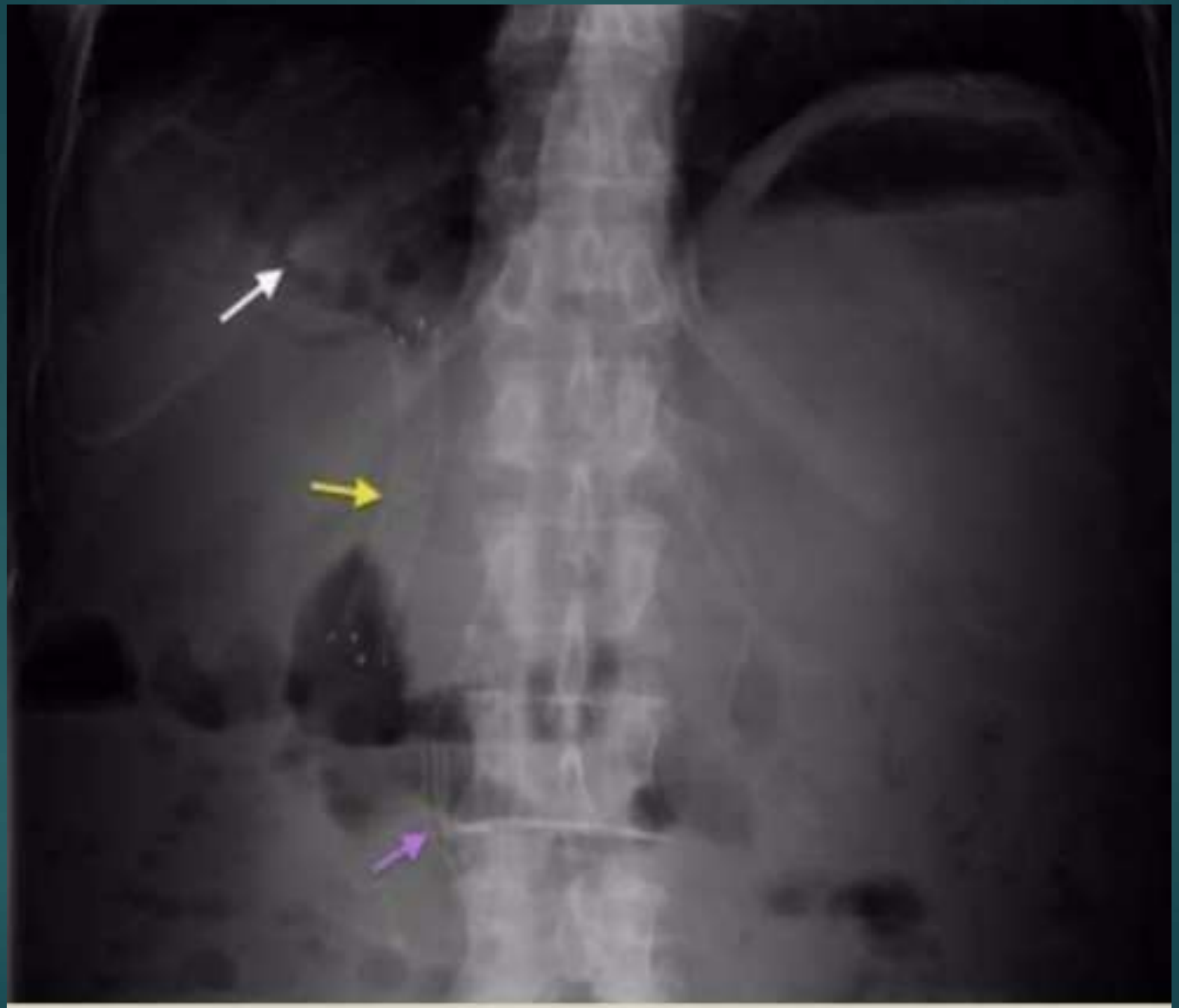
Pneuombilia

Clinical

Gas in the biliary tree is most commonly secondary to surgical procedures such as choledochoenterostomy or sphincterotmy of the sphincter of Oddi. It may also arise in the setting of trauma, infection by gas producing organisms (i.e. emphysematous cholecystitis), fistulas connecting the biliary system and the intestinal tract (i.e. from dudodenal ulcers, or gallstones), malignant involvement of the ampulla of Vater, or as a congenital anomaly.

Pneumobilia





Pneuombilia

Gas in Portal Vein

Clinical

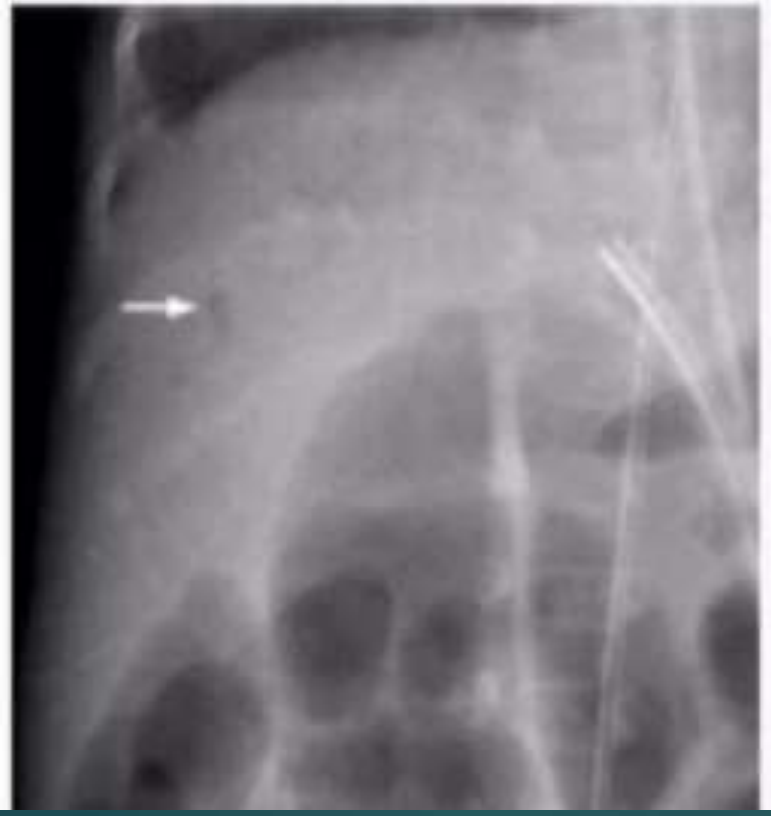
With the exception of umbilical vein catheterization in children, gas in the portal veins is a grave prognostic indicator and almost always signals imminent death. There are two major causes of gas in the portal veins. The first is necrosis of the bowel wall from either mechanical obstruction or mesenteric artery occlusion. The break down of the bowel wall allows gas to penetrate the vessel walls and flow to the liver. The second mechanism involves infection of the bowel wall. This may be caused by bowel necrosis with secondary infection with gas producing organisms, or may be due to overwhelming enterocolitis.

Radiological findings

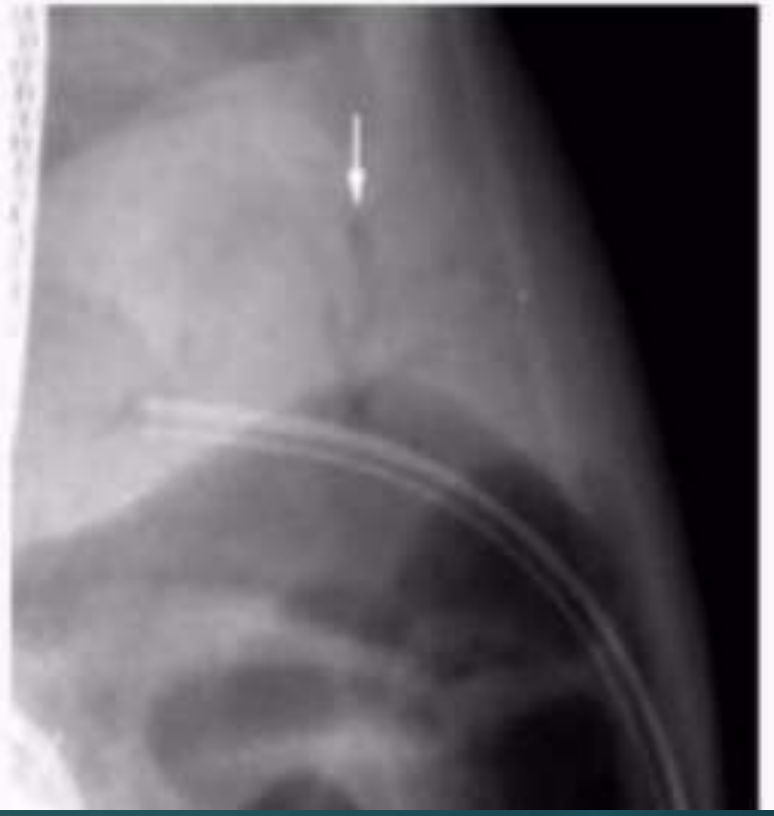
Gas in the portal veins has a very characteristic appearance. The gas follows the centrifugal flow of the portal veins and thus appears as radiating tubular radiolucencies branching from the porta hepatis. Gas seen in the outermost 2 cm of the liver is indicative of portal vein gas.

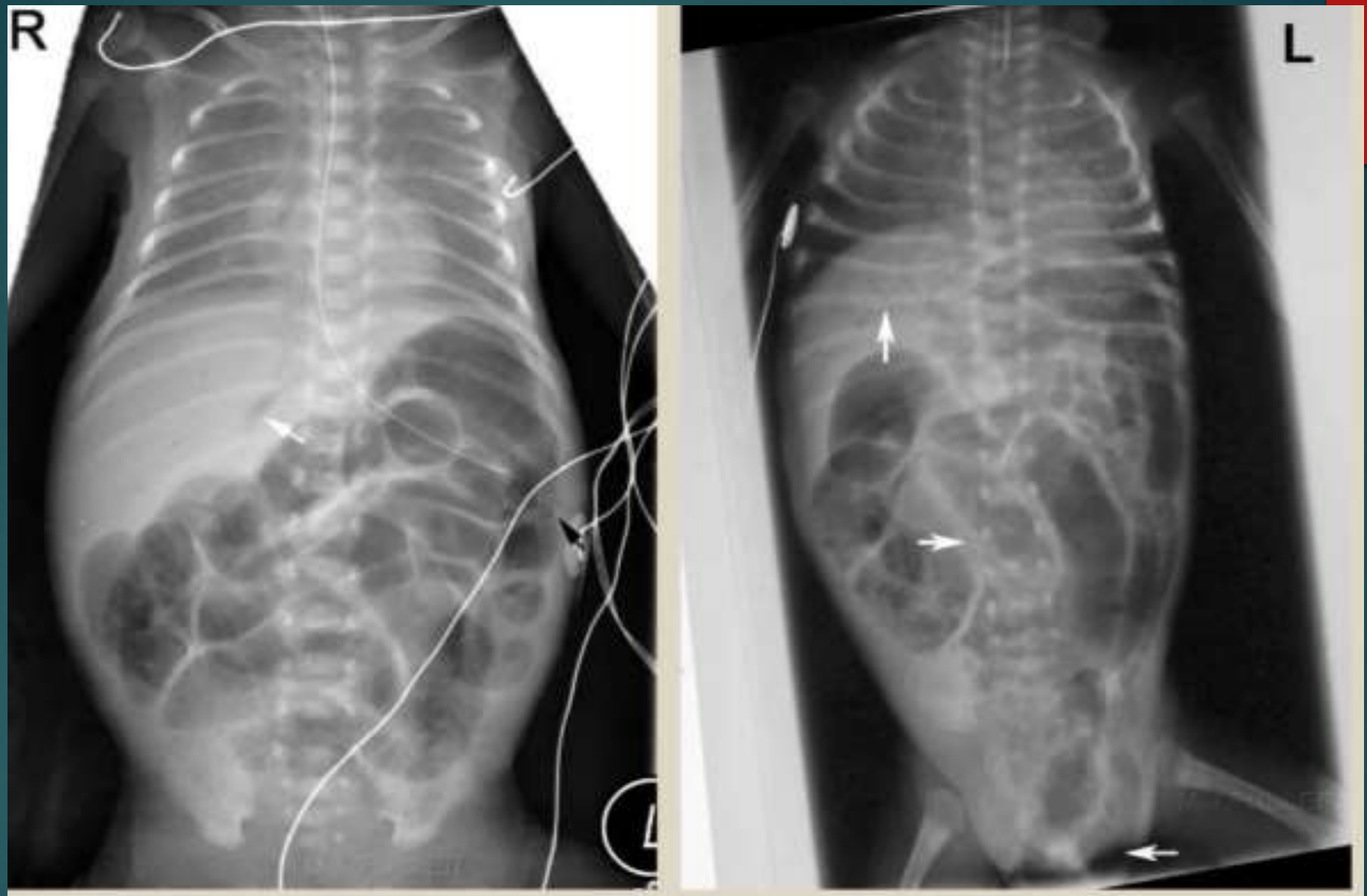
Necrotizing Enterocolitis: portal venous gas

Supine abdominal radiograph shows a small bubble of portal venous gas projected over the liver (arrow)



Cross-table lateral radiograph obtained immediately after a shows that portal venous gas (arrow) may be depicted more extensively in the liver on this view





Intramural gas and Portal-venous Gas.

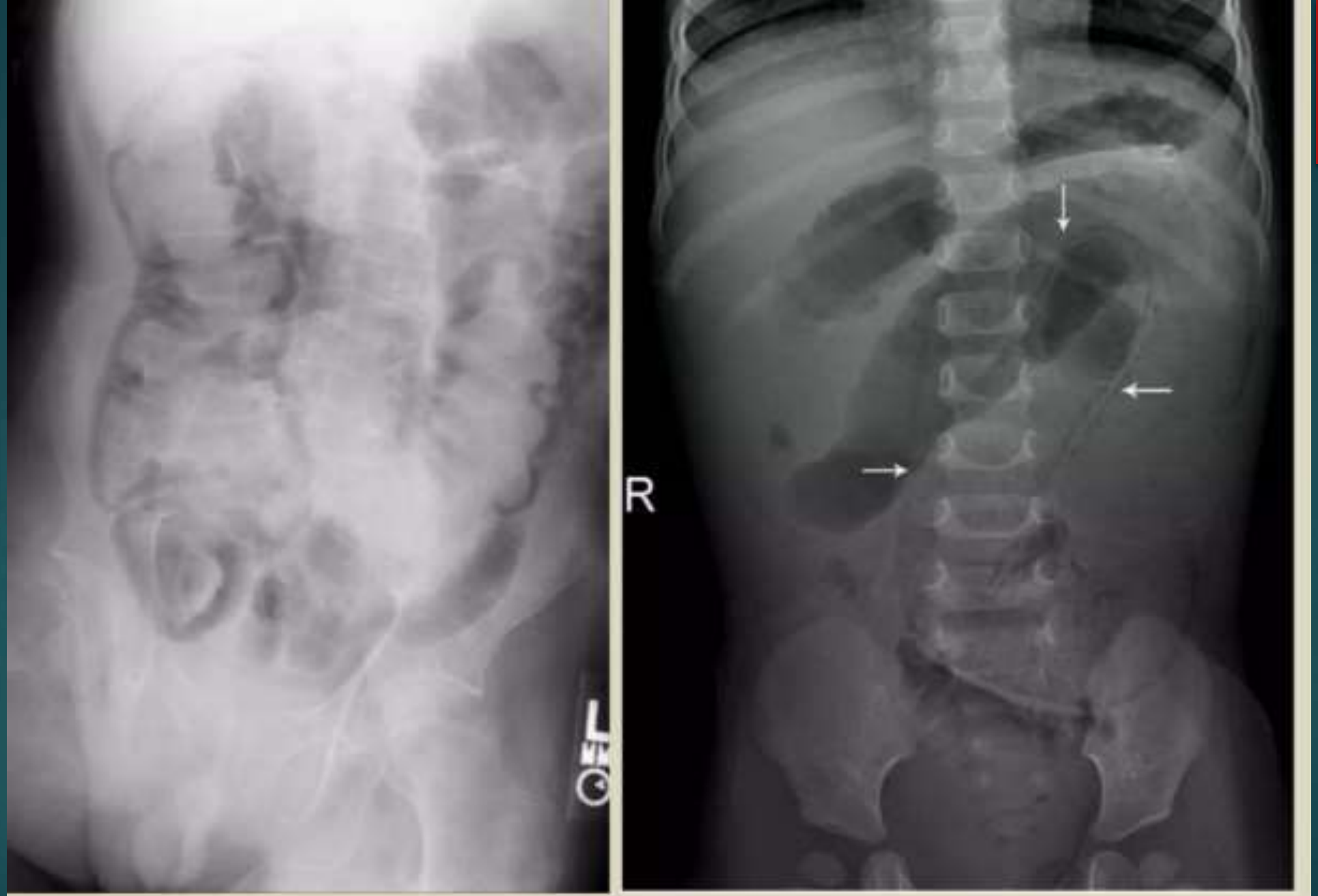
Gas in the Bowel Wall (Pneumatosis Intestinalis)

Clinical

Pneumatosis intestinalis can occur as a primary or secondary disorder. Primary pneumatosis intestinalis is less common (15%) and occurs when there is no other underlying respiratory or gastrointestinal abnormality. It is primarily a disease of older adults and is often asymptomatic. Secondary pneumatosis intestinalis is much more common (85%) and occurs int the setting of underlying bowel or pulmonary disease. It may be broken down into three subgroups: GI disease with bowel necrosis (i.e. necrotizing enterocolitis in infants, ischemic necrosis due to mesenteric vascular disease, strangulation, primary infection of the bowel wall); GI disease without bowel necrosis (i.e. pyloroduodenal peptic ulcers, bowel obstruction, IBD, connective tissue disease, endoscopy/colonoscopy, percutaneous jejunostomy tube, steroid therapy, leukemia, intestinal parasites, etc.); obstructive pulmonary disease (i.e. emphysema, bullous disease, chronic bronchitis, asthma).

Radiological findings

Primary pneumatosis intestinalis will appear as cystic gas in the colon on plain film and CT. Secondary pneumatosis intestinalis will appear as linear gas collections throughout the bowel wall.



Pneumatosis intestinalis.

B

Bowel loops pathology.

Dilated stomach.

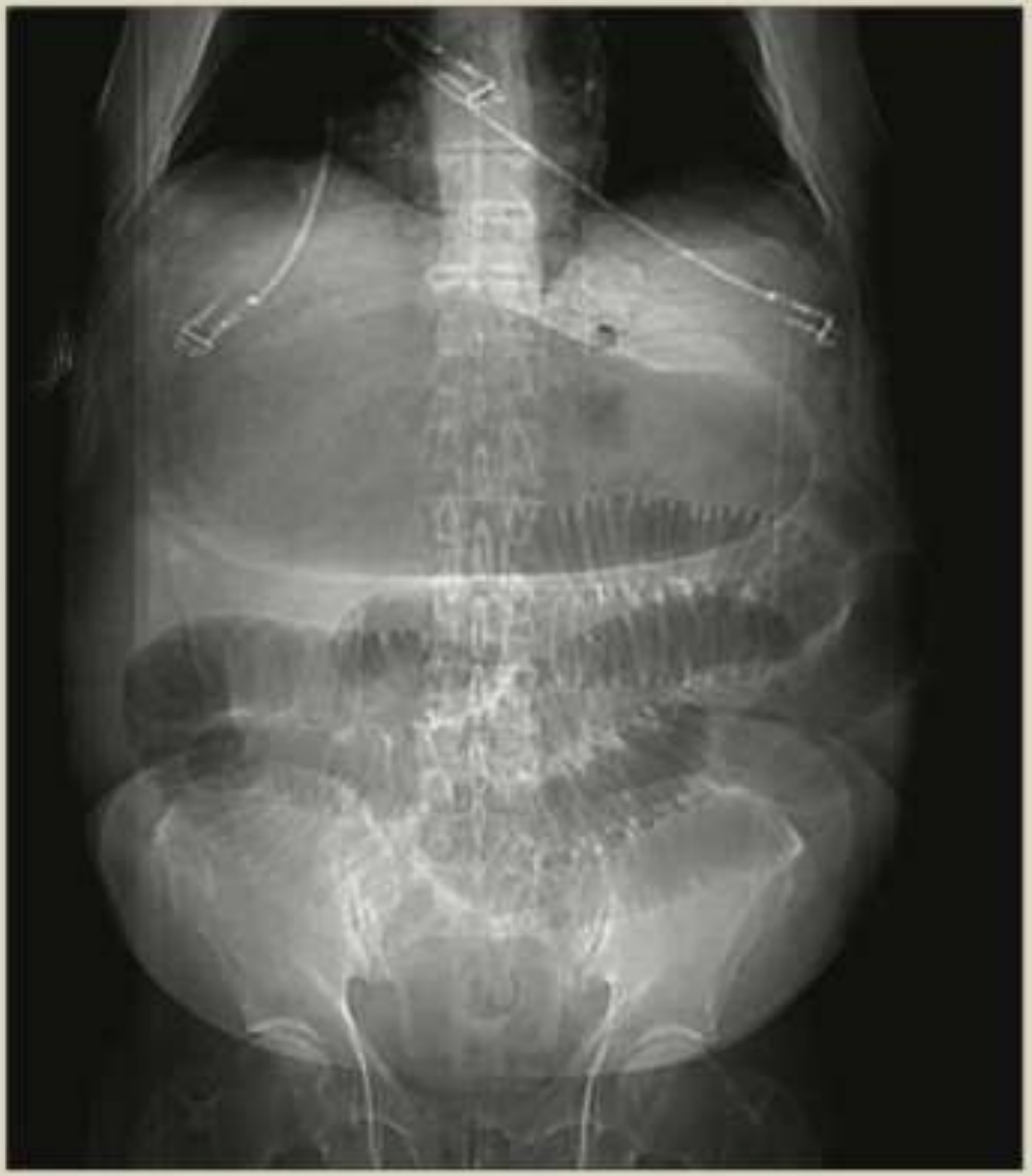
Dilated small and large bowel loops.

Volvulus.

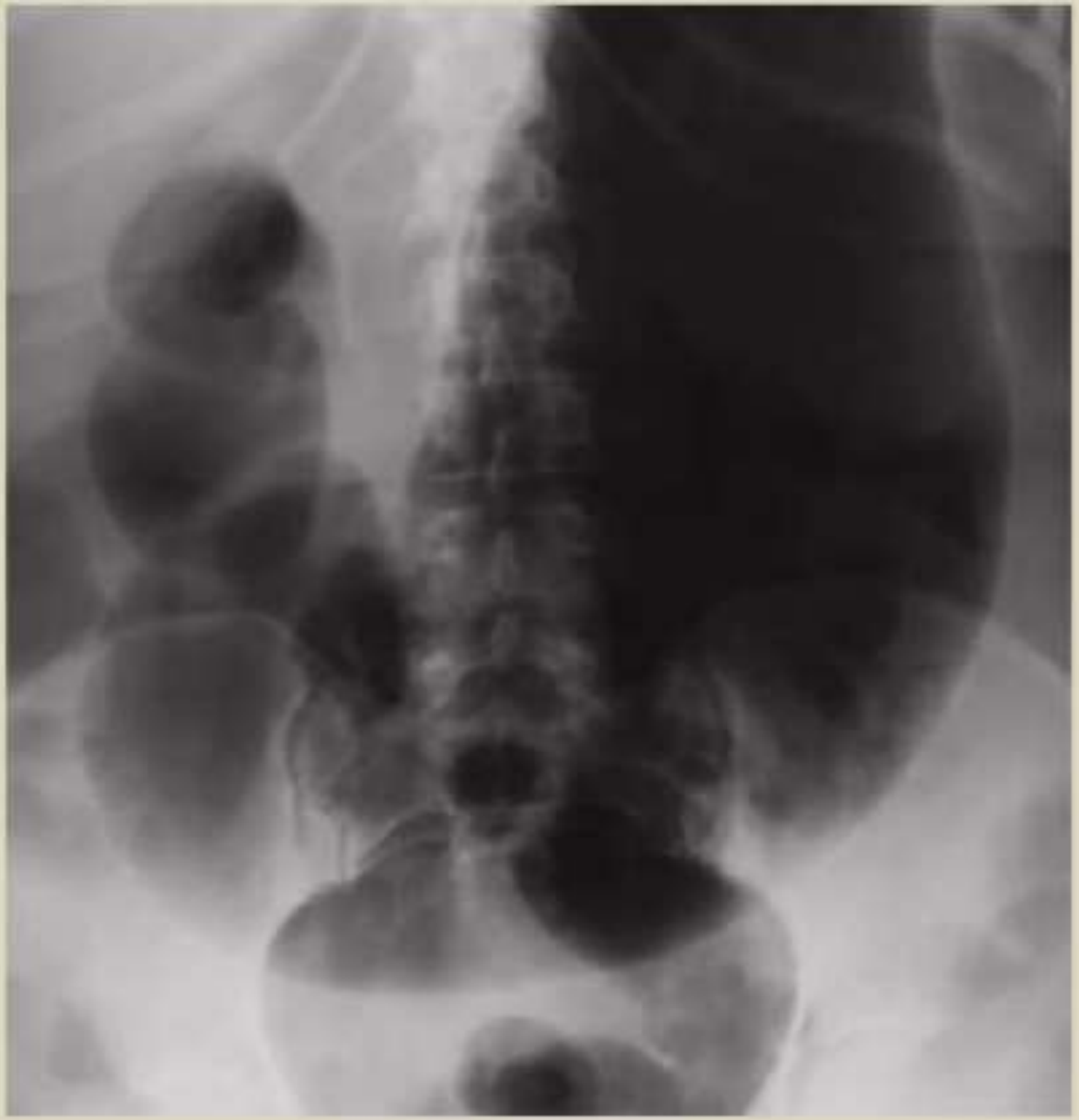
Inflammatory bowel disease.

Hernia.

Constipation with fecal impaction.

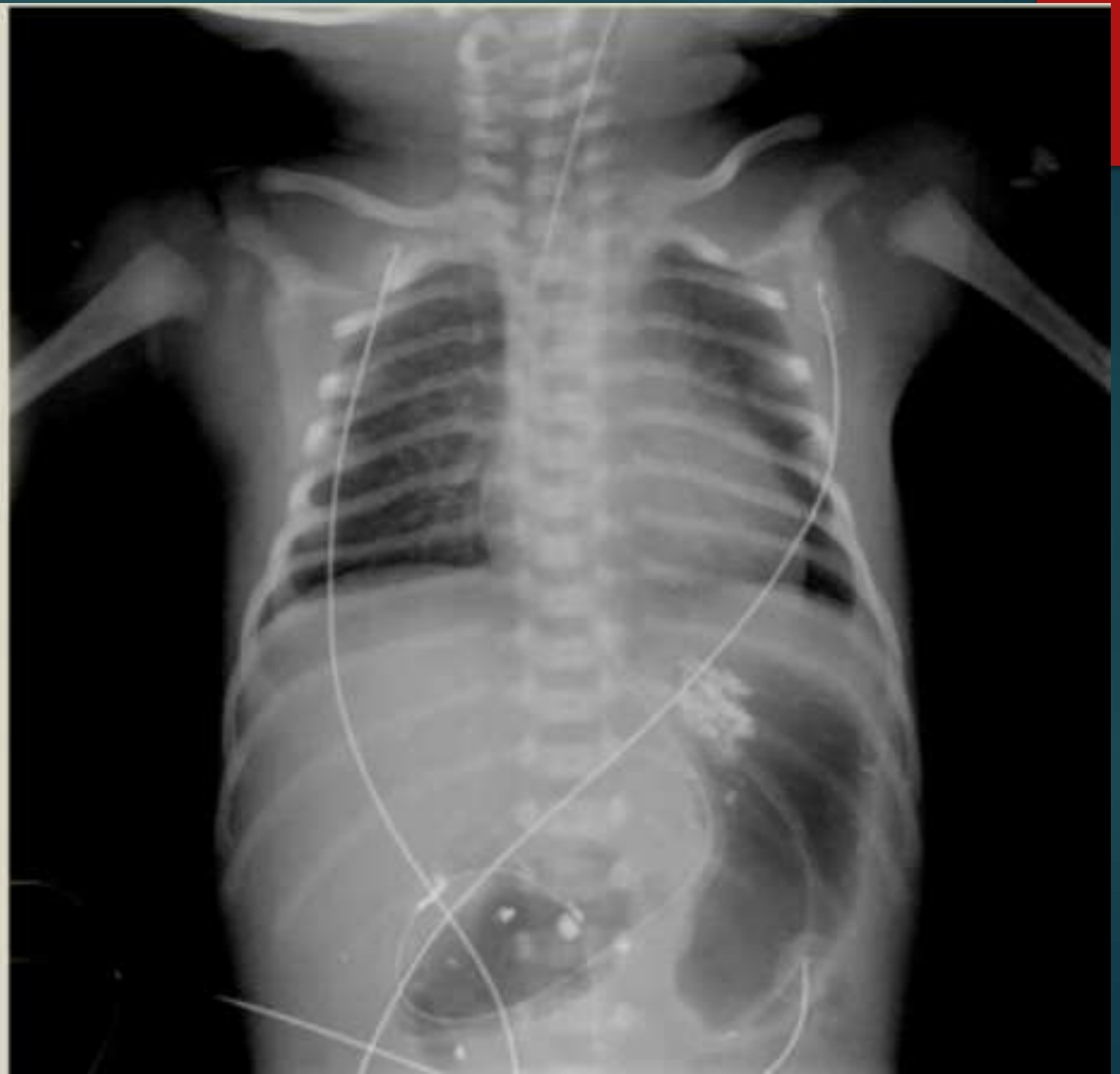


CT scout image showing massive gastric dilation.



Gastric dilatation.

Double Bubble Sign: abdominal radiography showing two air-filled structures in the upper abdomen, with no air distally. The proximal bubble in the left side filled with air represents the stomach and the second bubble to the right of the midline represents the proximal duodenum.

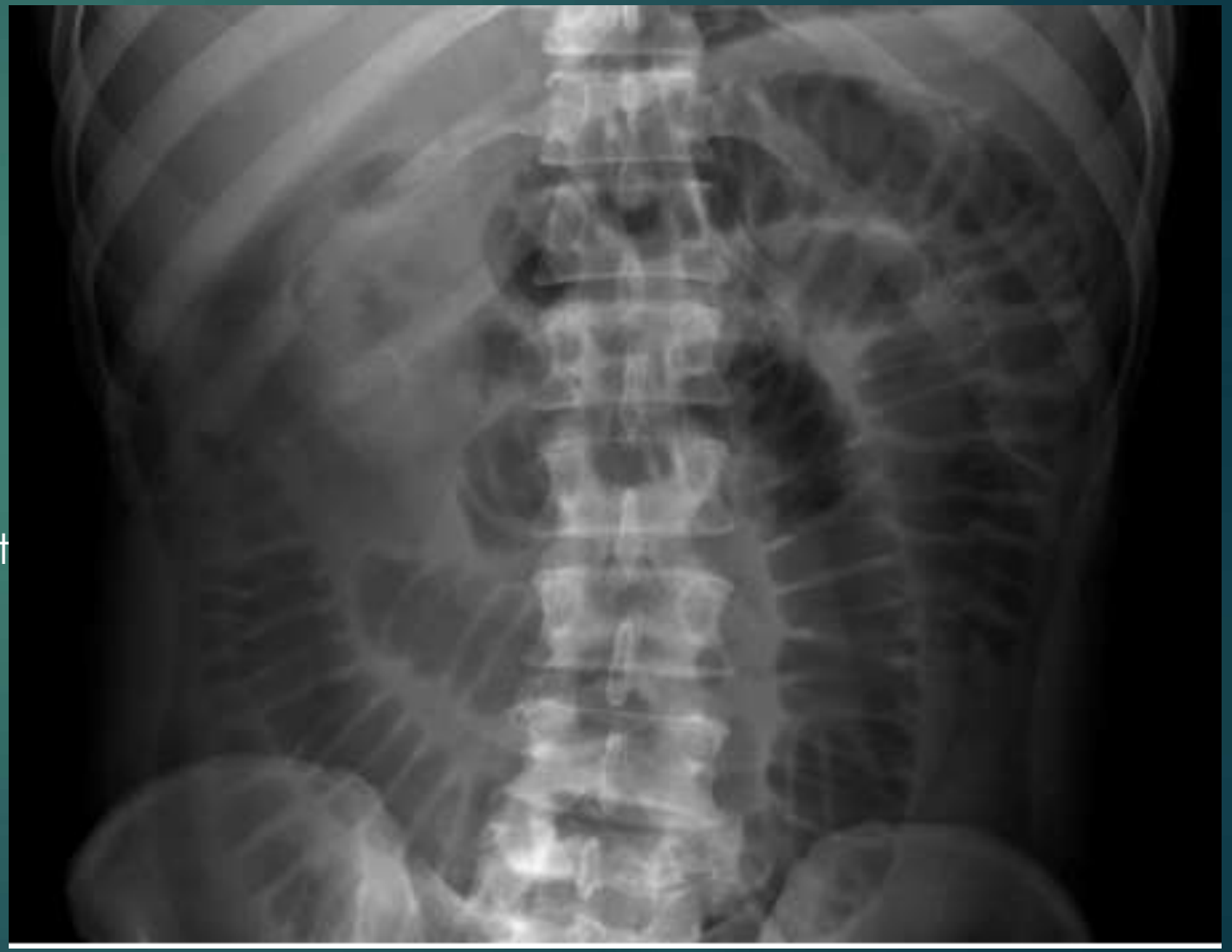


- If a patient presents with clinical features of obstruction then radiological assessment can be very helpful in determining the level of obstruction, and occasionally the cause

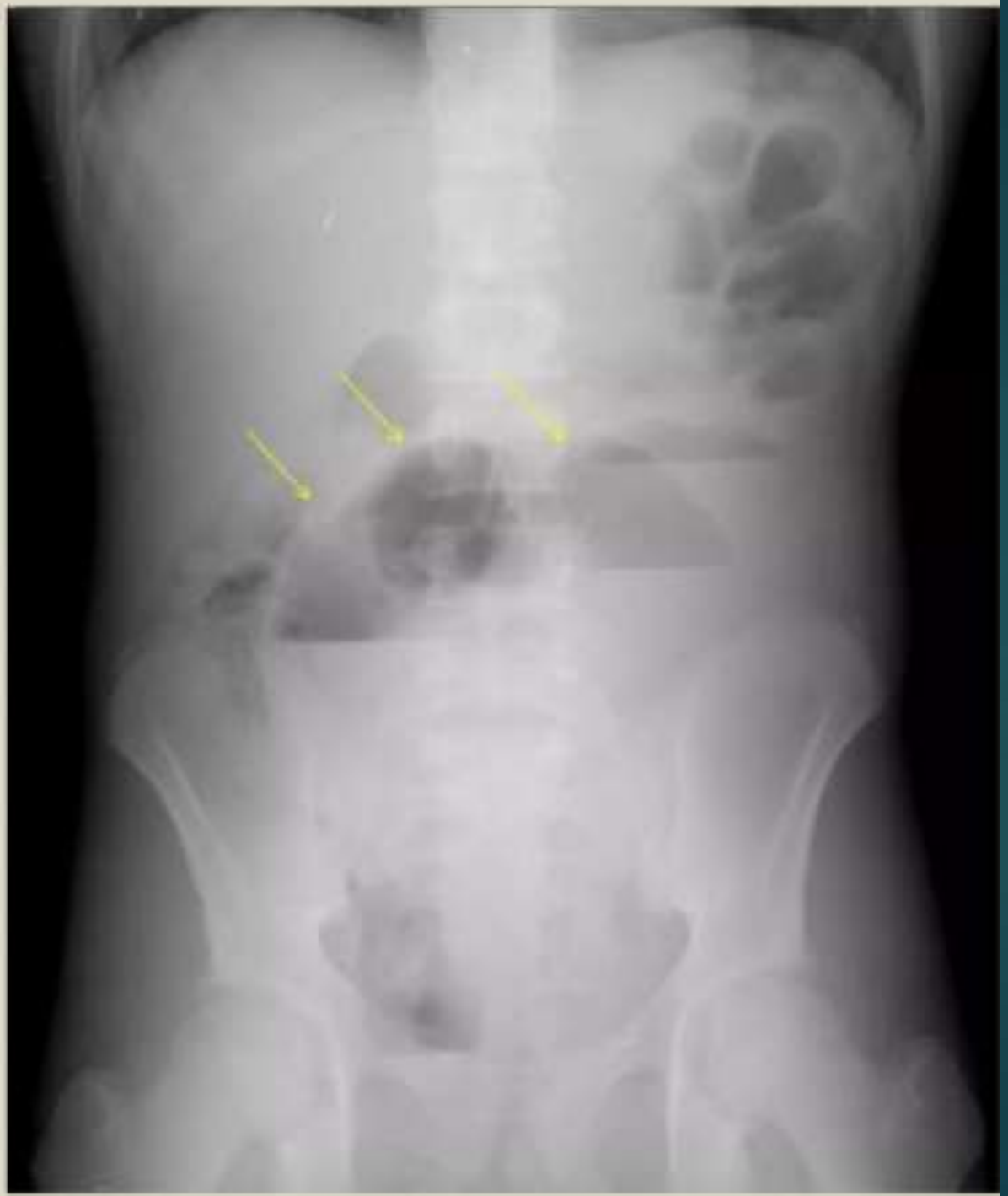
Small bowel obstruction

- Dilatation >3cm of the small bowel is considered abnormal, however the longer the segment of bowel that is dilated, the more likely bowel dilatation represents a genuine obstruction.

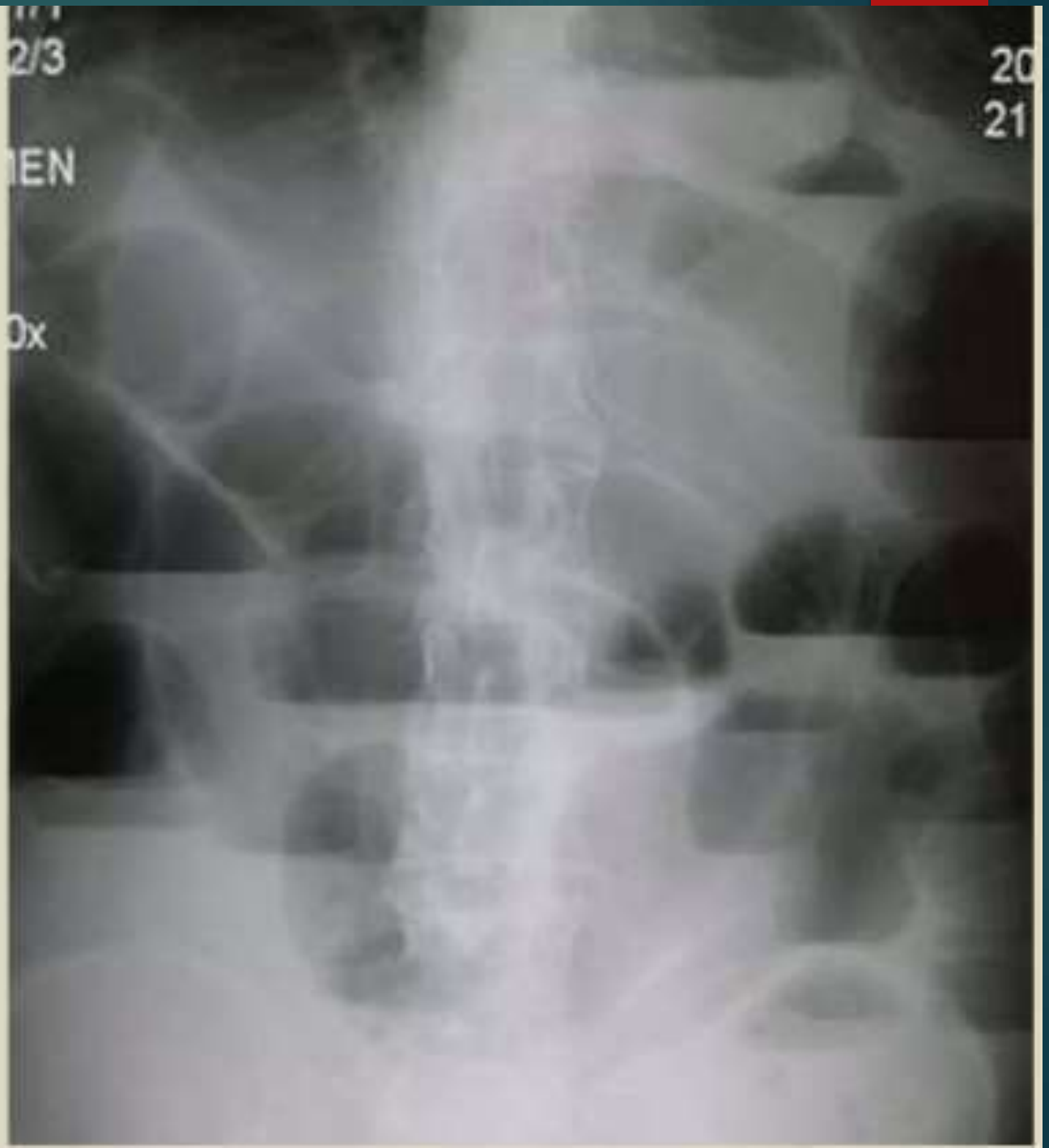
- **Small bowel obstruction - features**
- Centrally located multiple dilated loops of gas filled bowel
- Valvulae conniventes are visible - confirming this is small bowel
- Evidence of previous surgery - (not always)
- note the anastomosis site - this suggests adhesions is the likely cause of obstruction

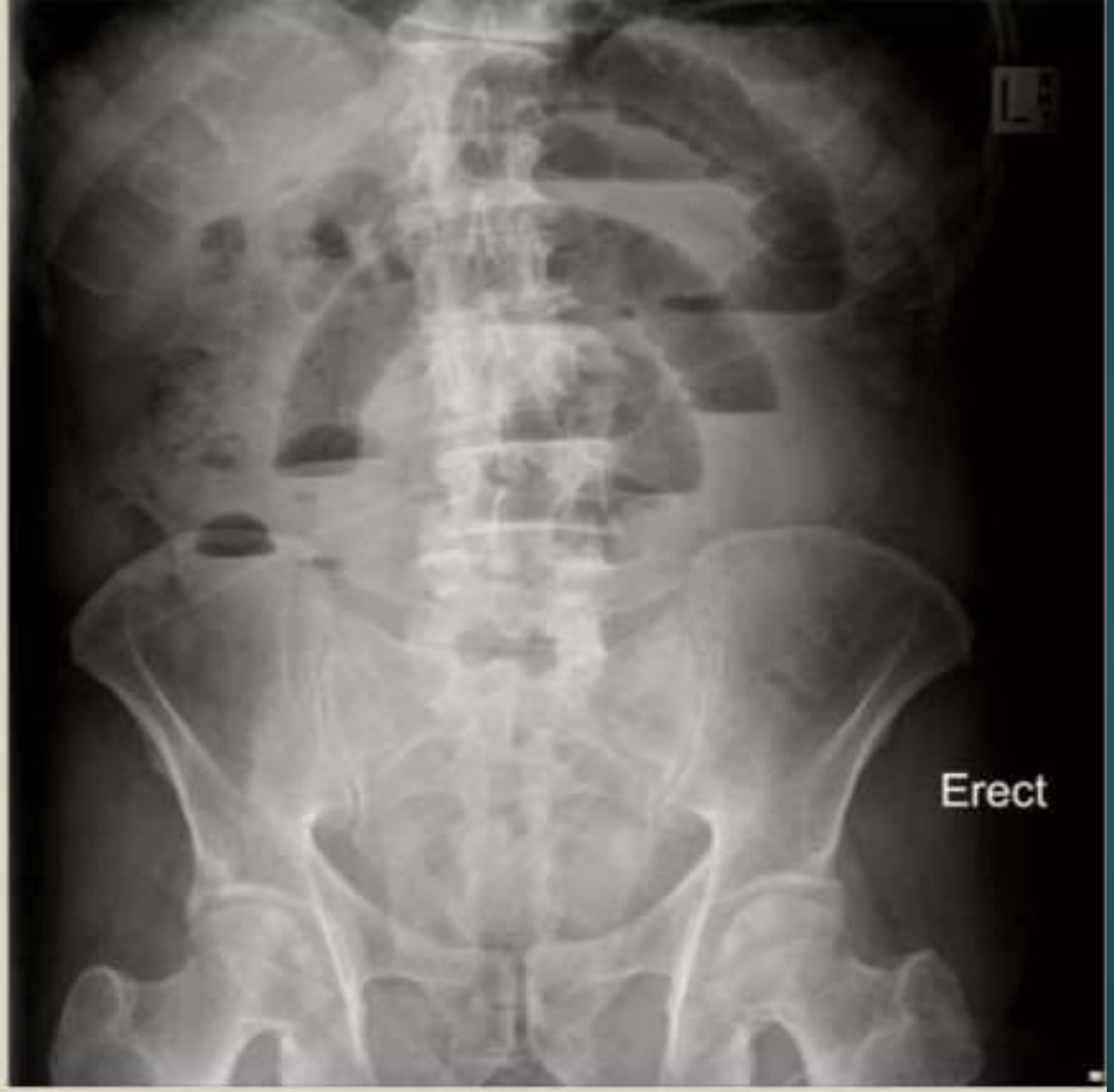


Stepladder Appearance - *abdominal radiography showing dilated loops of the small bowel in the left upper quadrant in a mechanical small bowel obstruction.*

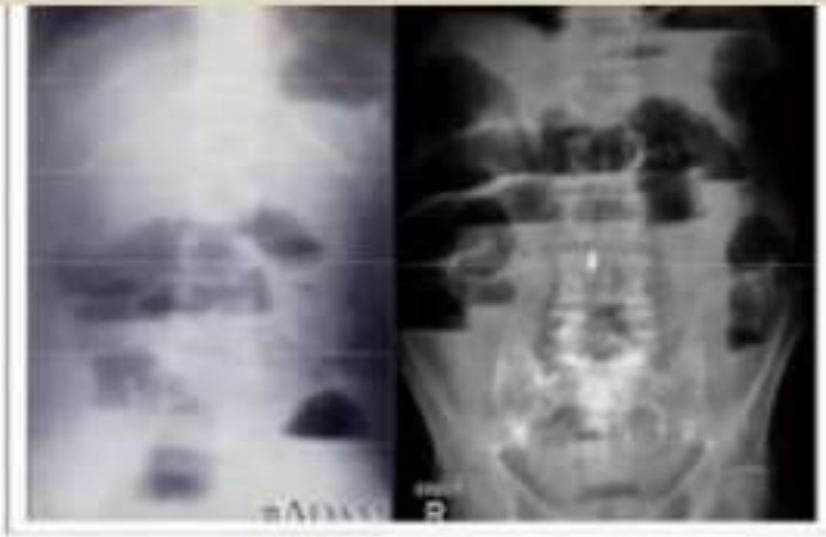


Upright abdominal X-ray demonstrating a small bowel obstruction. Note multiple air fluid levels.



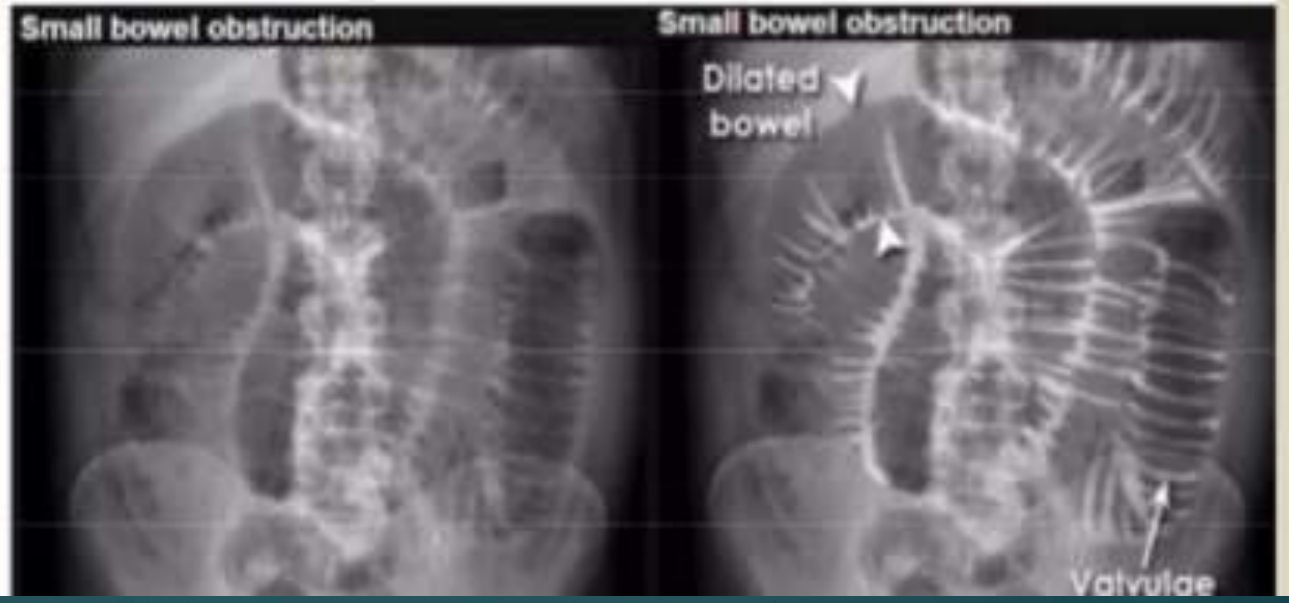


Small Bowel Obstruction.

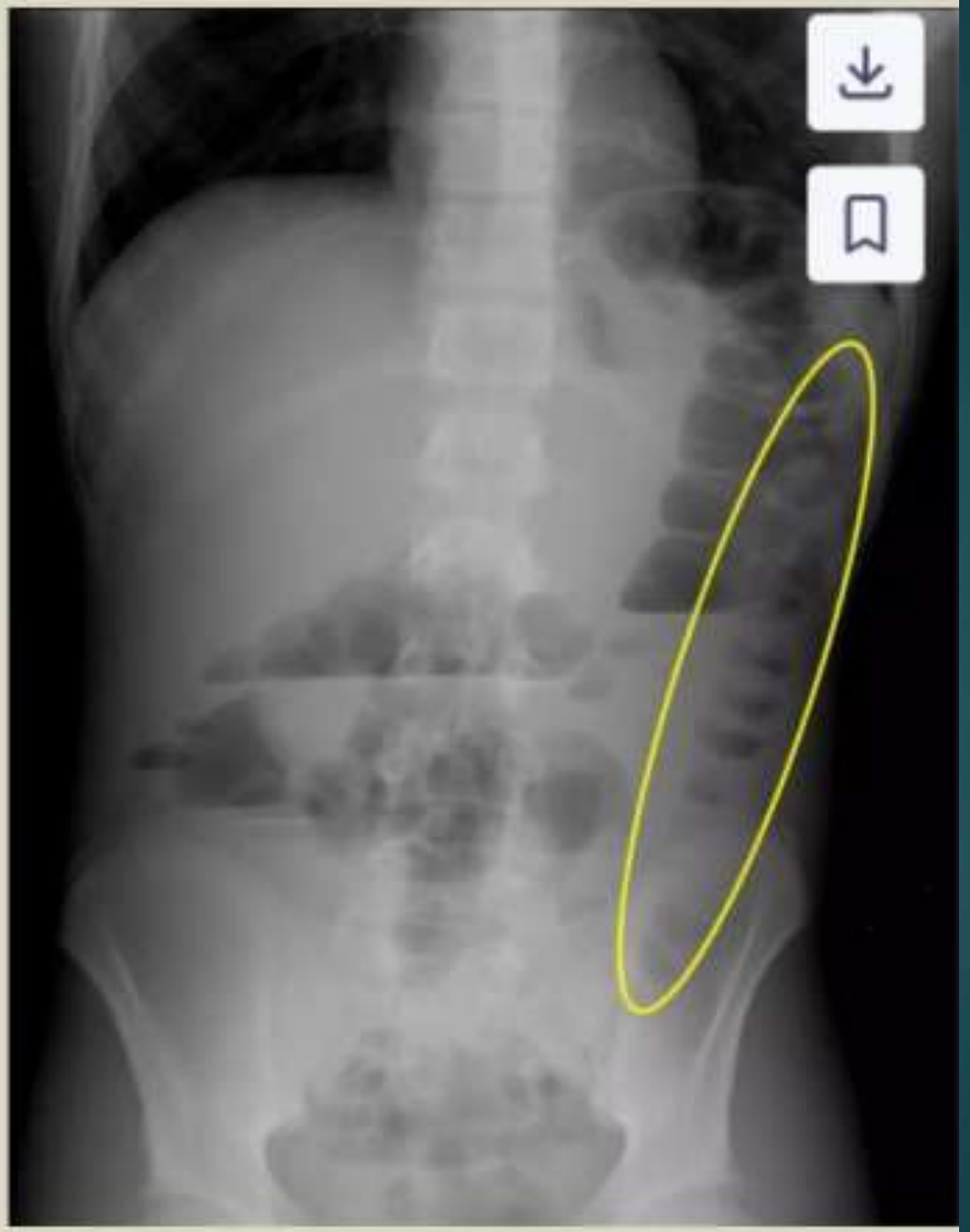


Features of small bowel obstruction include the central position of gas-filled and distended loops of bowel.

The white lines passing across the full width of the bowel are 'valvulae conniventes' - these are only found in the small bowel.



String of Beads Sign - *abdominal radiography showing linearly arranged small pockets of air in a fluid-dilated small bowel loop.*



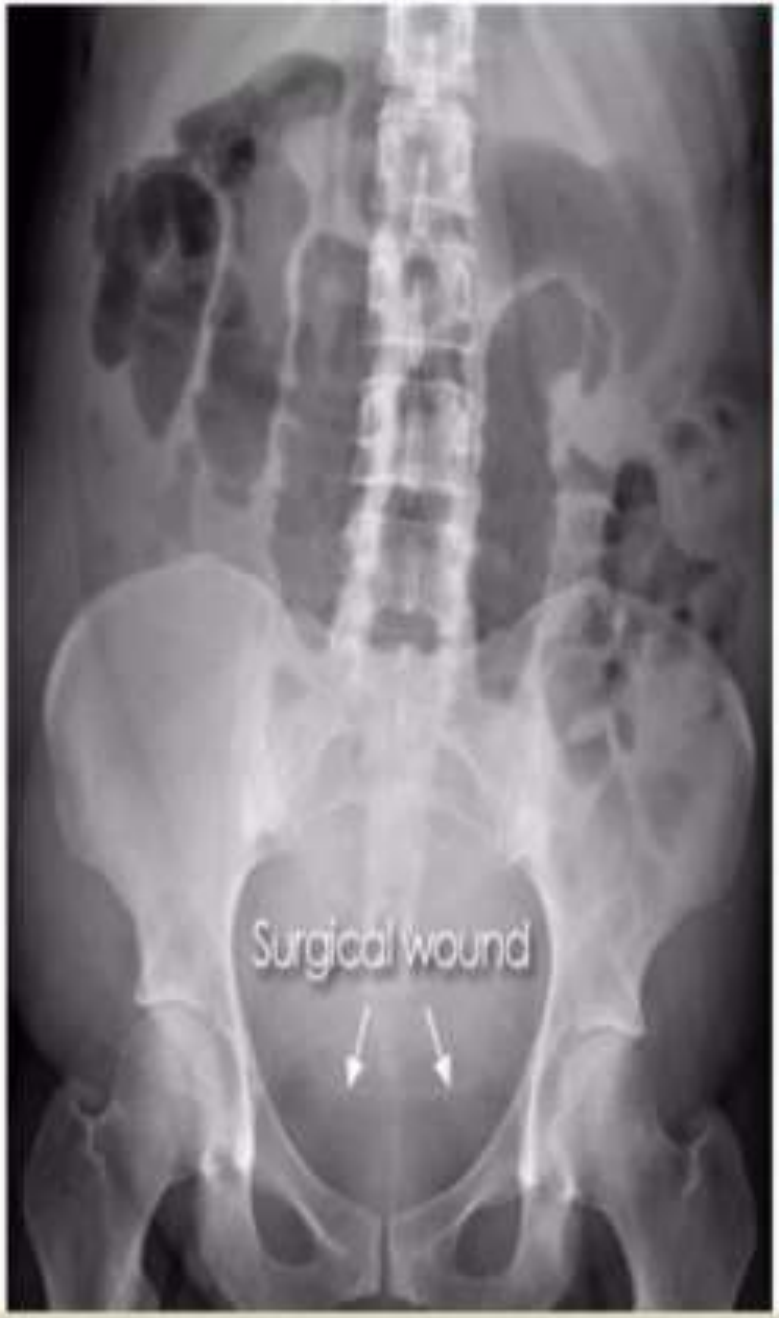
- **Small bowel obstruction - causes**
- The most common causes of obstruction are adhesions secondary to intra-abdominal surgery, hernias, tumours and Crohn's disease. Regardless of whether there is evidence of these causes on an abdominal radiograph, a full surgical history should be taken and examination of the hernial orifices should be performed.

- Ileus is a term used for aperistaltic bowel not caused by a mechanical obstruction. This phenomenon is common after abdominal surgery. The radiological features can be similar to those of obstruction.

- **Post operative ileus**
- Appearances are similar to those of mechanical obstruction
- There are multiple loops of gas filled bowel projected centrally over the abdomen
- This patient had prolonged non-colicky abdominal pain following a Caesarean section - recovery was spontaneous

Post operative ileus

Hover on/off image to show/hide findings



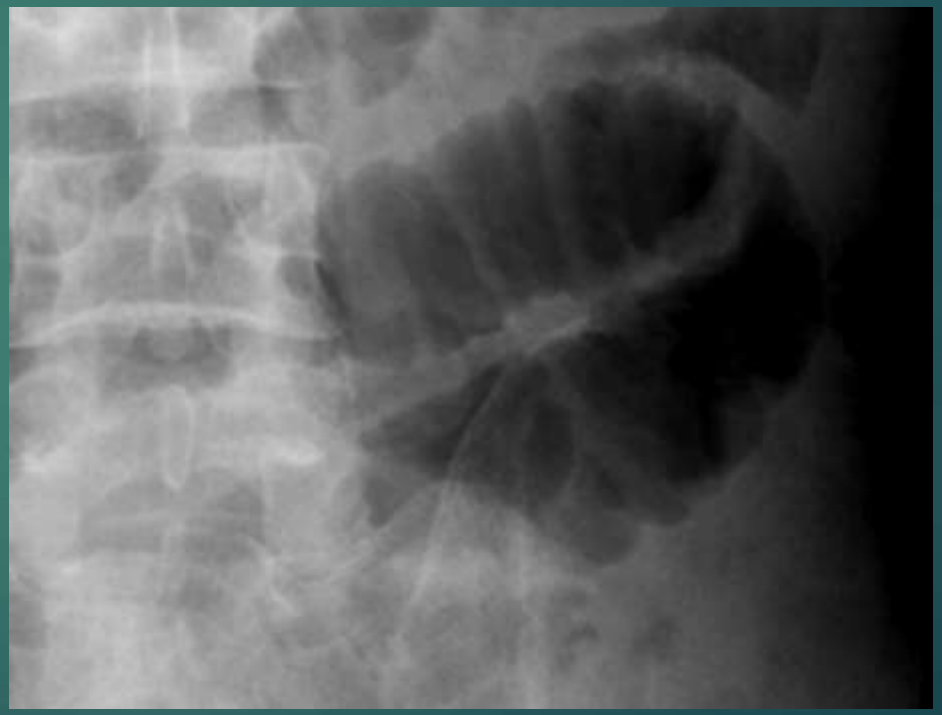
Post operative ileus

- Appearances are similar to those of mechanical obstruction
- There are multiple loops of gas filled bowel projected centrally over the abdomen
- This patient had prolonged non-colicky abdominal pain following a Caesarian section - recovery was spontaneous

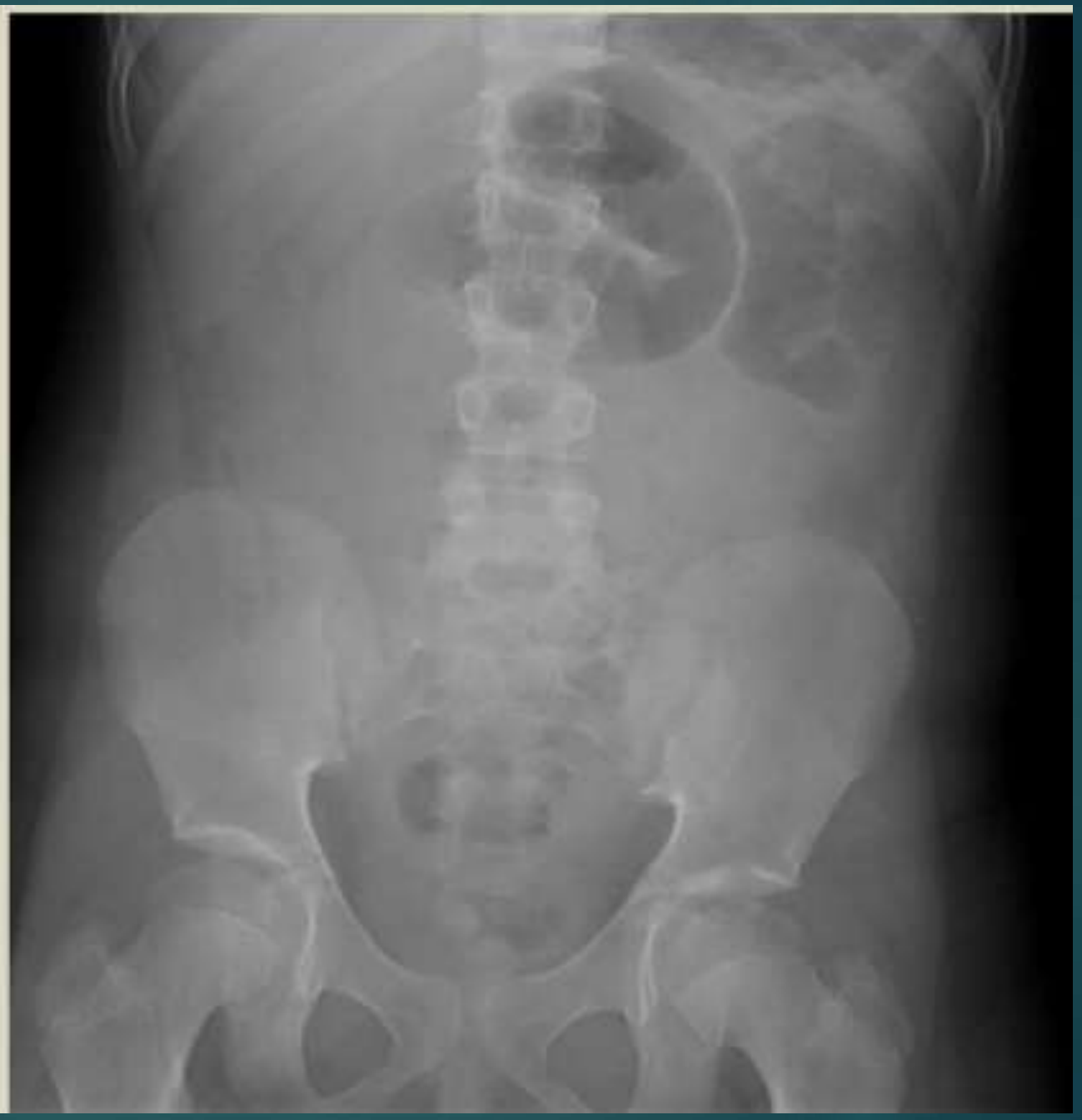
Sentinel loop

- Intra-abdominal inflammation, such as with pancreatitis, can lead to a localized ileus. This may appear as a single loop of dilated bowel known as a 'sentinel loop.'

- A localized loop of small bowel is dilated in this patient with acute pancreatitis
- This appearance is not diagnostic of intra-abdominal inflammation, but rather an occasional associated feature



Sentinel Loop Sign - *abdominal radiography showing dilated loops of small bowel, in a patient with an acute pancreatitis.*



Large bowel obstruction

Key points

Dilatation of the caecum >9cm is abnormal

Dilatation of any other part of the colon >6cm is abnormal

Abdominal X-ray may demonstrate the level of obstruction

Abdominal X-ray cannot reliably differentiate mechanical obstruction from pseudo-obstruction

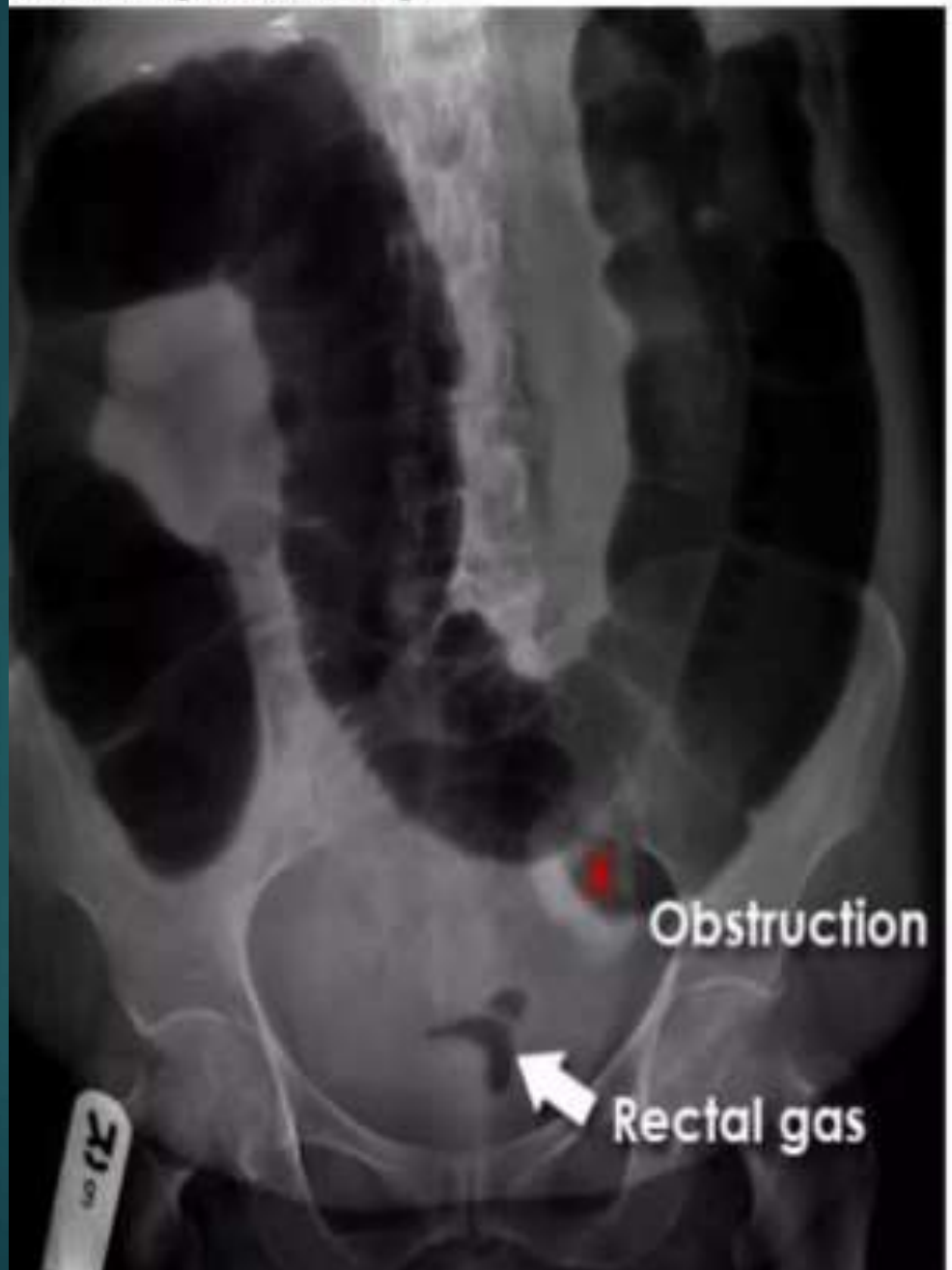
The most common causes of large bowel obstruction are colorectal carcinoma and diverticular strictures. Less common causes are hernias or volvulus (twisting of the bowel on its mesentery).

Adhesions do not commonly cause large bowel obstruction.

Radiological appearances of large bowel obstruction differ from those of small bowel obstruction, however, with large bowel obstruction there is often co-existing small bowel dilatation proximally. Dilatation of the caecum >9cm, and >6cm for the rest of the colon is considered abnormal.

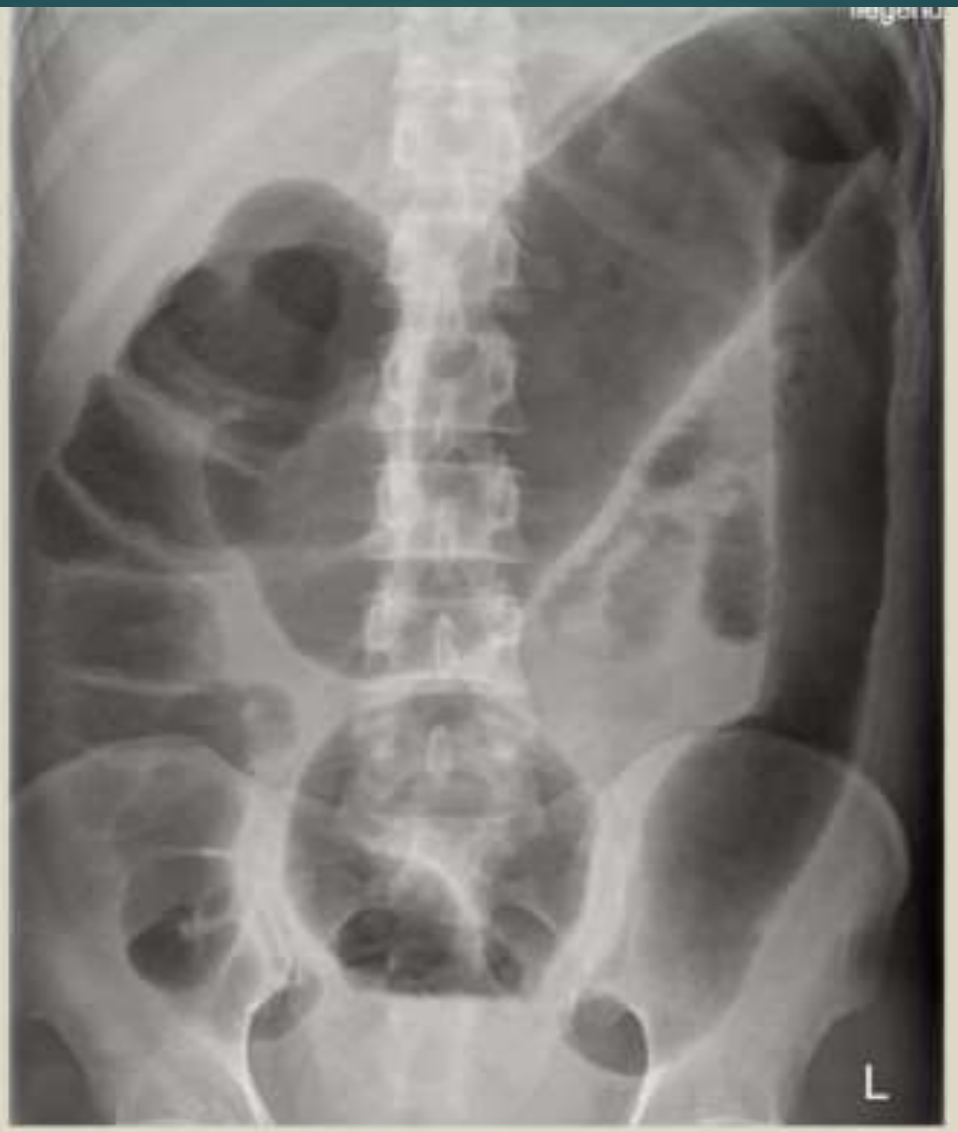
Large bowel obstruction

Hover on/off image to show/hide findings

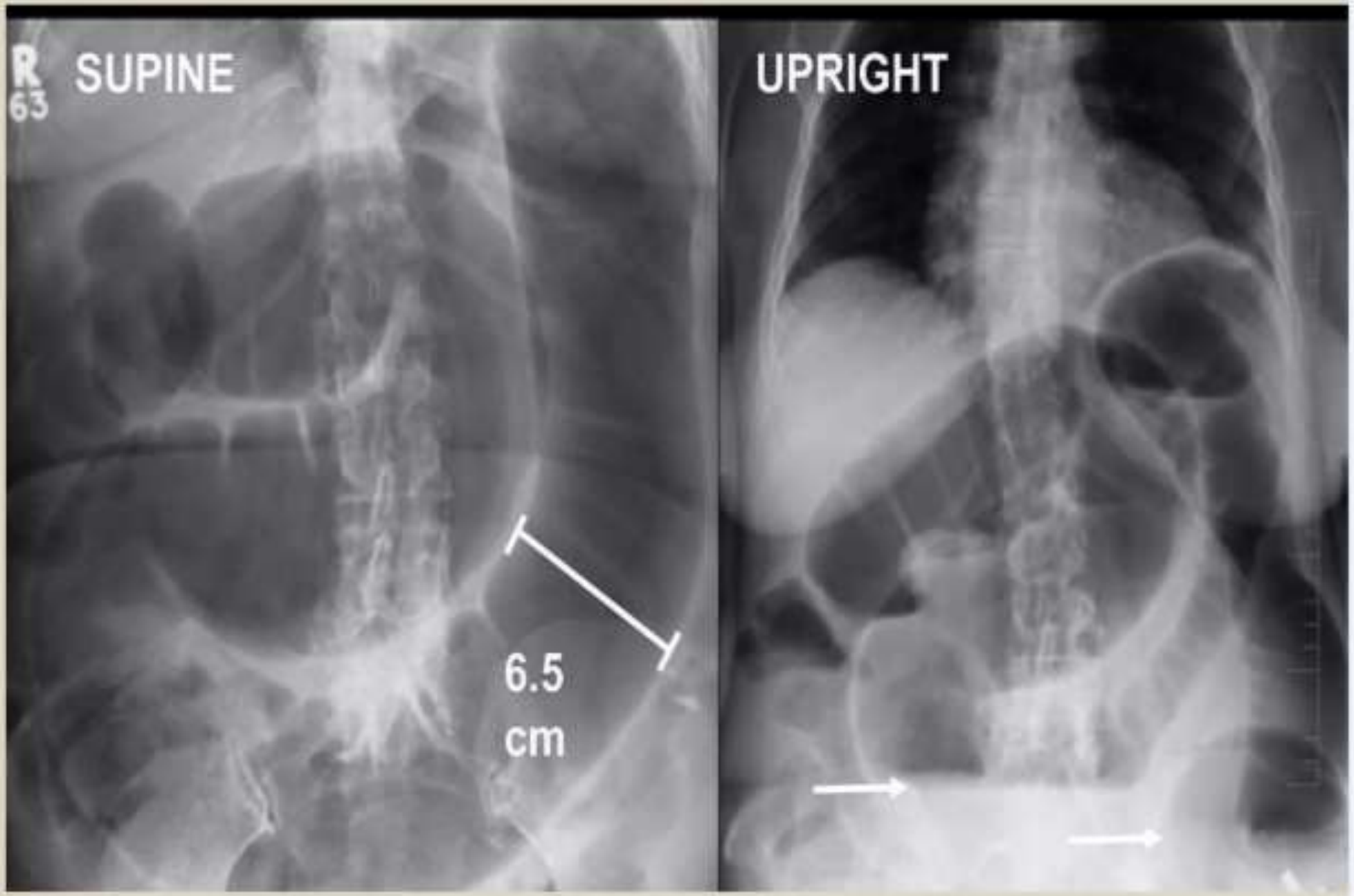


Large bowel obstruction

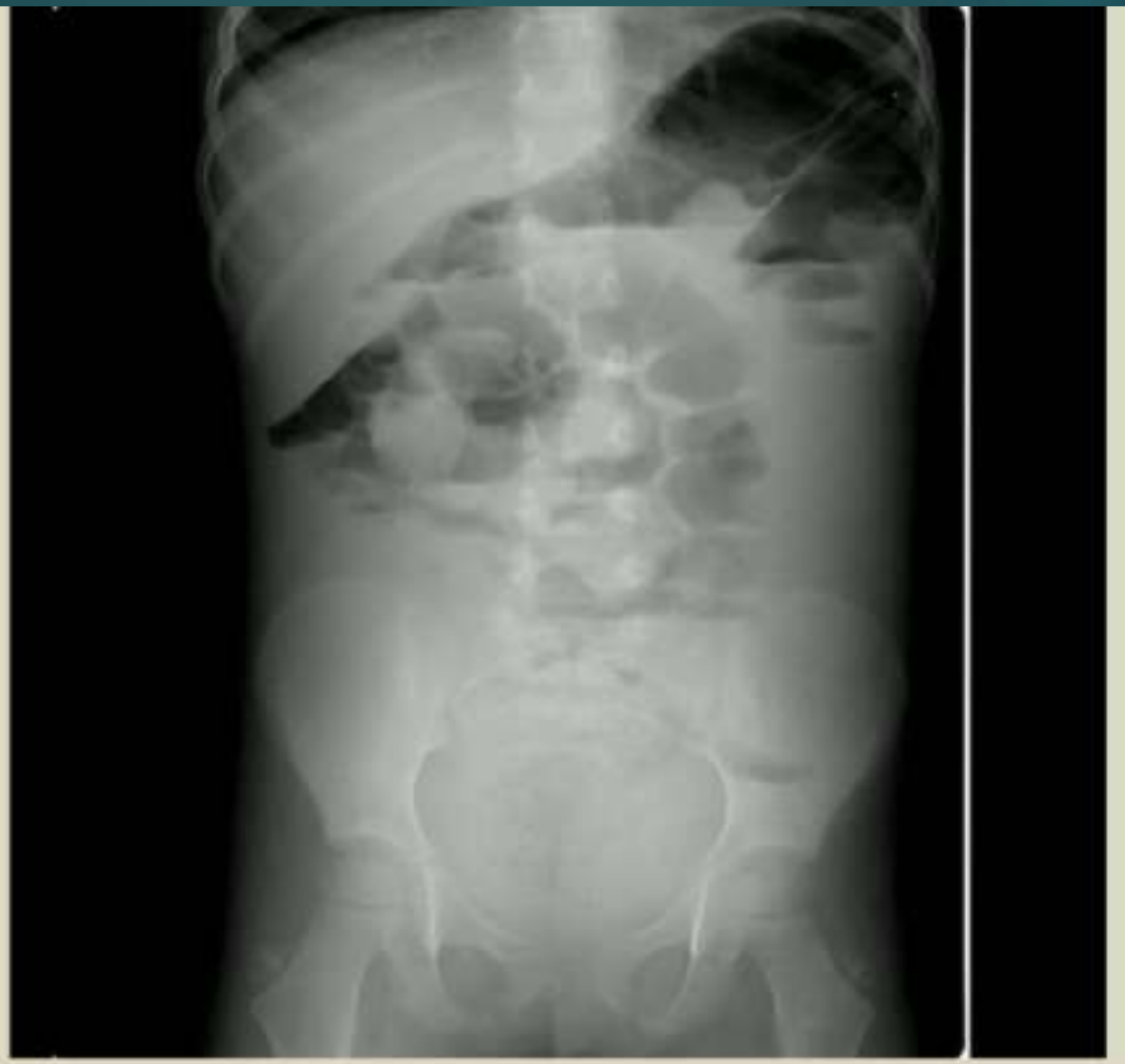
- Here the colon is dilated down to the level of the distal descending colon. There is the impression of soft tissue density at the level of obstruction (**X**). No gas is seen within the sigmoid colon.
- Obstruction is not absolute in this patient as a small volume of gas has reached the rectum (**arrow**).
- An obstructing colon carcinoma was confirmed on CT and at surgery.



Toxic Megacolon Abdominal X-ray - large bowel obstruction.



Large Bowel Obstruction.



Colon Cutoff Sign: abdominal radiography showing dilated transverse colon to splenic flexure, in this case was associated with pancreatitis.

Twisting of the bowel - or 'volvulus-

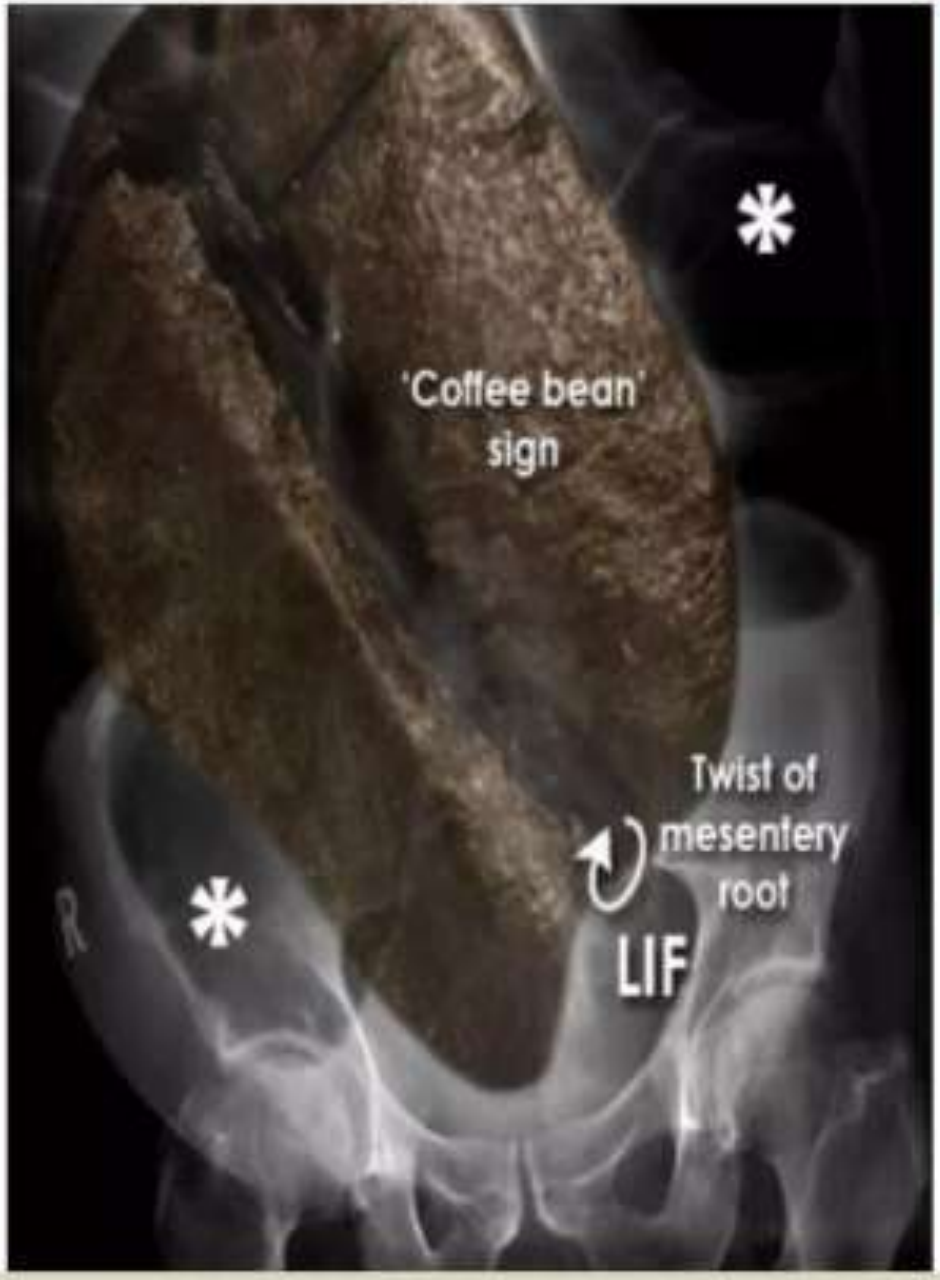
is a specific cause of bowel obstruction which can have characteristic appearances on an abdominal X-ray. The two commonest types of bowel twisting are sigmoid volvulus and cecal volvulus.

Sigmoid volvulus

The sigmoid colon is more prone to twisting than other segments of the large bowel because it is 'mobile' on its own mesentery, which arises from a fixed point in the left iliac fossa (LIF). Twisting at the root of the mesentery results in the formation of an enclosed loop of sigmoid colon which becomes very dilated. If untreated this can lead either to perforation, due to excessive dilatation, or to ischemia due to compromise of the blood supply.

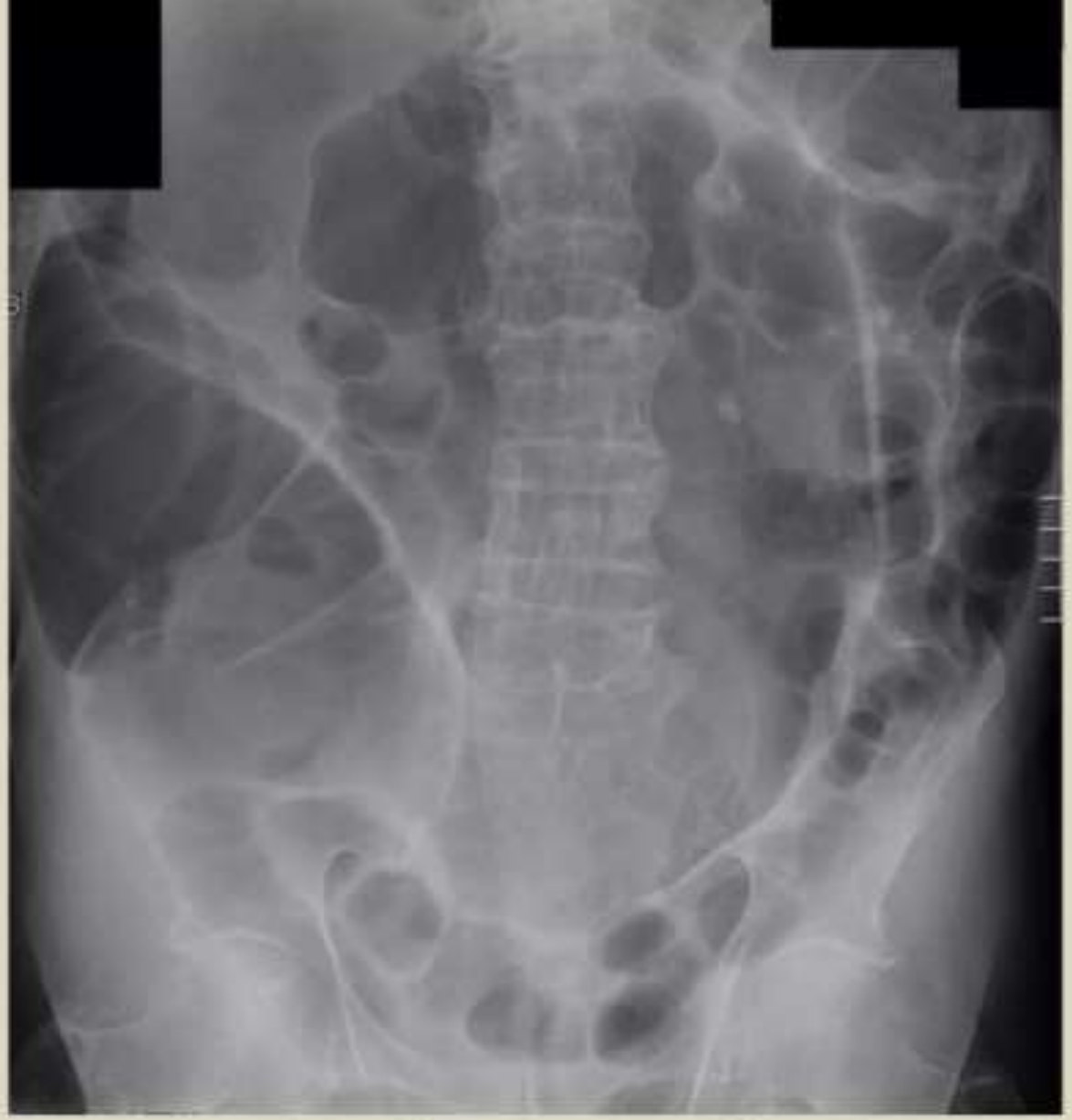
Sigmoid volvulus - 'coffee bean' sign

Hover on/off image to show/hide findings

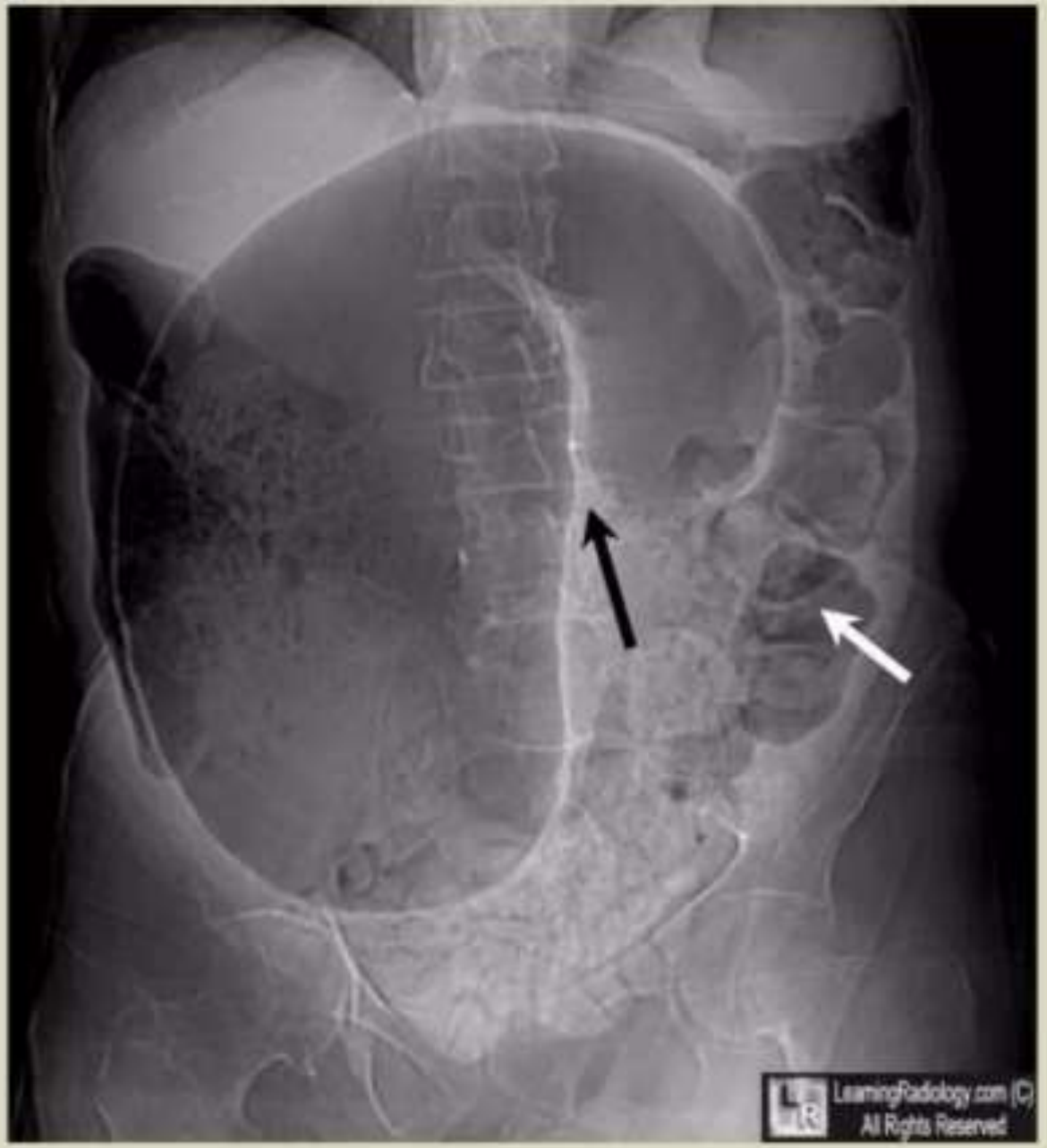


Sigmoid volvulus - 'coffee bean' sign

- The sigmoid colon is very dilated because it is twisted at the root of its mesentery in the left iliac fossa (**LIF**). The proximal large bowel is also dilated (**asterisks**).
- The twisted loop of sigmoid colon is said to resemble a coffee bean. As in this case the loop of dilated sigmoid colon - or 'coffee bean' - usually points upwards towards the diaphragm.
- This patient is at high risk of perforation and/or bowel ischaemia.



Coffee-bean Sign - plain film showing dilated sigmoid colon in sigmoid volvulus.



Sigmoid Volvulus.

Cecal volvulus: ***The caecum is most frequently a retroperitoneal structure, and therefore not susceptible to twisting. However, in up to 20% of individuals there is congenital incomplete peritoneal covering of the caecum with formation of a 'mobile' caecum on a mesentery, such that it no longer lies in the right iliac fossa.***

Caecal volvulus

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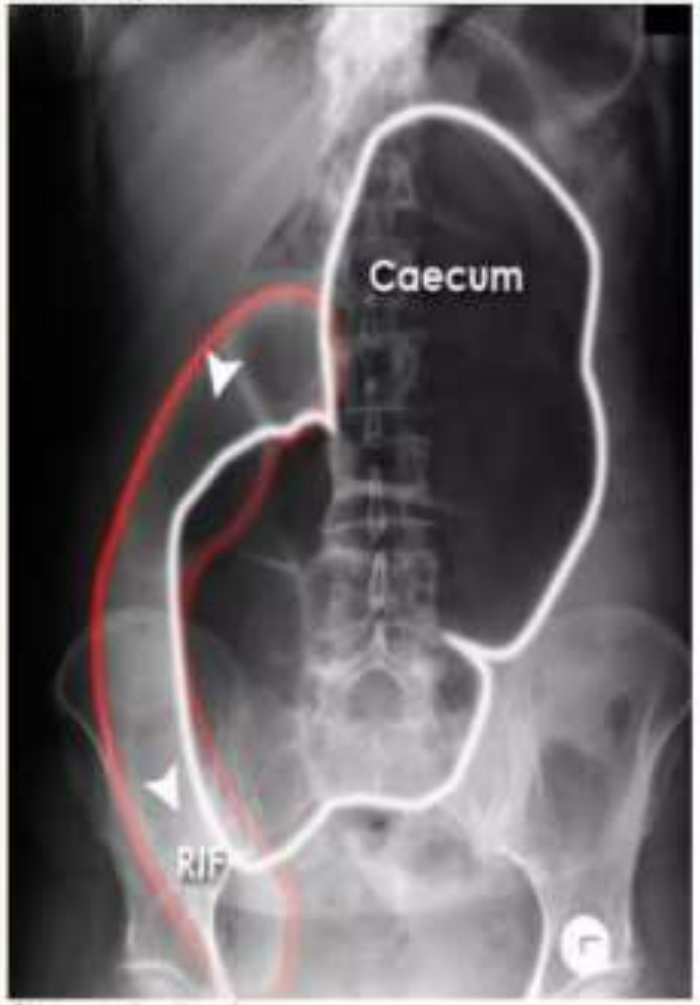
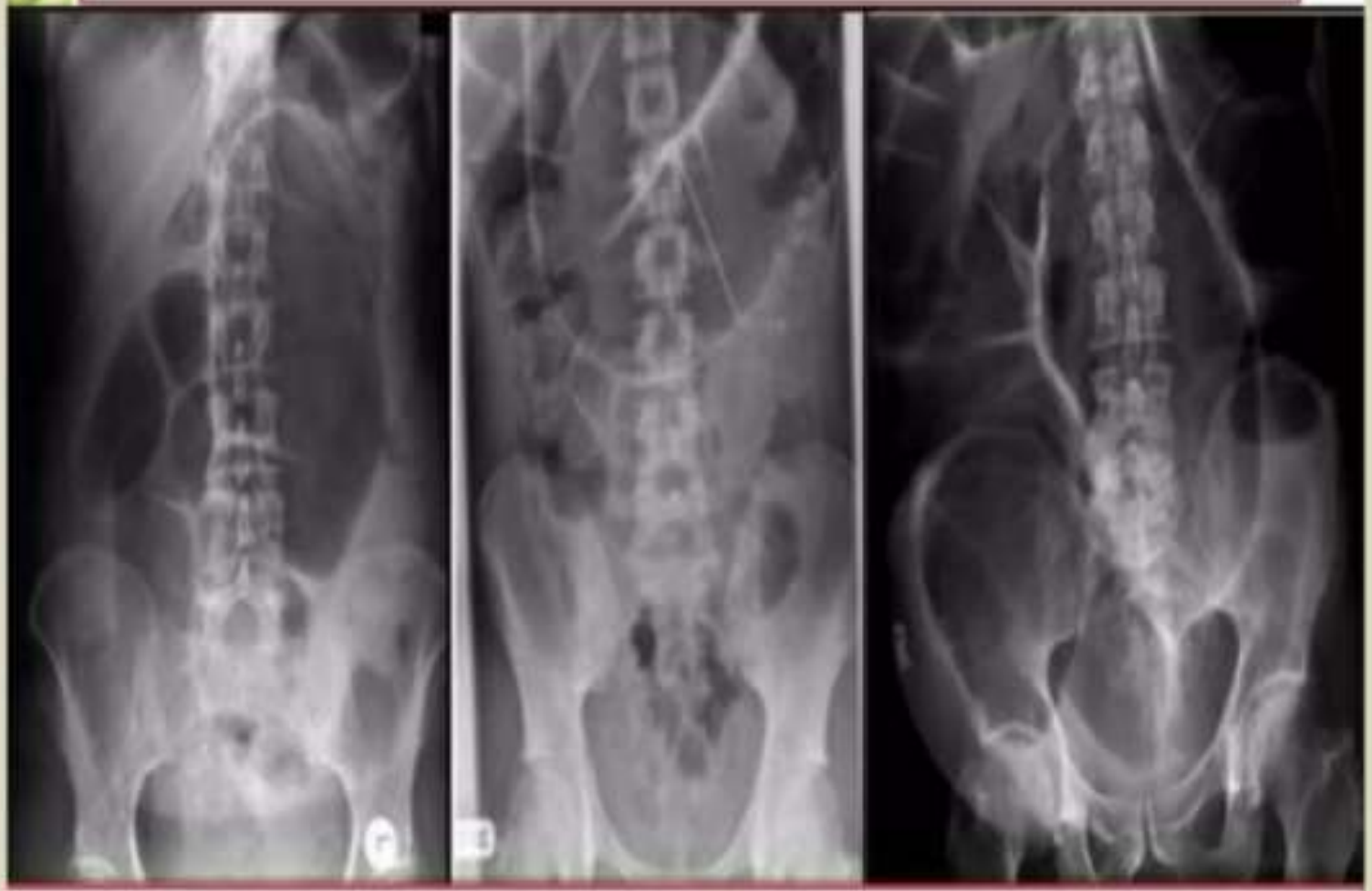


Caecal volvulus

- The massively dilated caecum no longer lies in the right iliac fossa (**RIF**). Rather this is occupied by small bowel (**red outline**). The small bowel is identified by the valvulae conniventes - mucosal folds that cross the full width of the bowel (**arrowheads**). Caecal volvulus was confirmed at laparotomy

Colonic Volvuli - Radiographs



Cecal Volvulus | Transverse colon Volvulus | Sigmoid Volvulus

Bowel wall inflammation

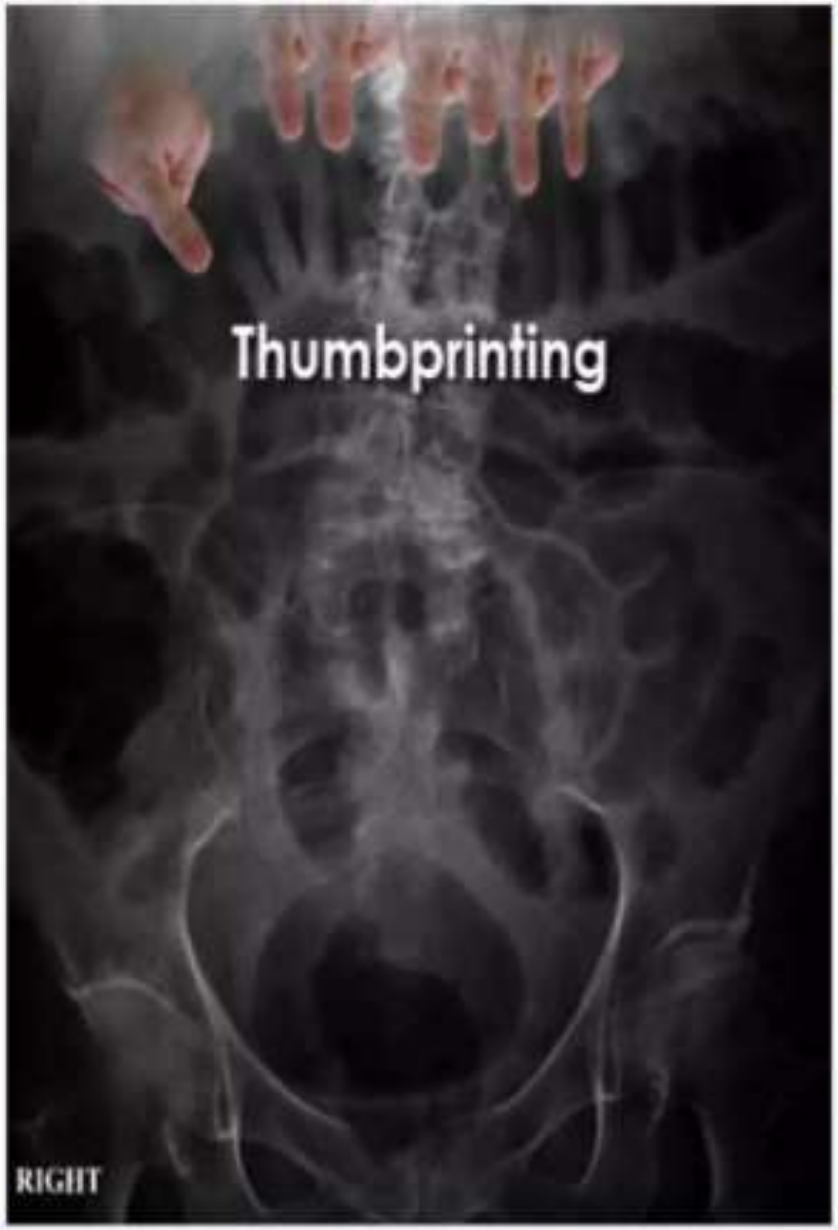
Key points

Abdominal X-rays sometimes demonstrate signs of bowel inflammation such as mucosal thickening 'thumb-printing' or a featureless colon 'lead pipe' colon.

Occasionally, abdominal X-rays show signs of inflammation in patients with inflammatory bowel disease. Abnormalities may relate to either acute or chronic stages of disease.

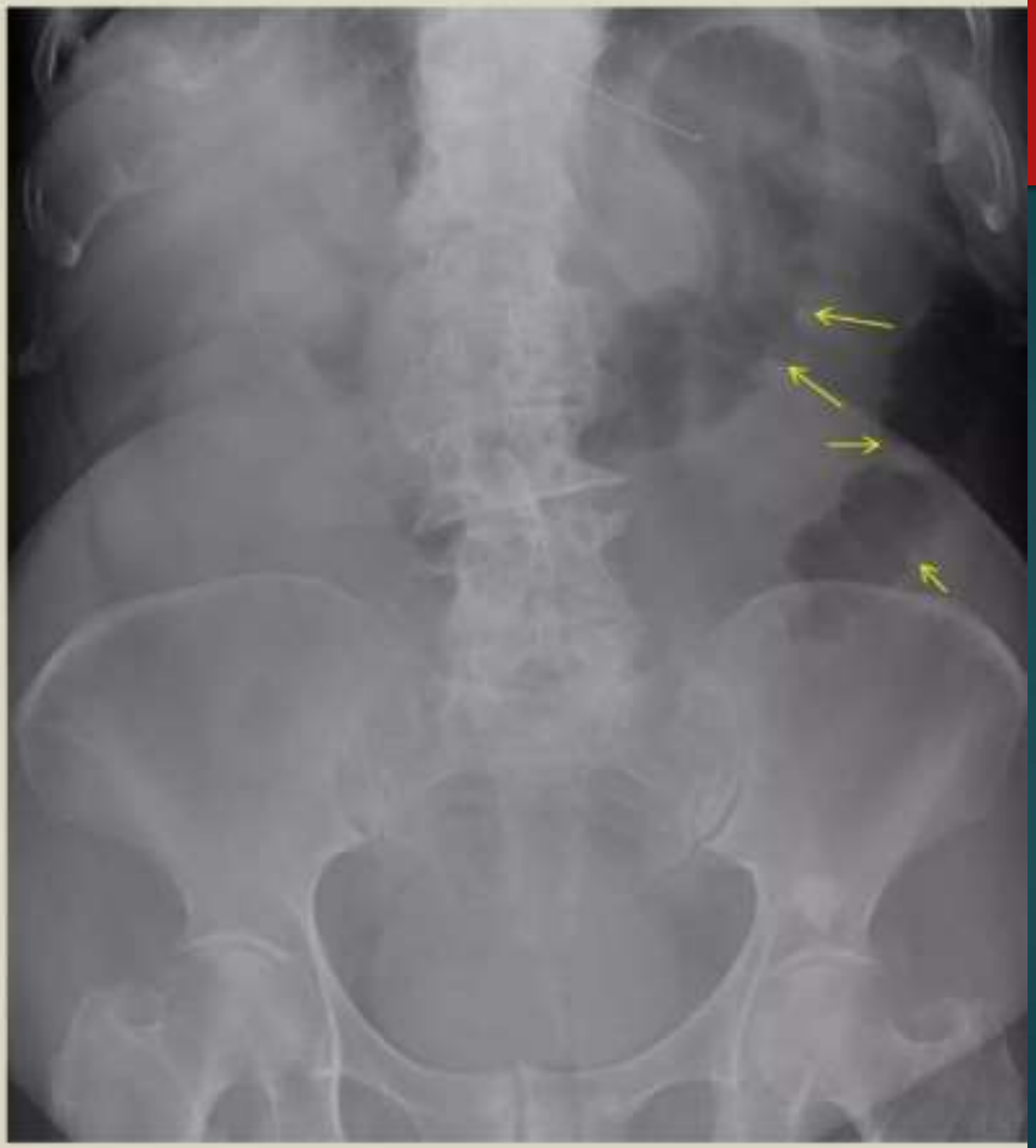
Mucosal thickening - 'thumbprinting'

Hover on/off image to show/hide findings



Mucosal thickening - 'thumbprinting'

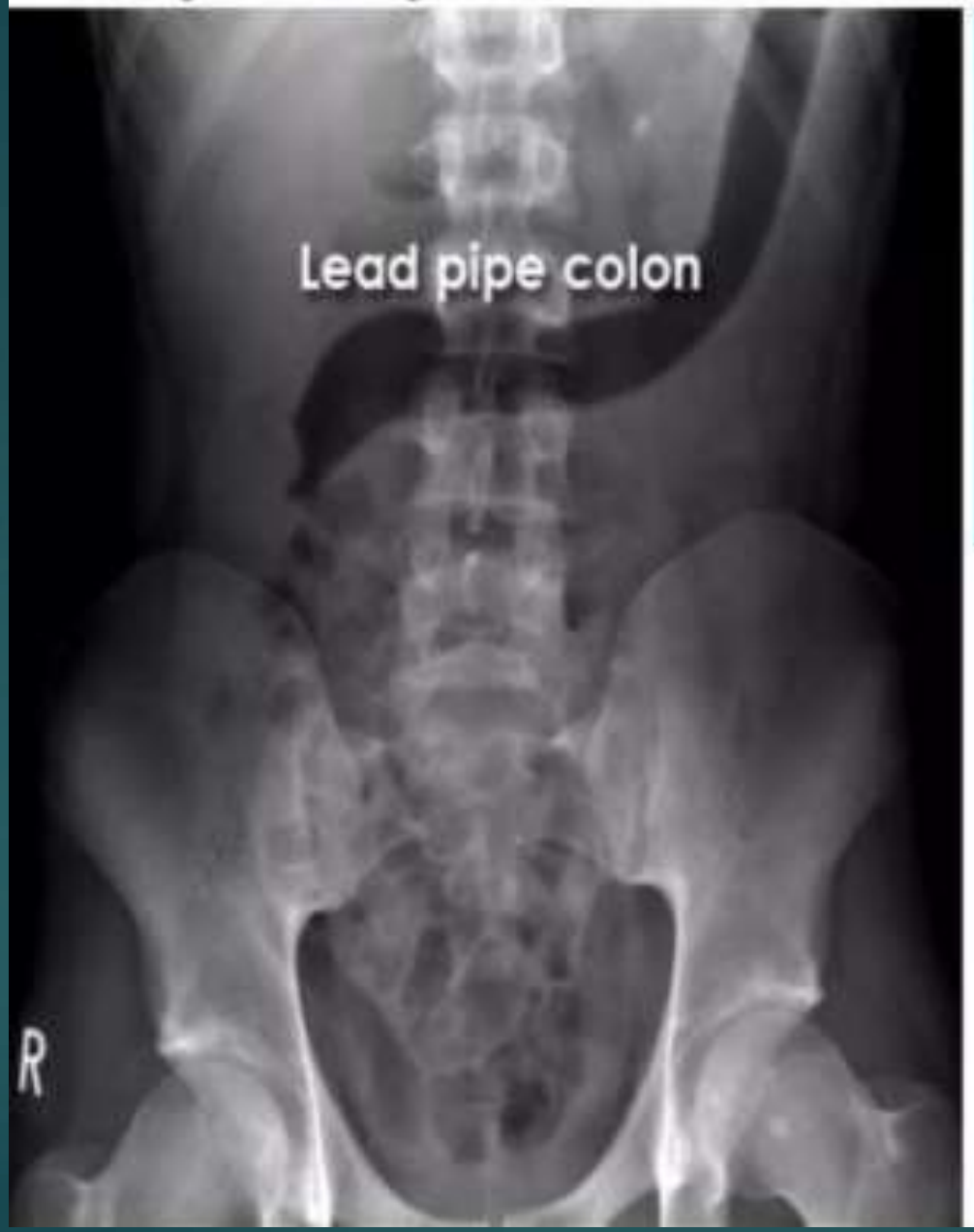
- This patient presented with an exacerbation of symptoms of ulcerative colitis.
- The distance between loops of bowel is increased (**arrows**) due to thickening of the bowel wall. The haustral folds are very thick (**arrowheads**), leading to a sign known as 'thumbprinting.'



Thumbprinting – abdominal radiography showing 'thumbprinting'(arrows). The normal haustral folds are replaced by wide transverse thickened bands.

Lead pipe colon

Hover on/off image to show/hide findings

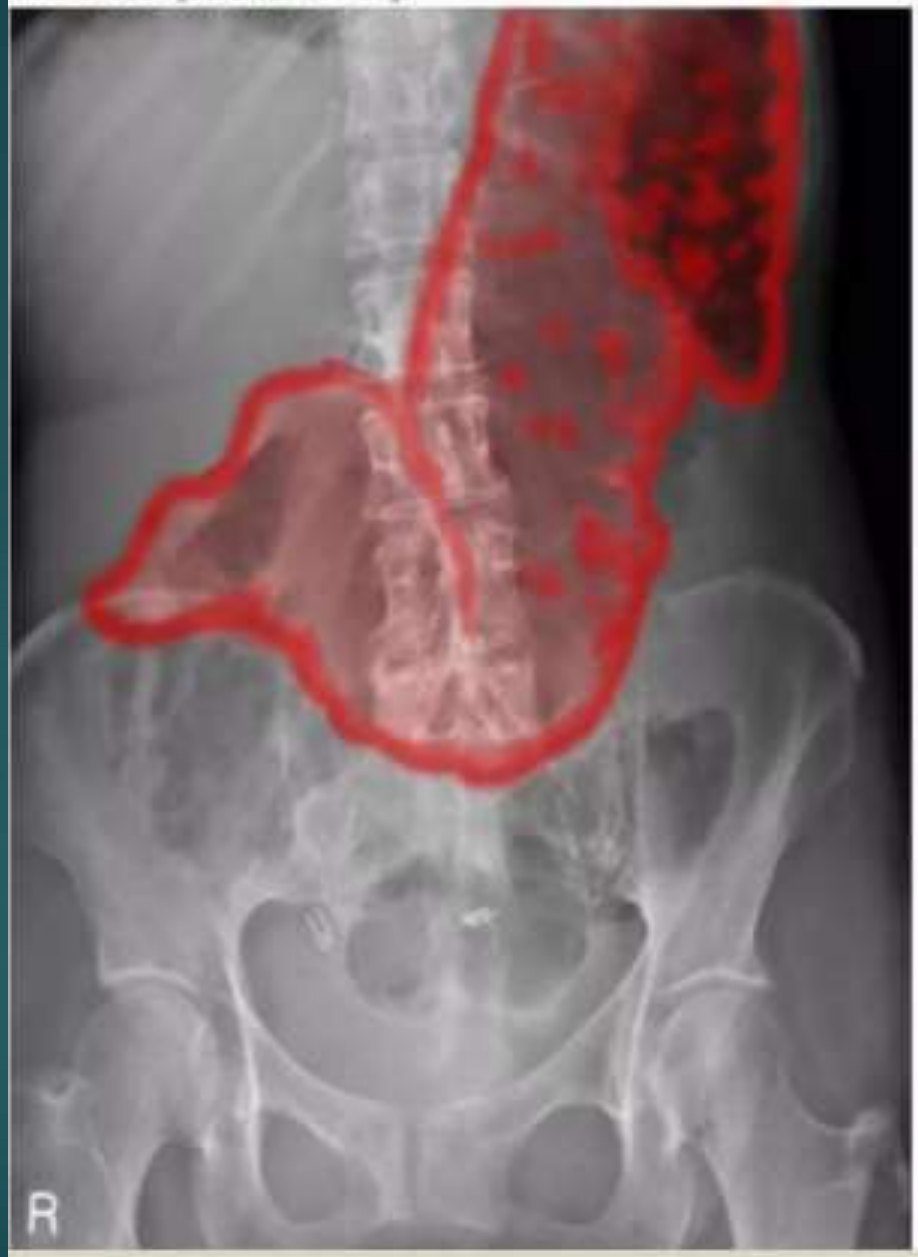


Lead pipe colon

- This patient with ulcerative colitis has a featureless segment of transverse colon with loss of the normal haustral markings.
- This 'lead pipe' appearance is associated with longstanding ulcerative colitis.
- The distal bowel is always involved in this disease but, as there is no air in the descending colon, this segment of colon is not evidently abnormal.

Toxic megacolon

Hover on/off image to show/hide findings



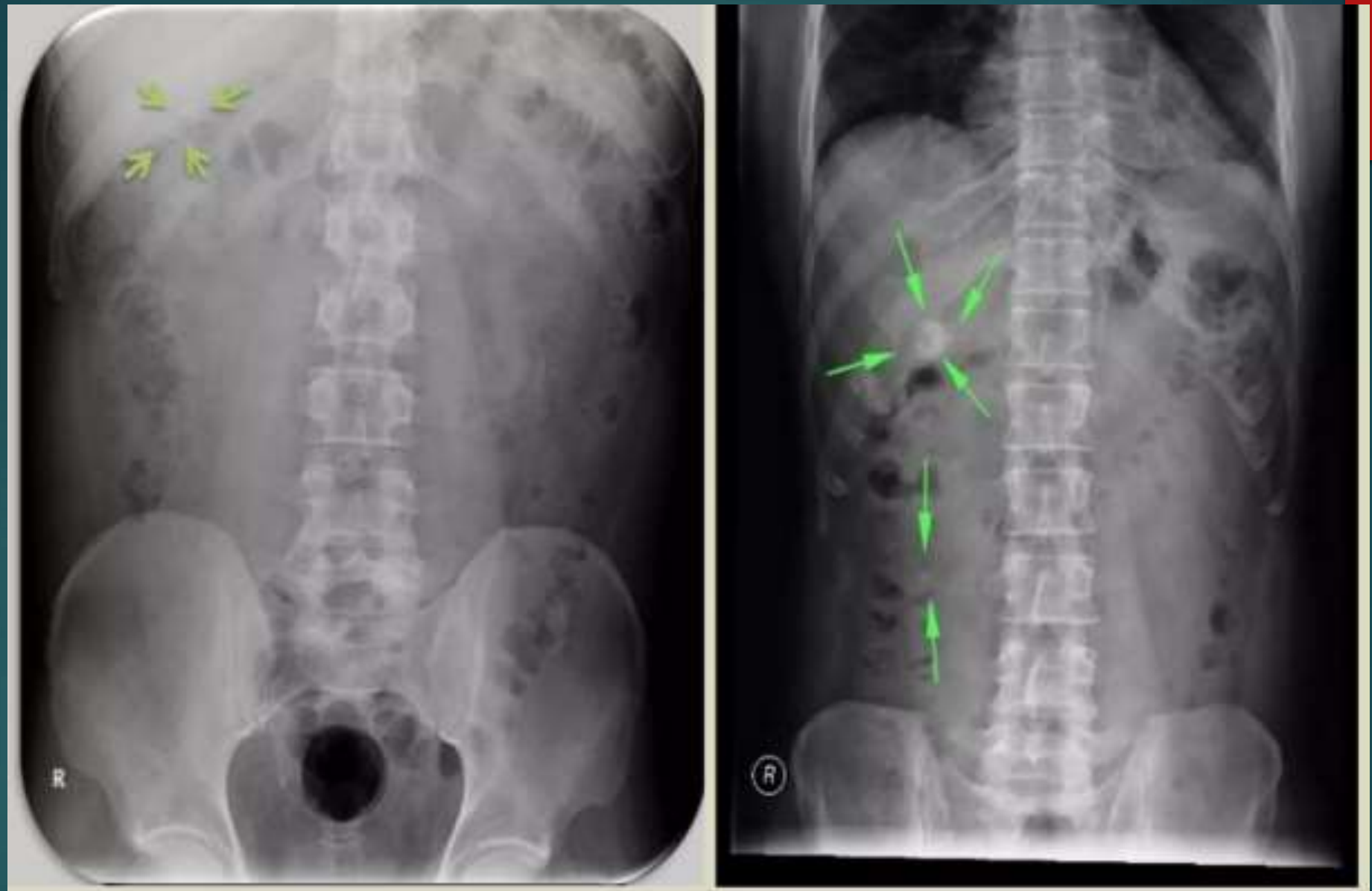
Toxic megacolon

- The colon is very dilated in this patient with acute abdominal pain, sepsis, and a known history of ulcerative colitis. The clinical features and X-ray appearances are consistent with toxic megacolon.
- There is evidence of bowel wall oedema with 'thumbprinting', and pseudopolyps or 'mucosal islands' (**red-patches**).

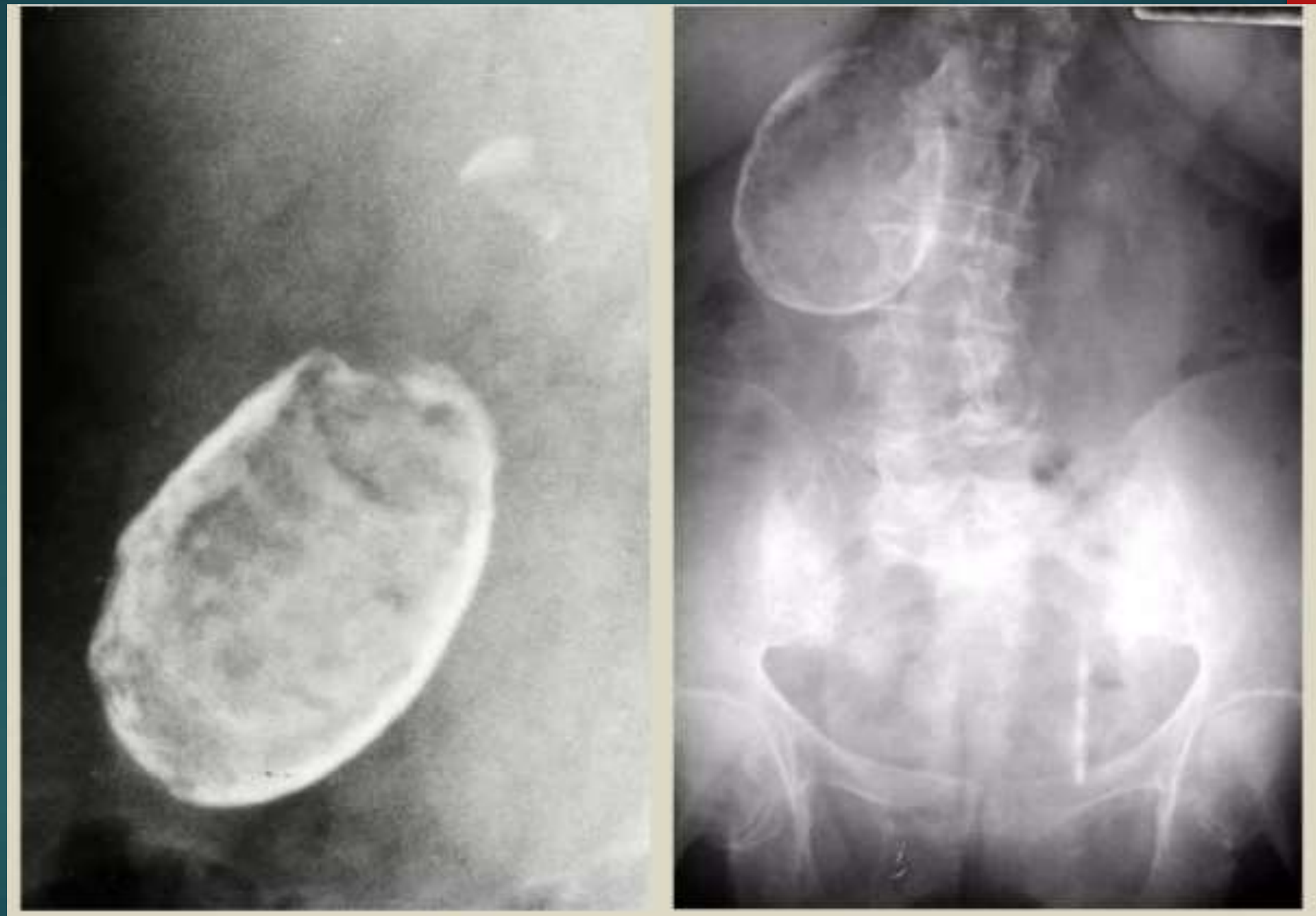
C

Intra-abdominal calcification is common and the causes may be classified into four broad groups based on morphology:

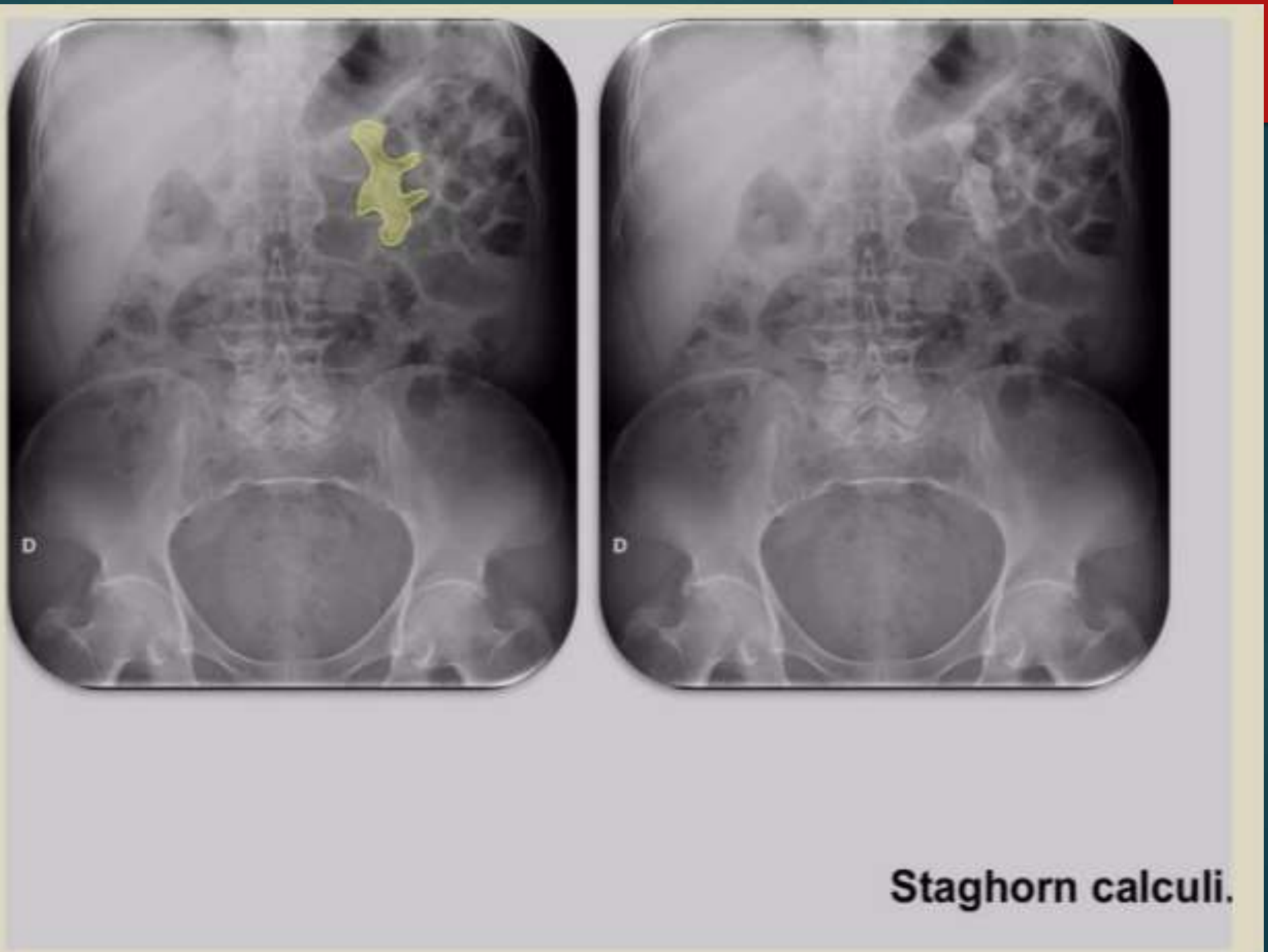
Stones: renal stones, ureteric stones, bladder stones, gallstones
pancreatic ductal calcification
nodal calcification: most commonly from treated lymphoma, tuberculosis or histoplasmosis
Phlebolith, appendicolith, calcified granuloma
failed renal transplant
encapsulating peritoneal sclerosis
Conduit calcification
Calcification within the walls of any fluid-filled hollow tube:
abdominal aorta, pancreatic duct, ductus deferens, large veins
Cystic calcification
Calcification in the wall of a mass such as a cyst, pseudocyst or aneurysm.
simple serous cysts, Aneurysms, echinococcal cysts, hematoma, 'porcelain' gallbladder, calcified appendiceal mucocele
Solid mass calcification
mesenteric nodes, adrenal calcifications, uterine fibroids
Primary tumours, e.g. ovarian dermoid, metastases, adenoma
Spleen (autosplenectomy in sickle cell disease)
Renal tuberculosis with autonephrectomy



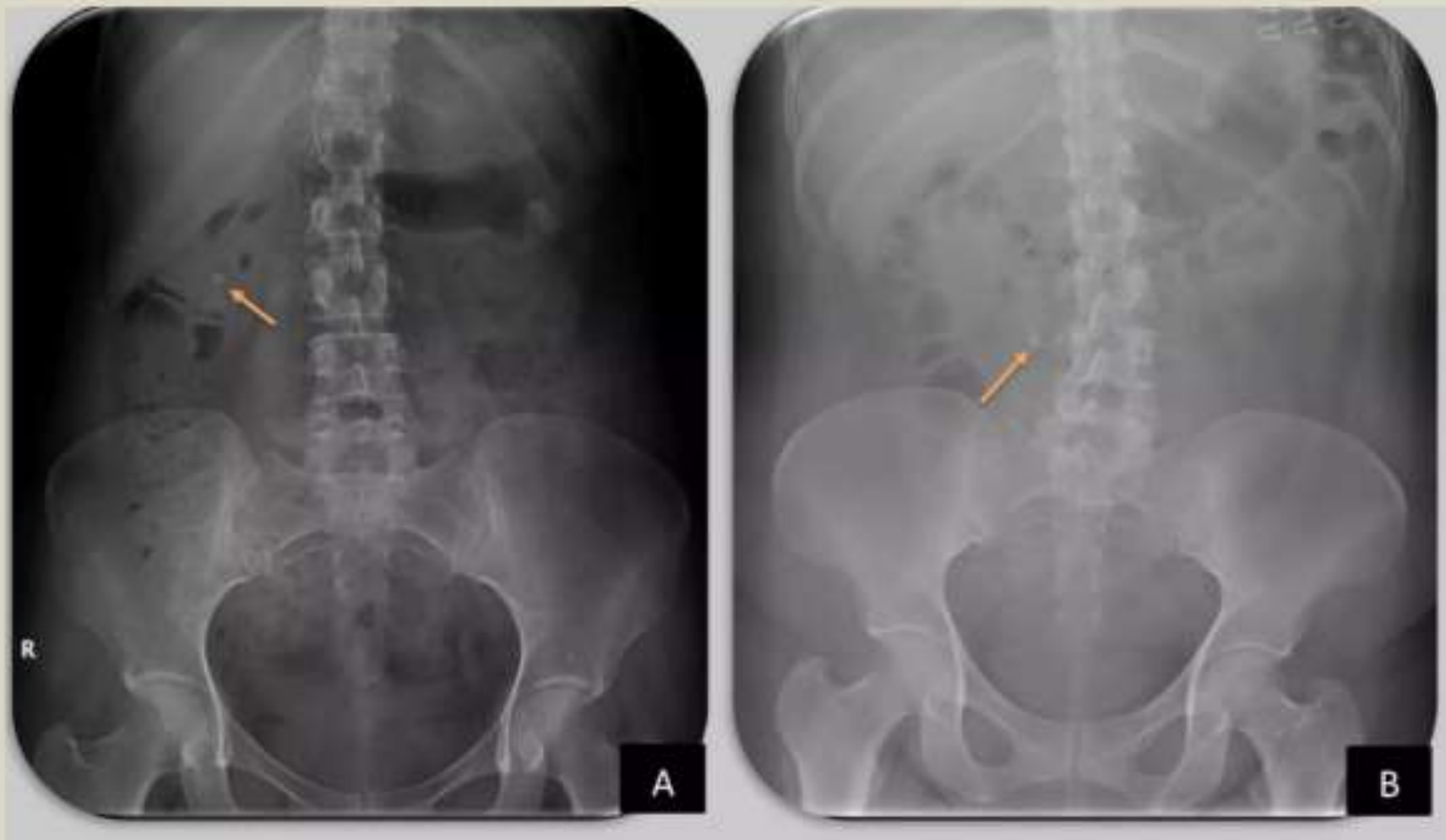
Gall Bladder stone.



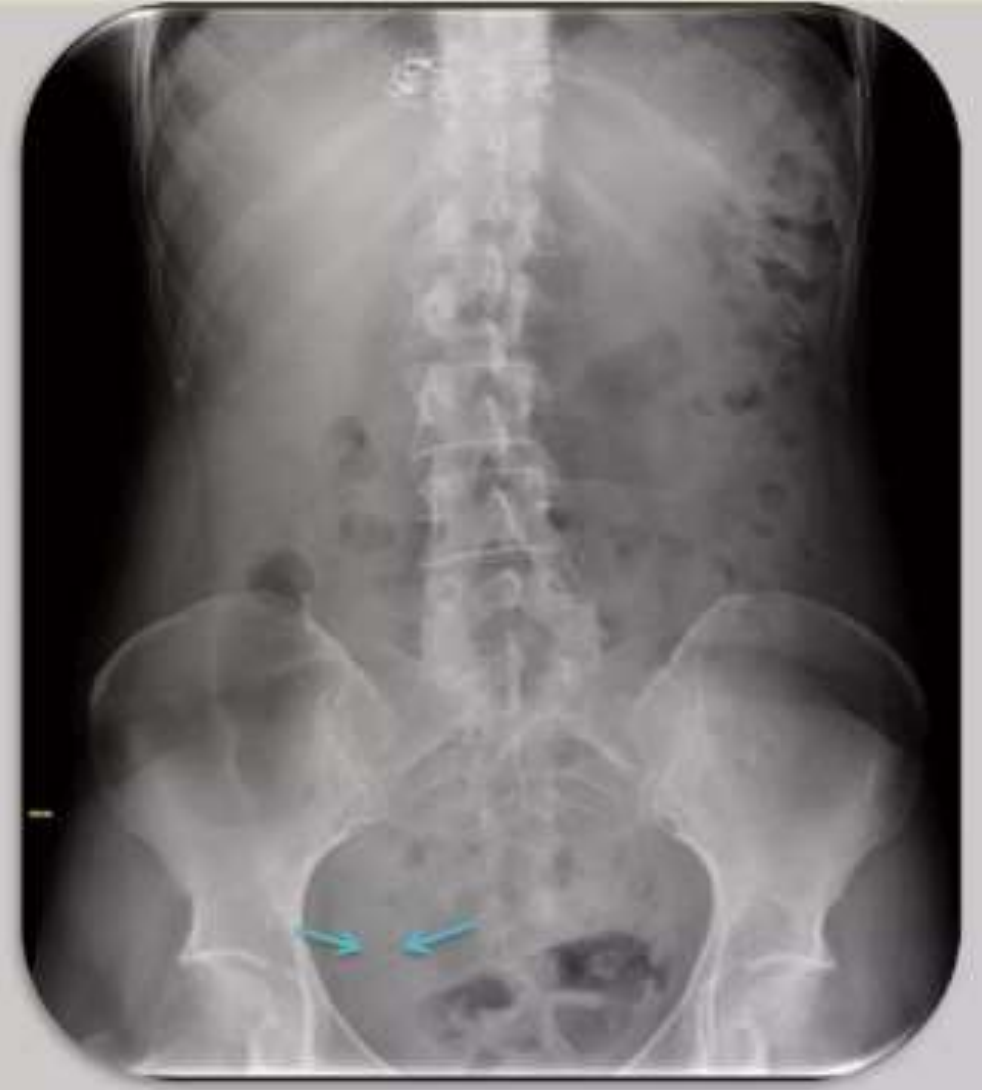
Porcelain Gallbladder.



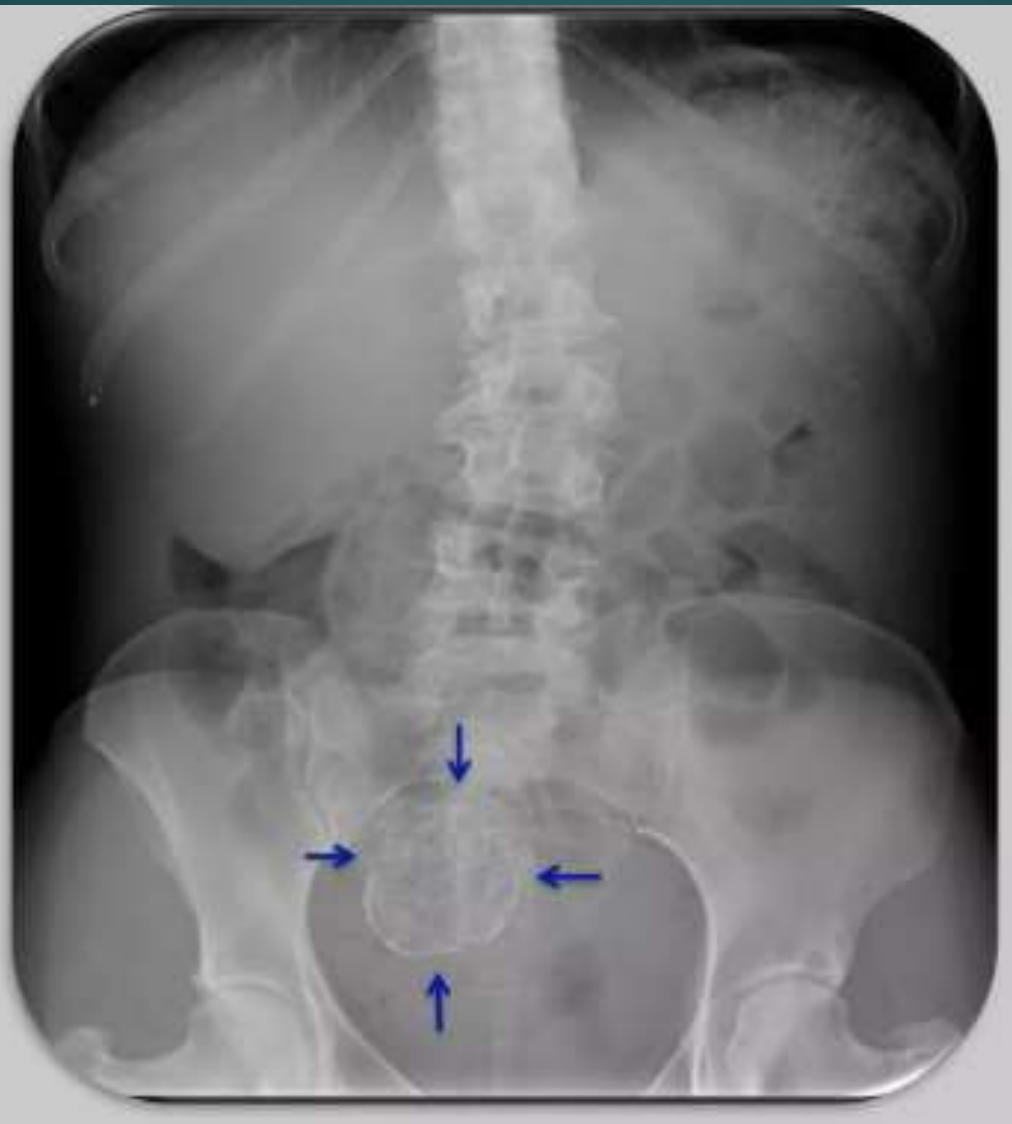
Staghorn calculi.



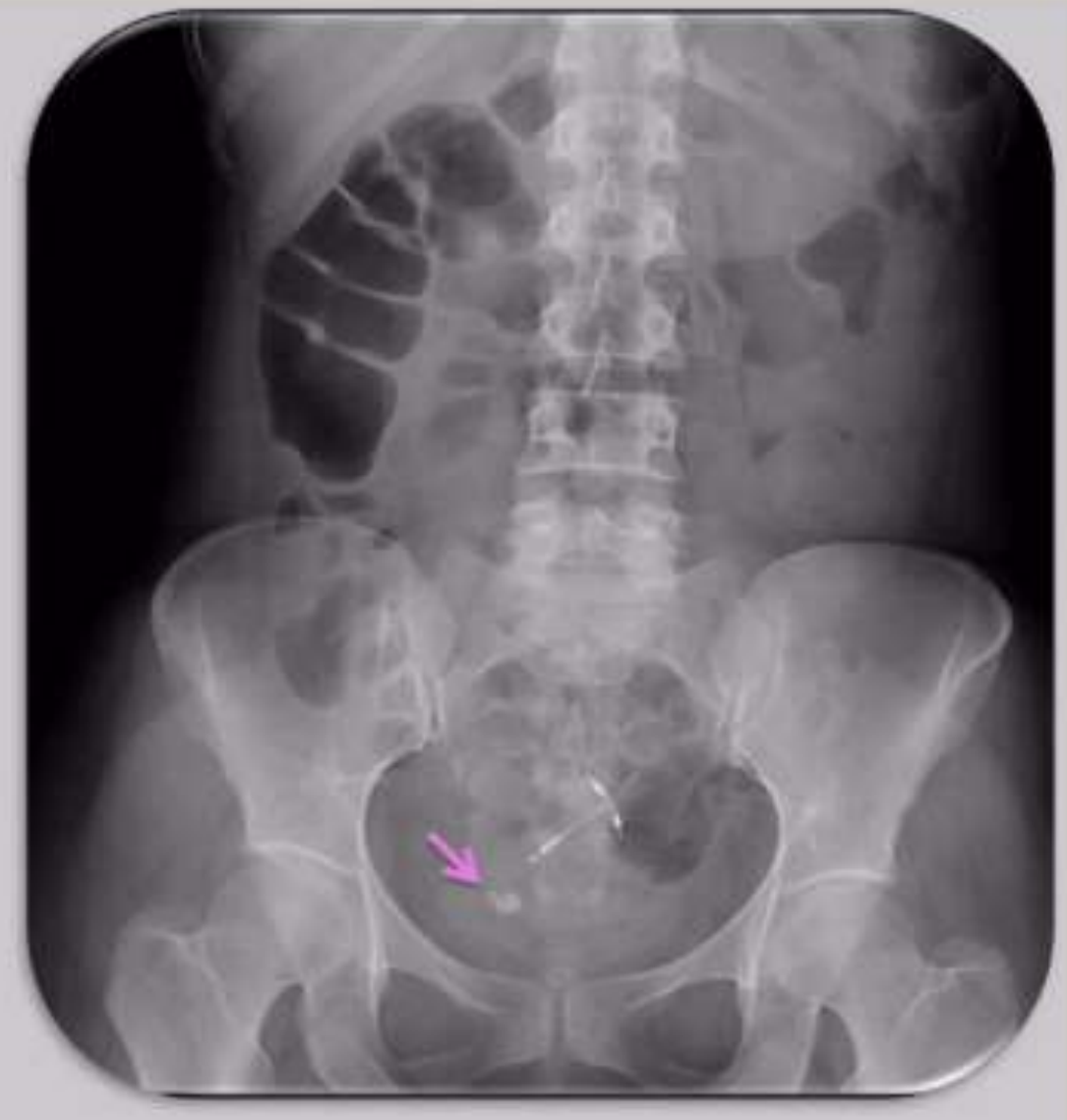
A stone in the Kidney (A) and in the ureter course (B).



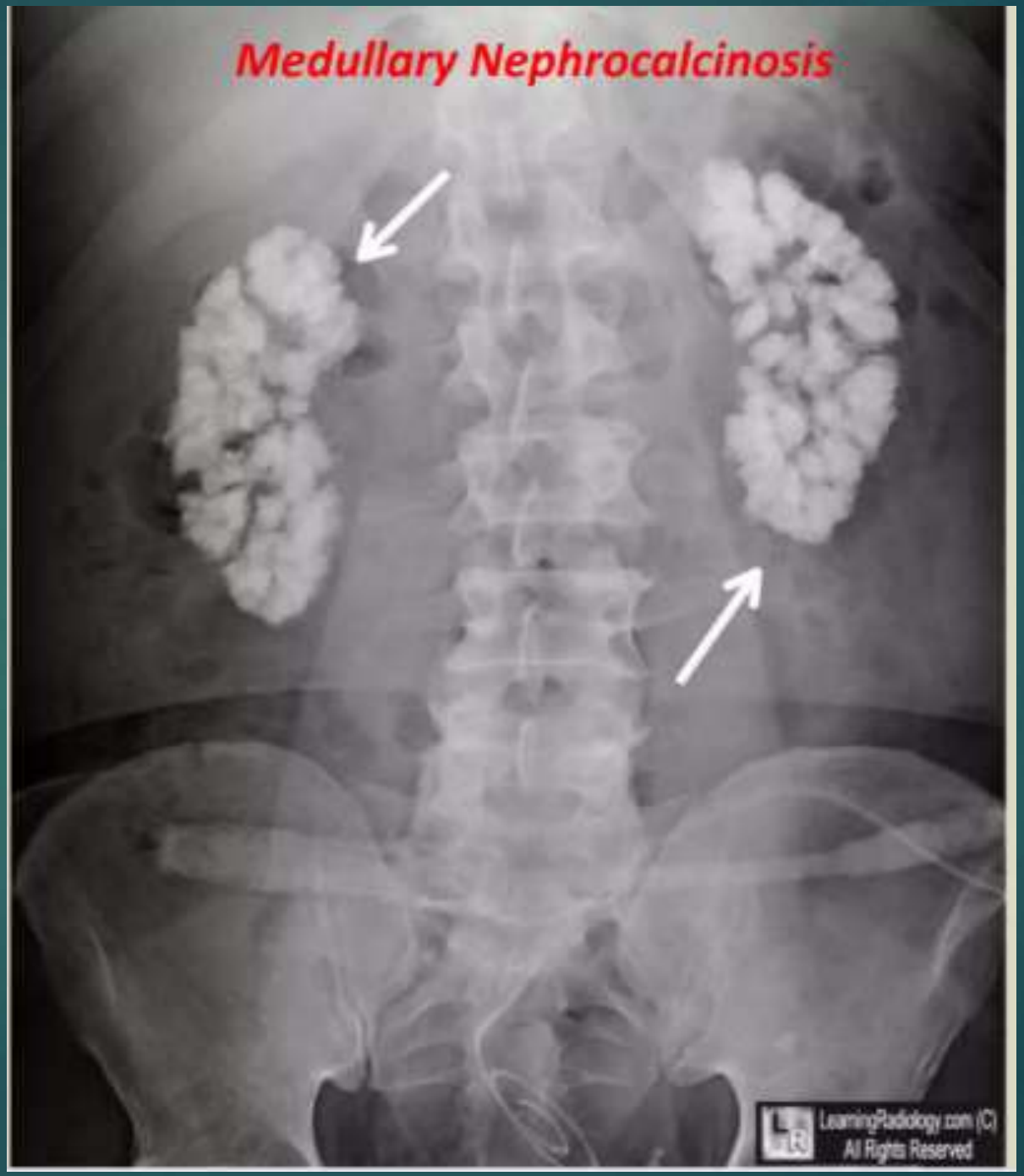
Appendicolith in a patient with appendicitis.



Calcified leiomyoma of the uterus.



Tooth in the true pelvis is diagnostic of mature cystic teratoma in a patient with a intrauterine device.


Medullary Nephrocalcinosis
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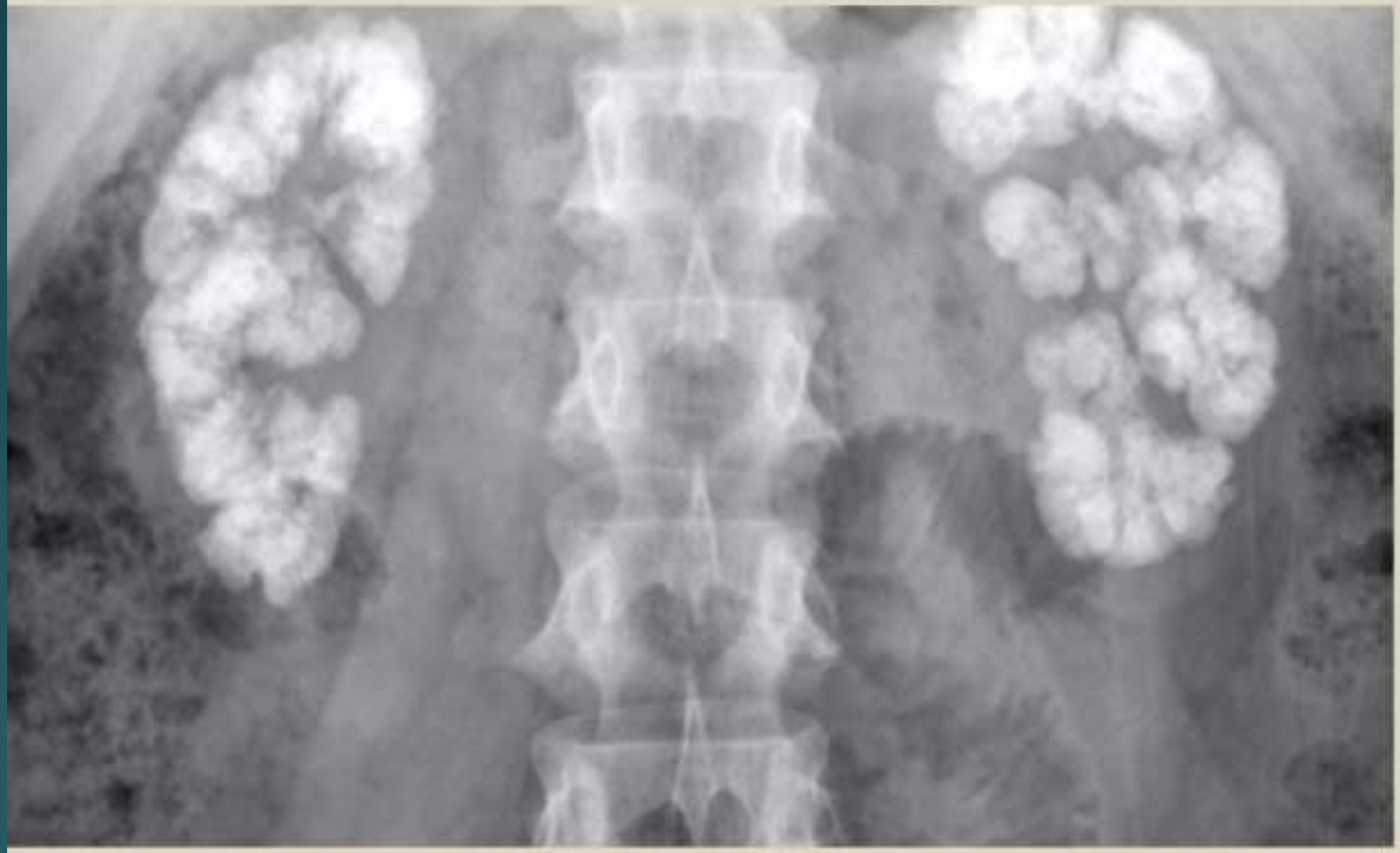
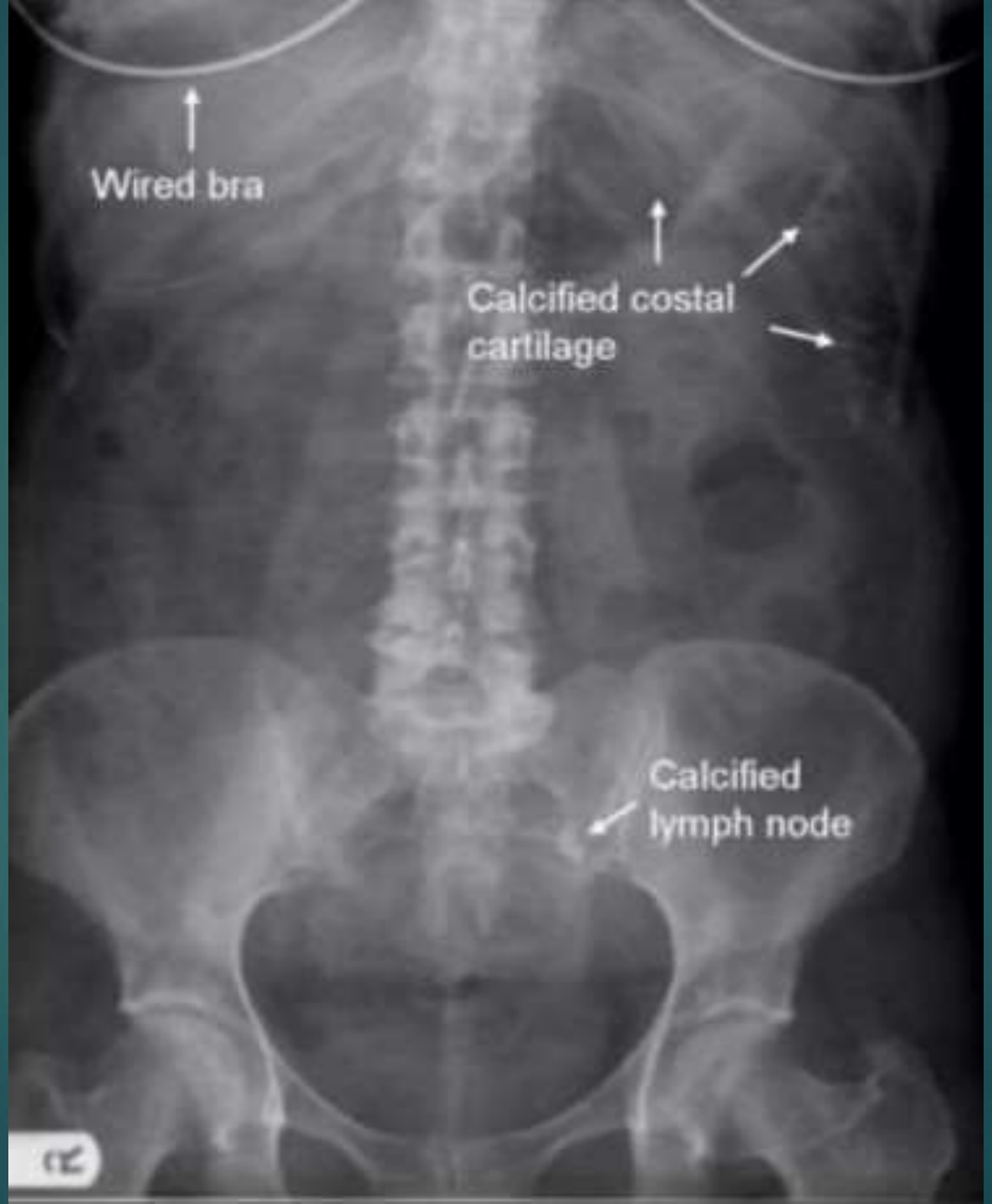
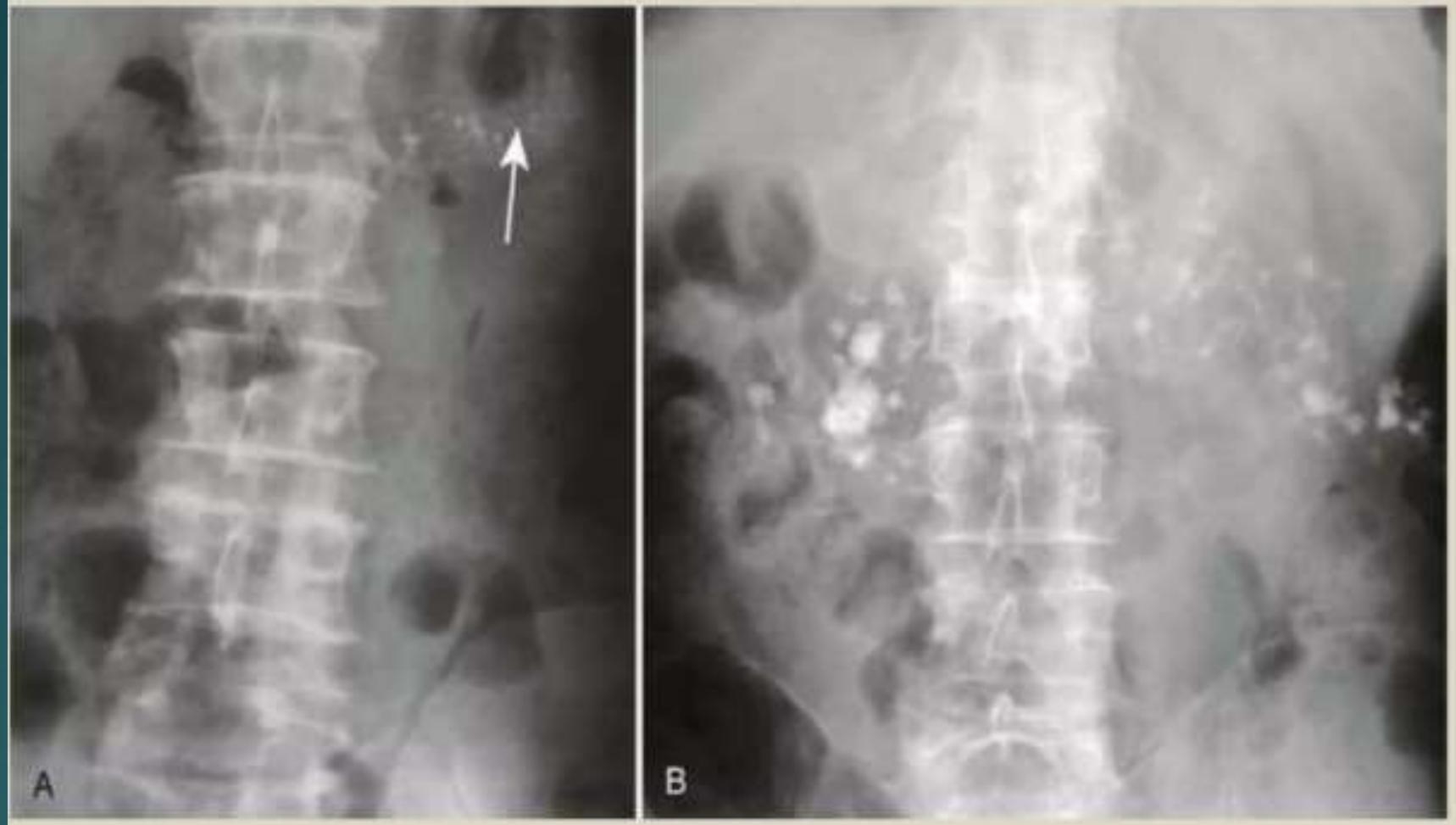
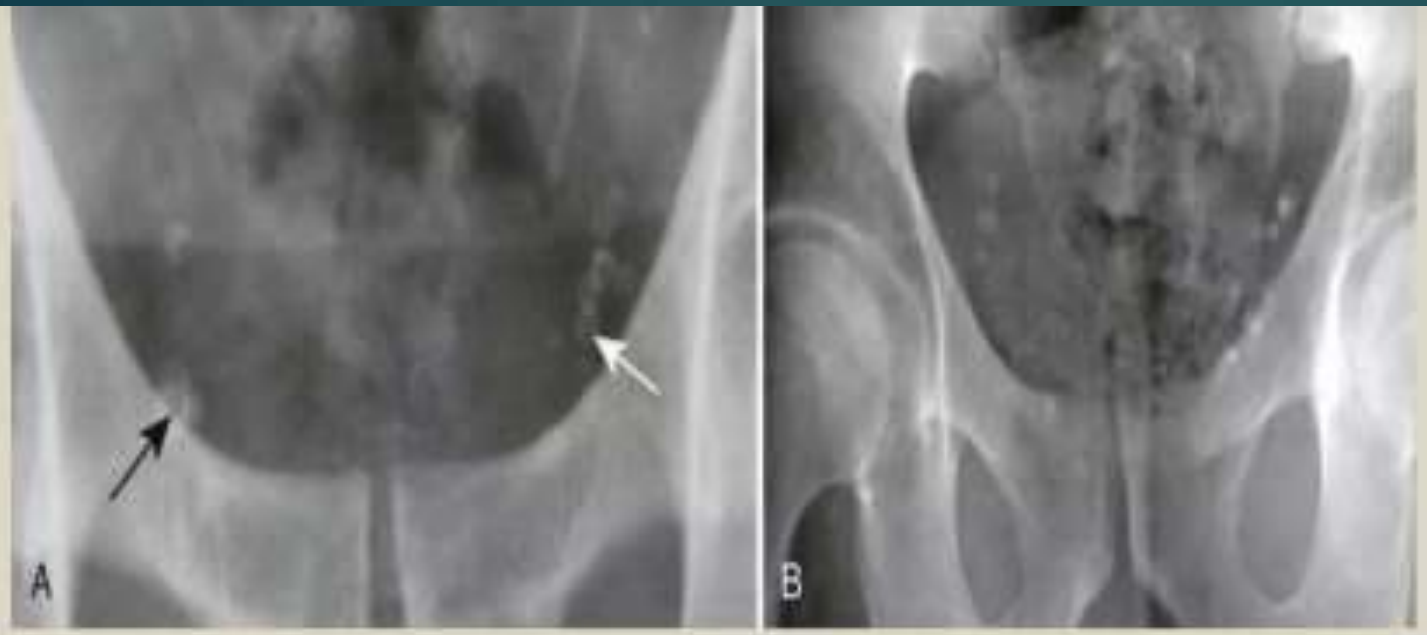


Medullary Nephrocalcinosis.


Wired bra
Calcified costal cartilage
Calcified lymph node

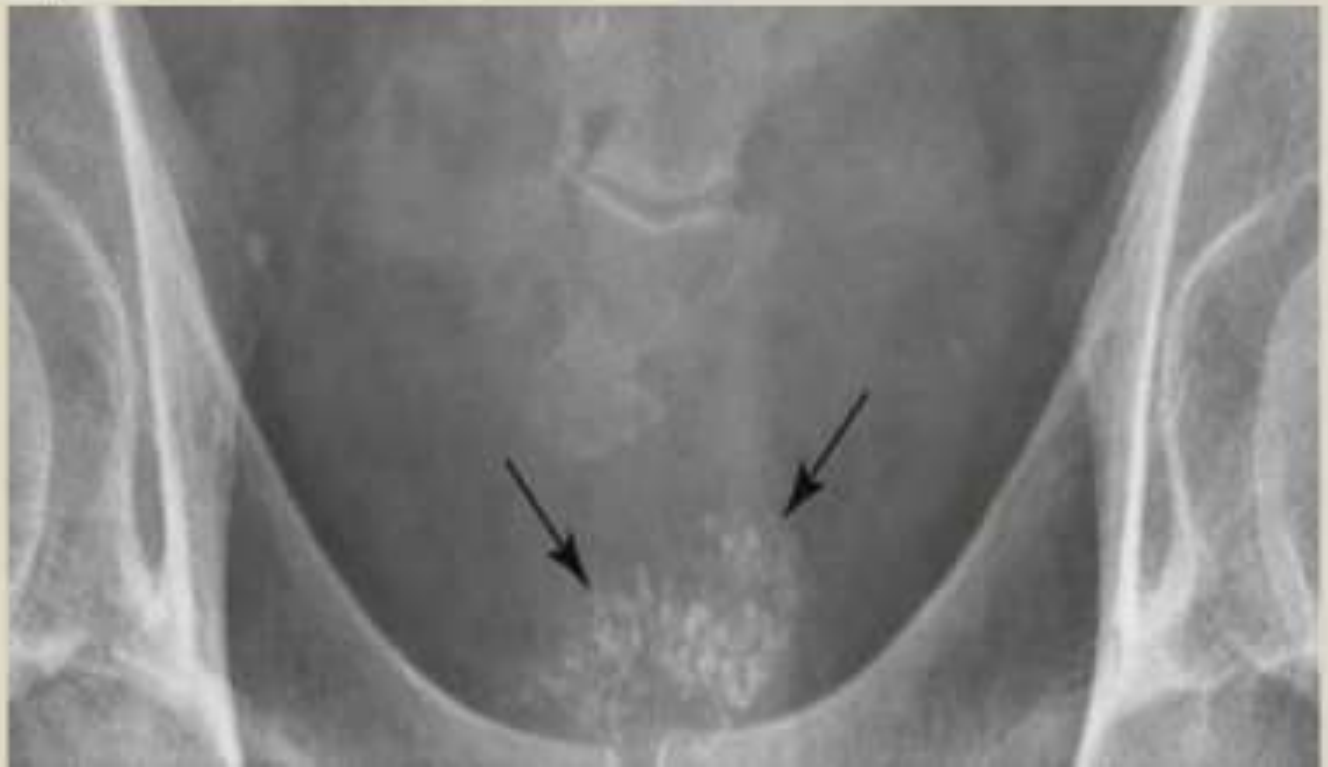


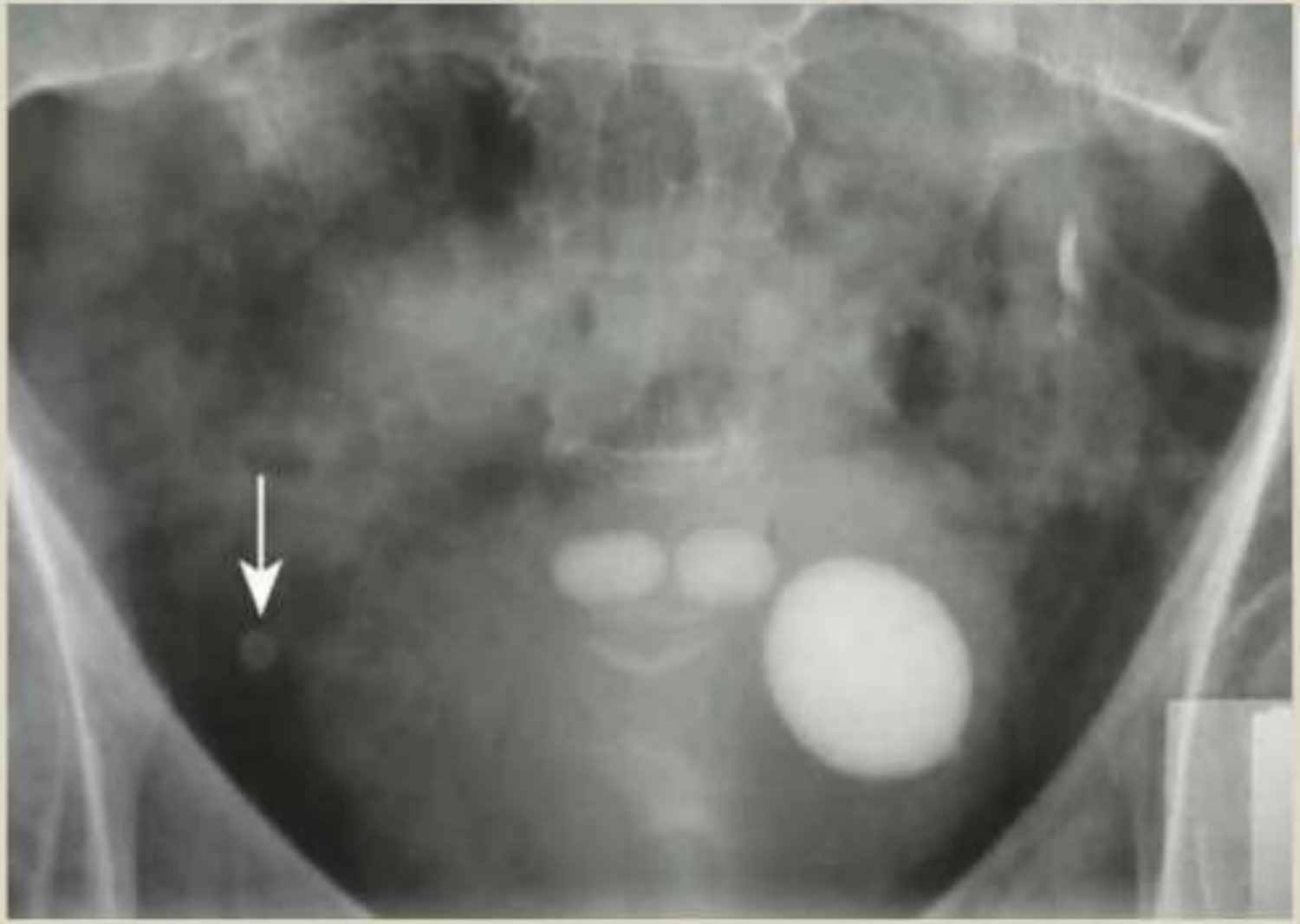
A and B, Two patients with pancreatic calculi and chronic pancreatitis in a patient with alcoholism. This is the typical appearance of numerous dense, discrete opacities that cross the midline at the level of L1 to L2 (arrow). The normal pancreas is not visible on abdominal plain films.



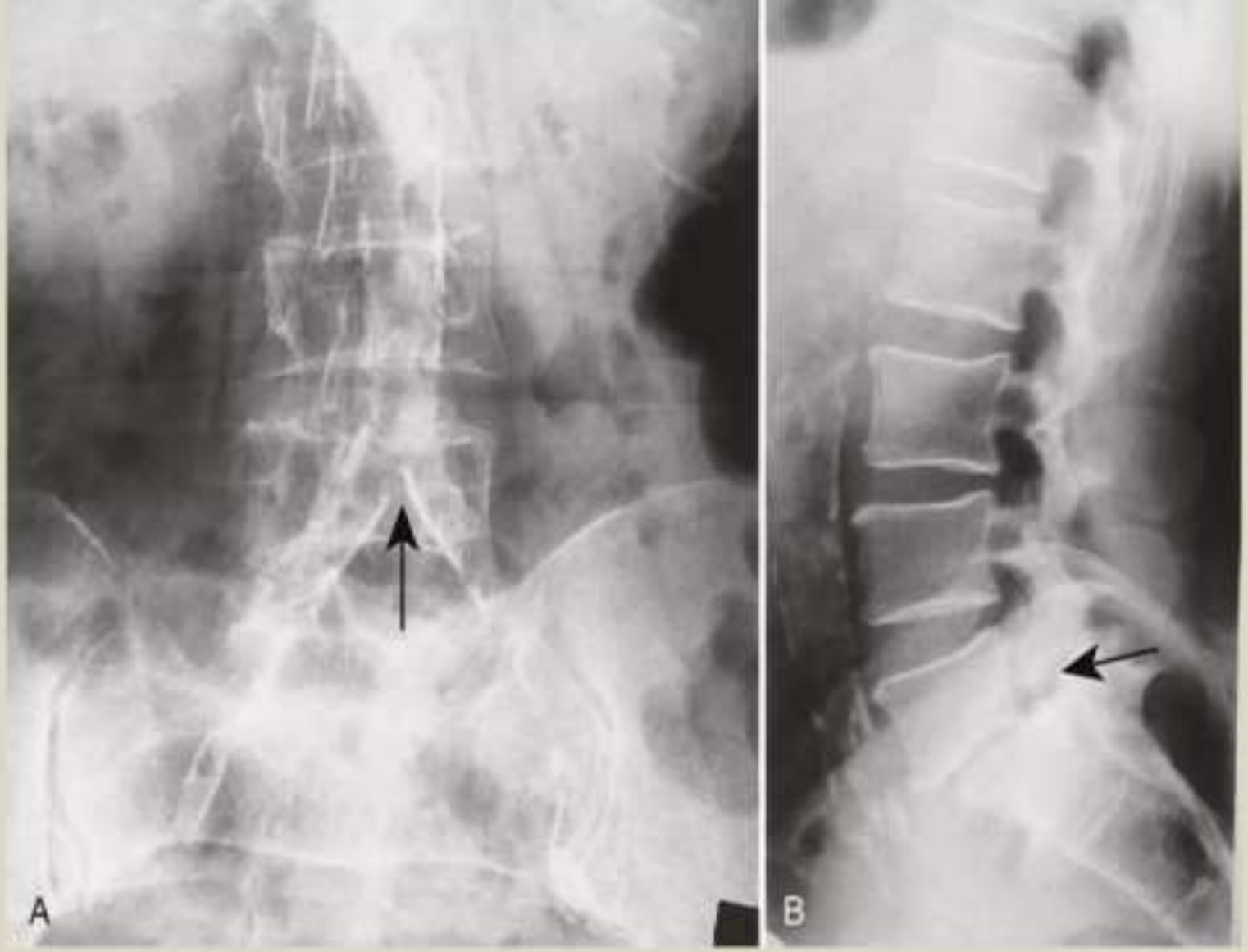
frequently are multiple and bilateral, and they are asymptomatic. They are inconsequential concretions of thrombi attached to the walls of veins. Observe the concentric interior lucency of the phleboliths (arrows). These should not be confused with ureteral stones or calcifications of a pelvic mass

The numerous tiny calculi projecting above the pubic symphysis seen in this patient (arrows) are typical of the intraductal calculi often occurring in patients who have chronic inflammation of the prostate.





Bladder calculi. Three homogeneously dense bladder stones with a continuous rim of calcification typical of concretions. Incidentally noted is a phlebolith with the diagnostic concentric lucency that should not be mistaken for a ureteral stone (arrow).



Abdominal aorta and iliac arteries calcification. A, Anteroposterior projection. Tubular appearance characteristic of conduit wall calcification. The aortic bifurcation is seen clearly (arrow). B, Lateral view. Notice that the anterior and posterior walls are parallel and the abdominal aorta diameter does not exceed 3.5 cm. Aneurysm should be suspected if the diameter of the abdominal aorta exceeds 3.5 cm. A spondylolytic spondylolisthesis of L5 also is visible (arrow).

Density(D).

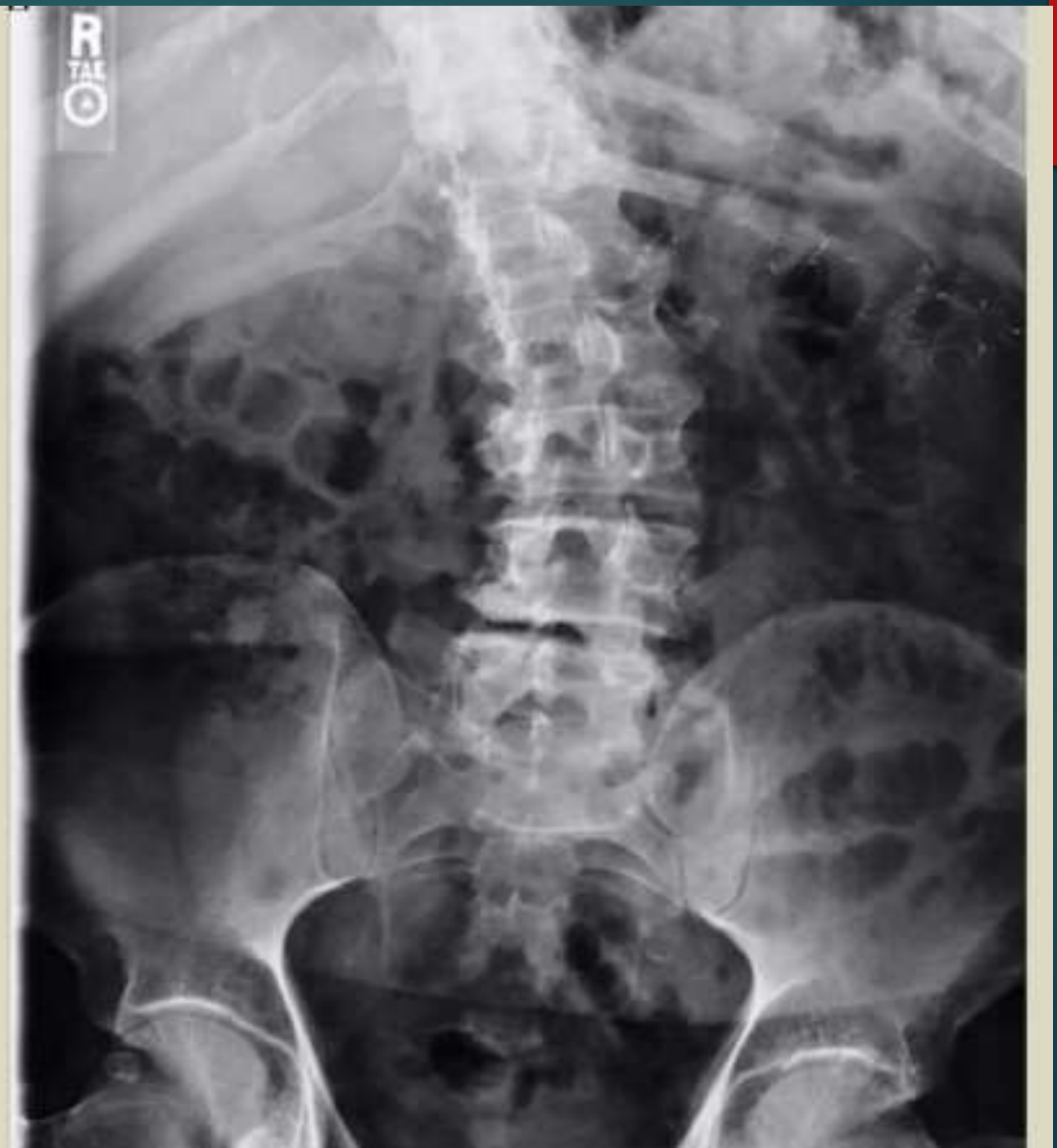
Bones

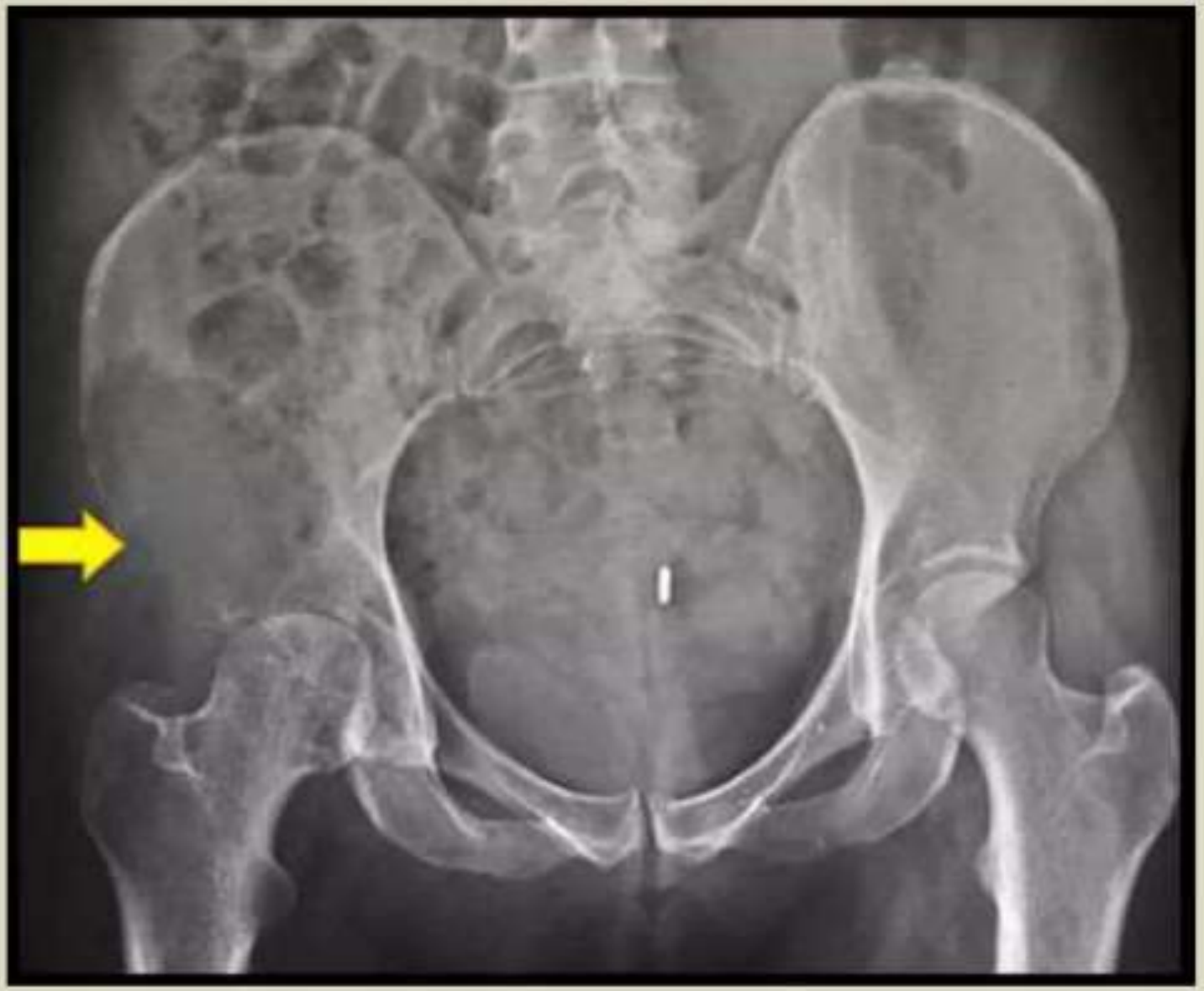
Lots of bones are visible on an AXR and it's important that you can identify each and screen for any pathology (which may be expected or unexpected). In addition, bones on the AXR provide useful landmarks for where you might expect to see a soft tissue structure (e.g. ischial spines are the usual level of the vesicoureteric junction).

Bones commonly visible on AXR include:

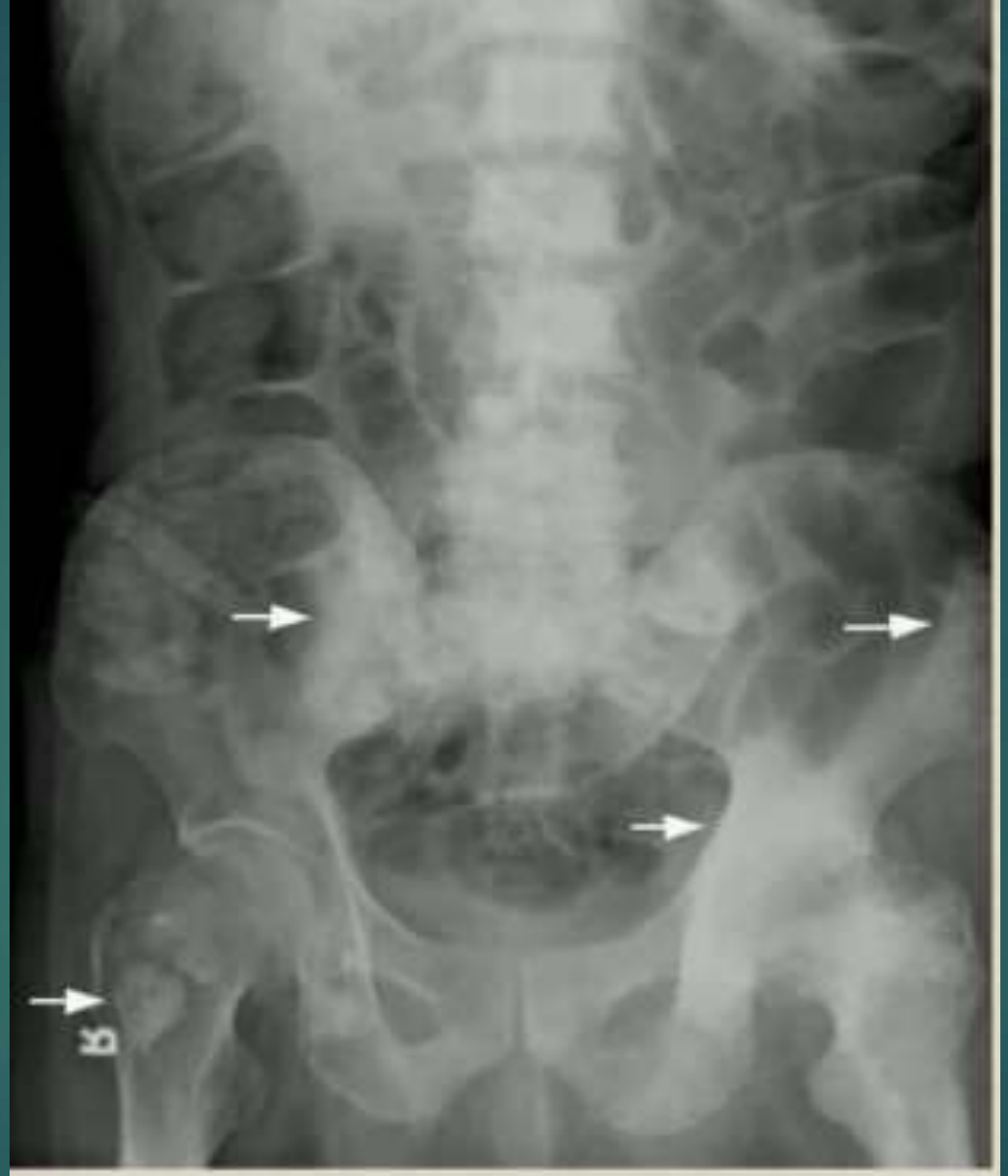
Ribs(Look for increased or decreased density).
Lumbar vertebrae(look for alignment, vertebral height and pedicle
Sacrum and Coccyx(Look for lytic or sclerotic lesion).
Pelvis(look for fracture, lytic or sclerotic lesion).
Proximal femurs(Looks for sclerotic, lytic lesion or fractures).

Scoliosis of the lumbar spine.





Metastatic Bone Disease.



Sclerotic bony metastases (arrows) in a male patient with prostate cancer.

Other organs and structures

Although AXR isn't well suited to imaging these structures, it's useful to recognize them to help orientate yourself and spot relevant pathology.

Lungs – check the lung bases if visible for pathology (e.g. consolidation) as abdominal pain can sometimes be caused by basal pneumonia

Liver – large right upper quadrant (RUQ) structure

Gallbladder – rarely seen, look for calcified gallstones and cholecystectomy clips

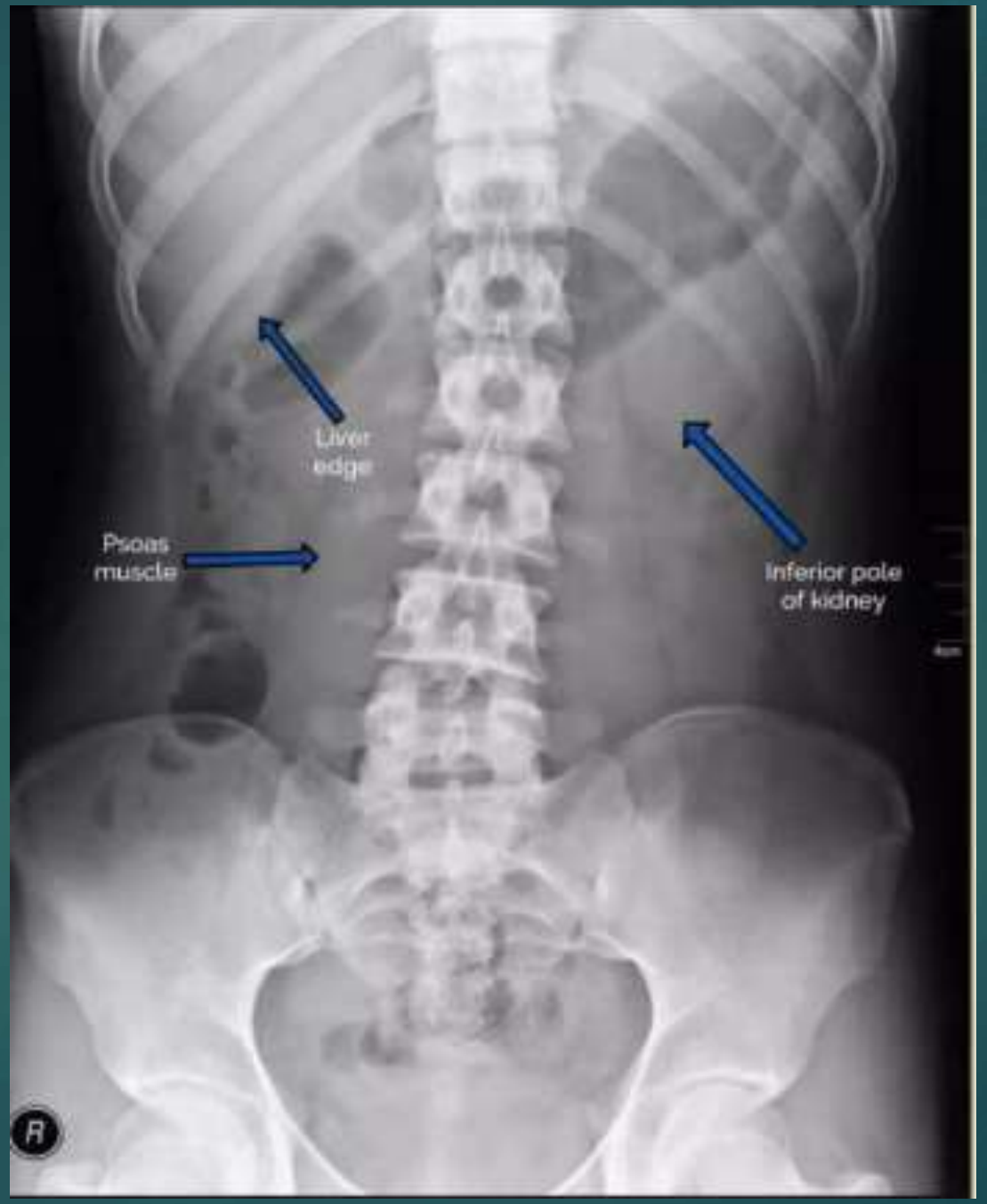
Stomach – left upper quadrant (LUQ) to midline structure, containing a variable amount of air

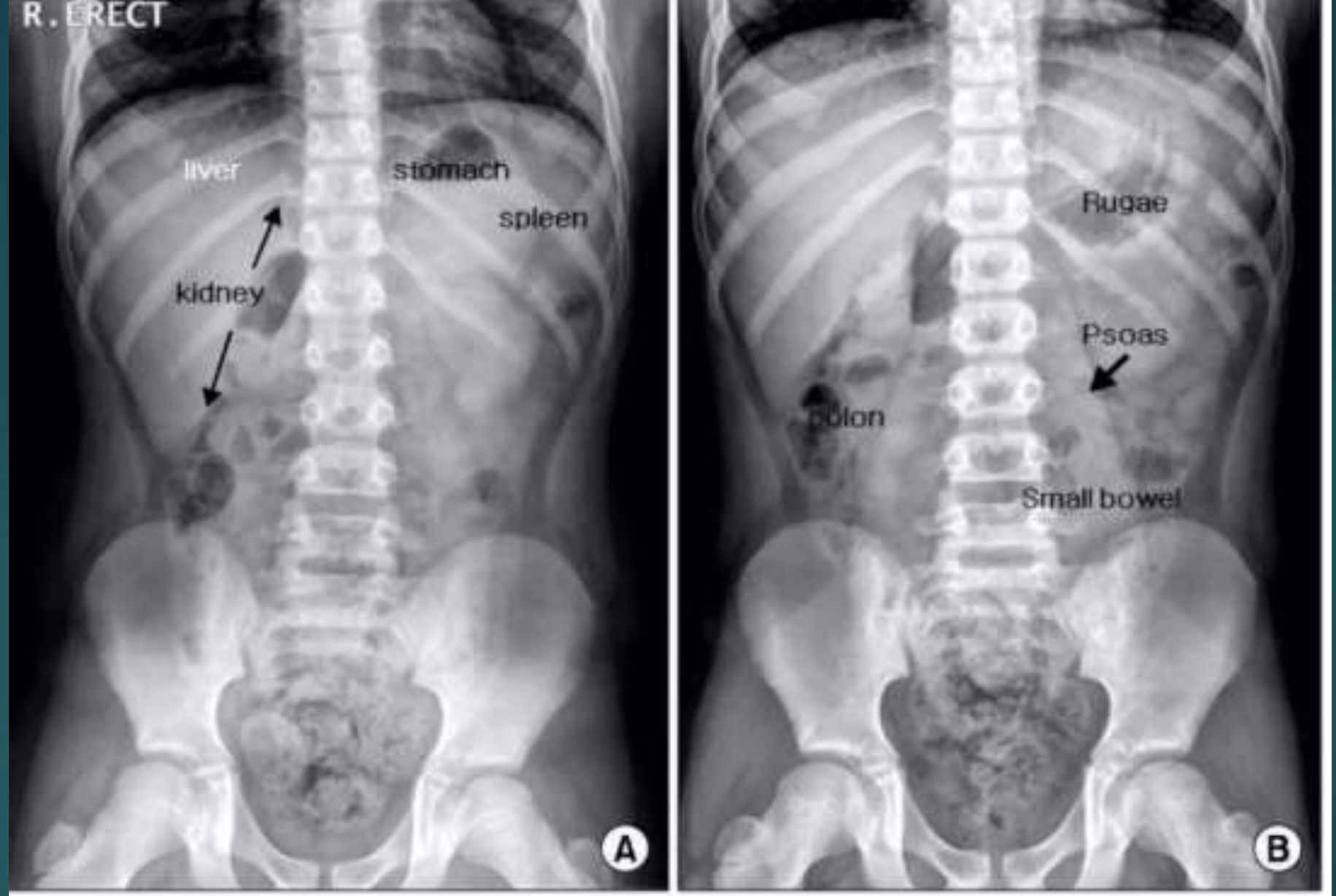
Psoas muscles – lateral edge marked by a relatively straight line either side of the lumbar vertebrae and sacrum

Kidneys – often visible, right lower than left due to the liver

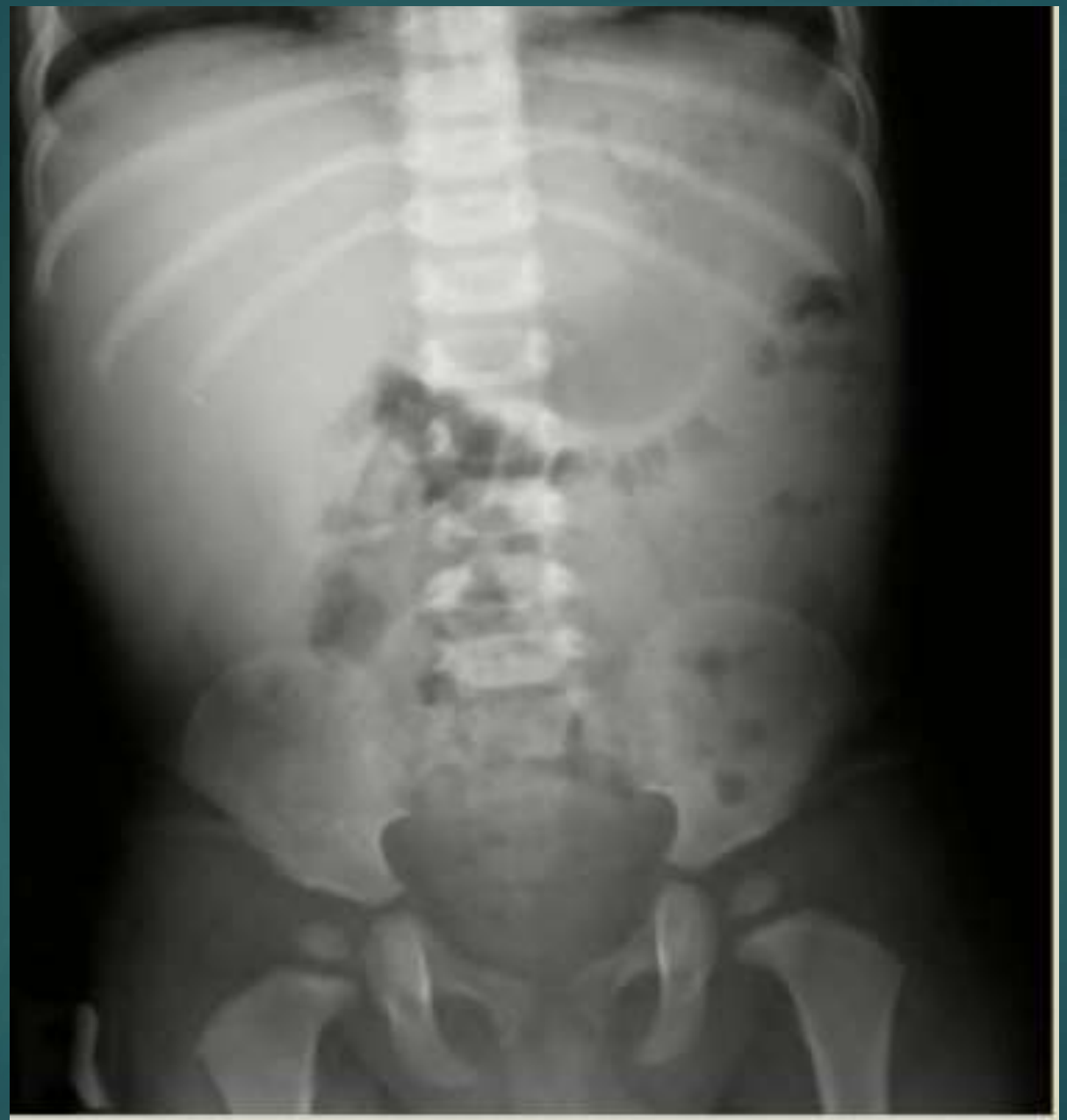
Spleen – LUQ, superior to left kidney

Bladder – variable appearance depending on fullness


Liver edge
Psoas muscle
Inferior pole of kidney
R

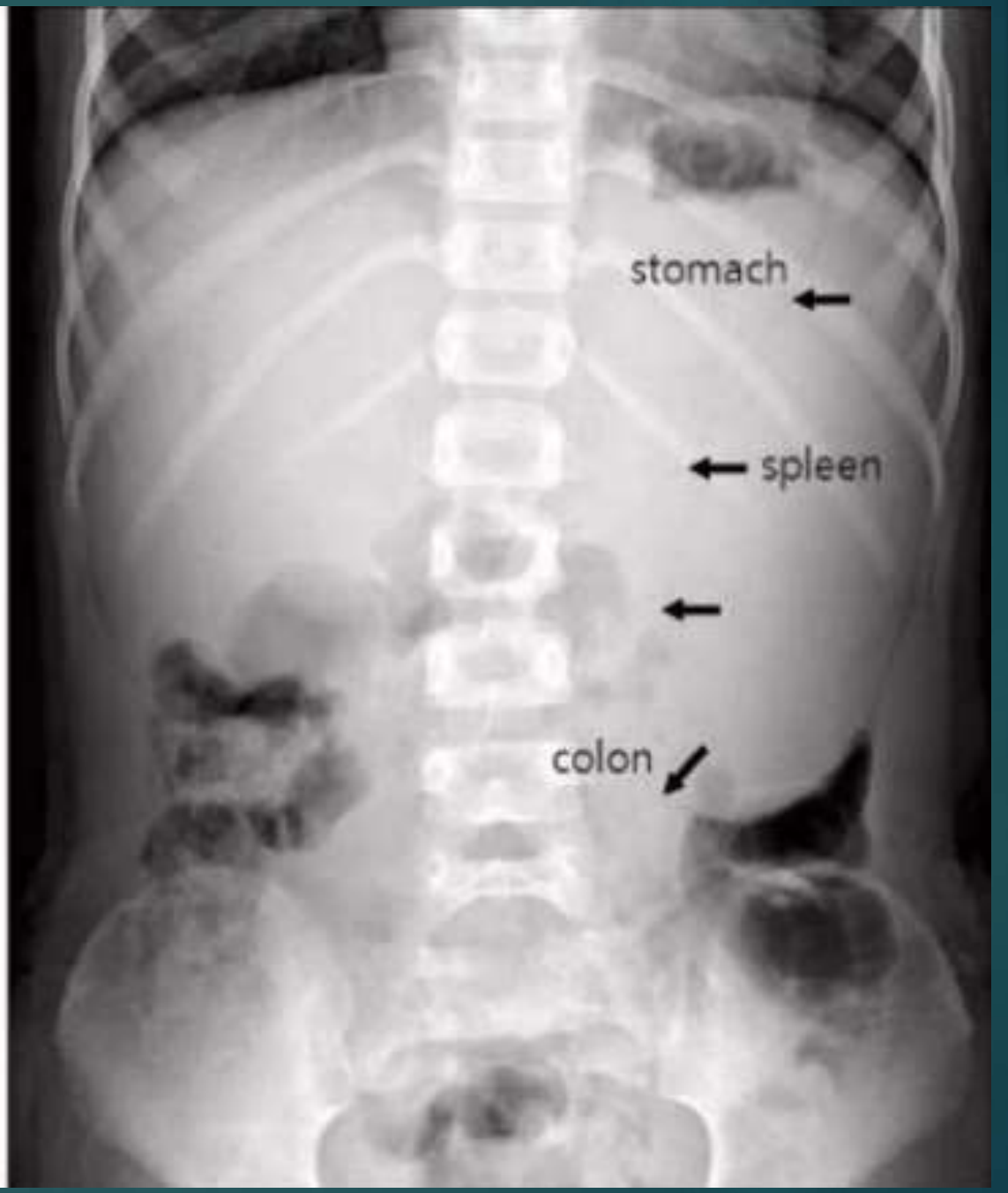


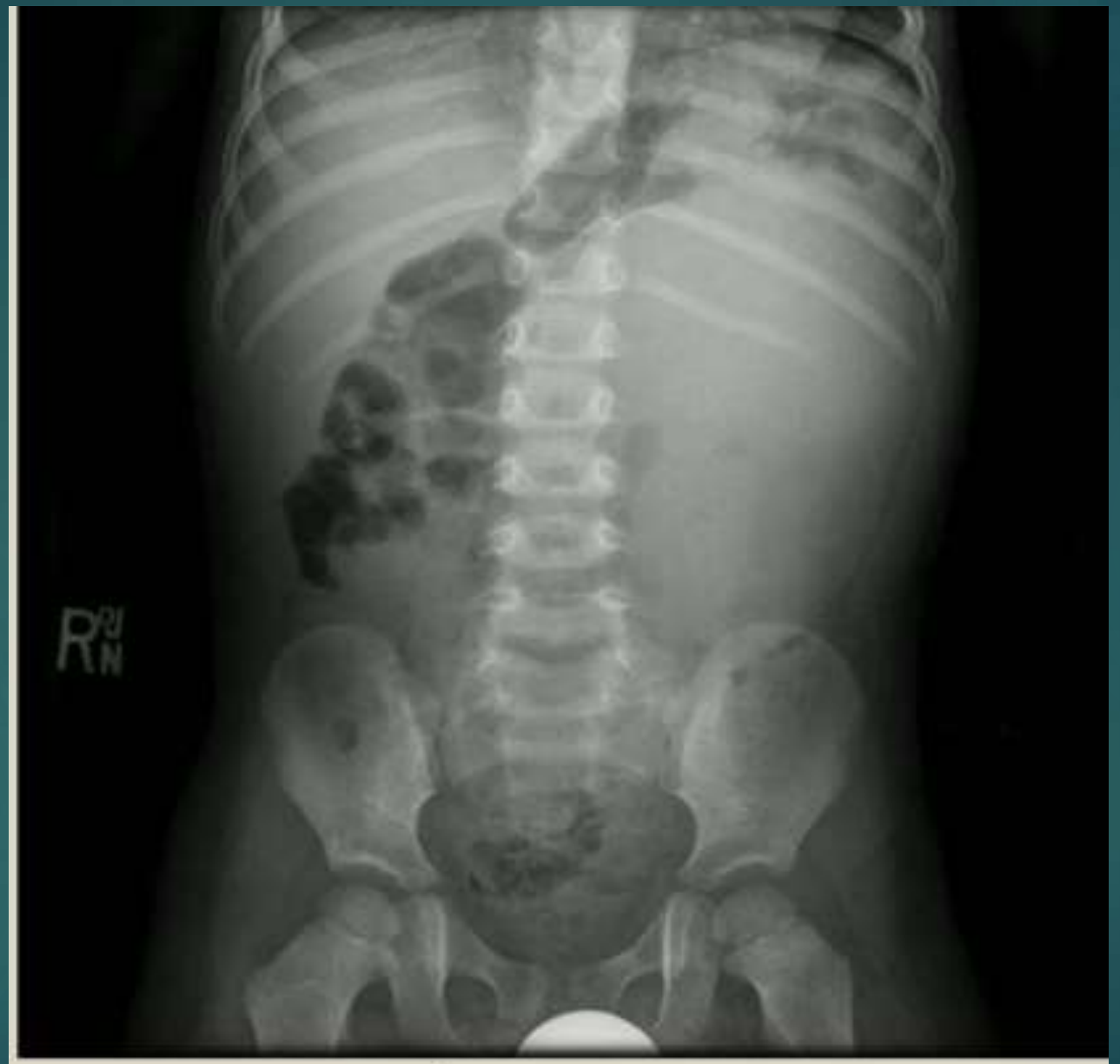
Erect (A) and supine (B) views of the abdominal radiography in a normal child (thin arrows: kidney, thick arrow: psoas shadow).



Plain X-ray finding of hepatomegaly.

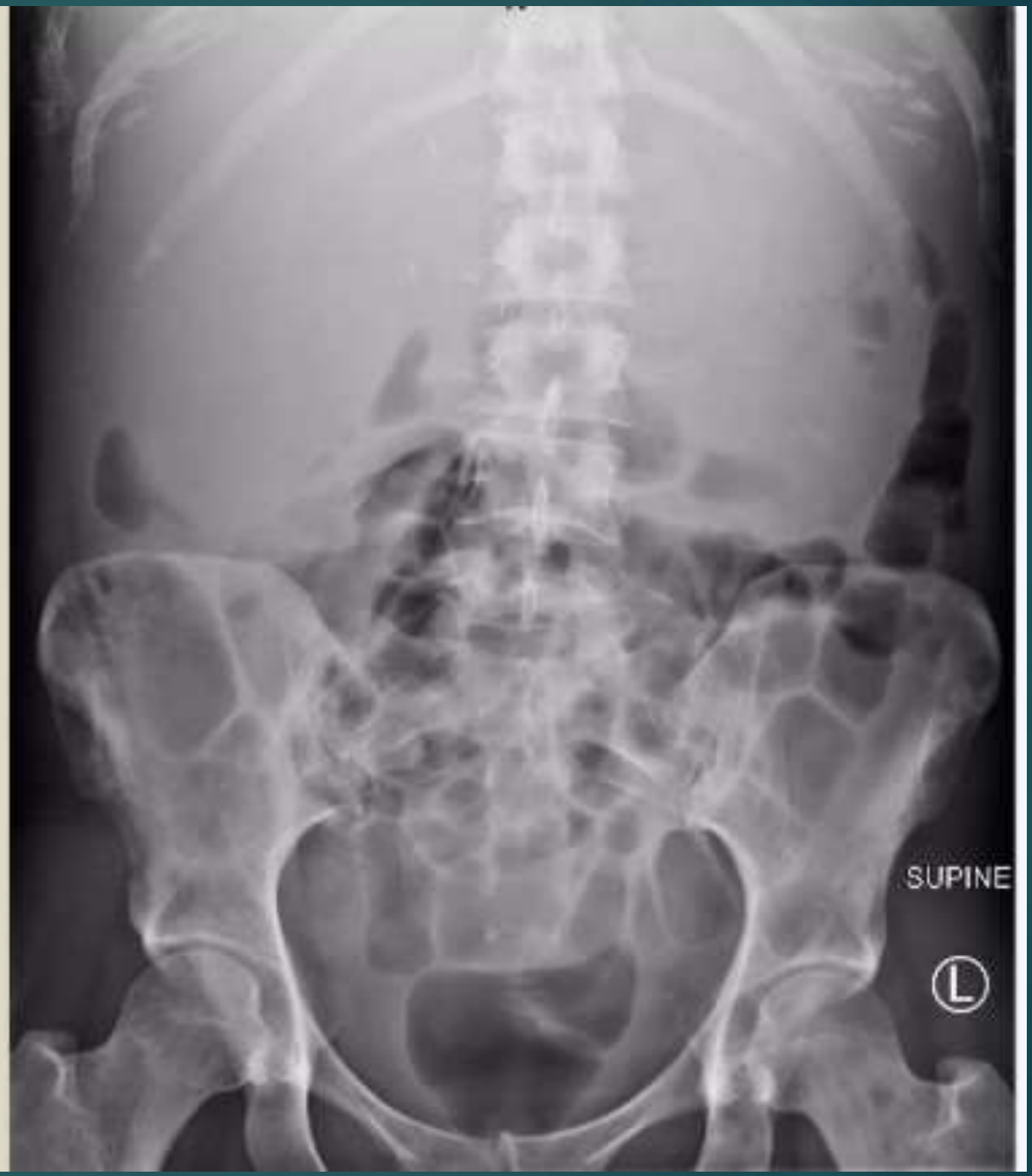
Splenomegaly. The enlarging spleen (arrows) in the left upper quadrant displaces the splenic flexure of the colon caudally and medially, and the stomach medially.





Wilms tumour.

Bowel loops are displaced inferiorly by an enlarged liver. No evidence of obstruction or pneumoperitoneum. No fecal loading. Multiple lytic lesions demonstrated through bony pelvis and proximal femurs. Upper abdominal surgical clips.



E

Everything(E)

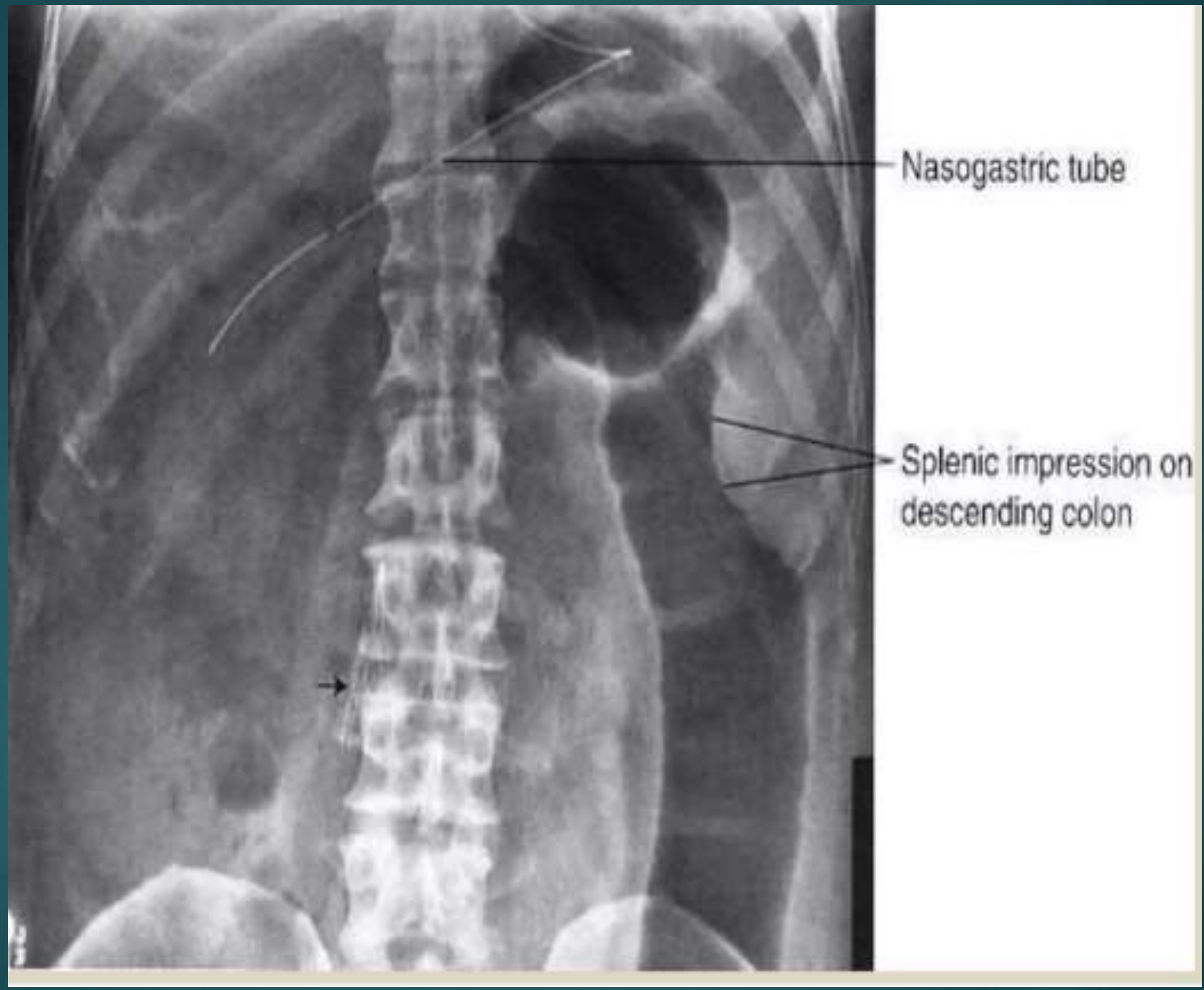
Looks for any abdominal IVC filter, catheter, stent or naso-gastric tube.

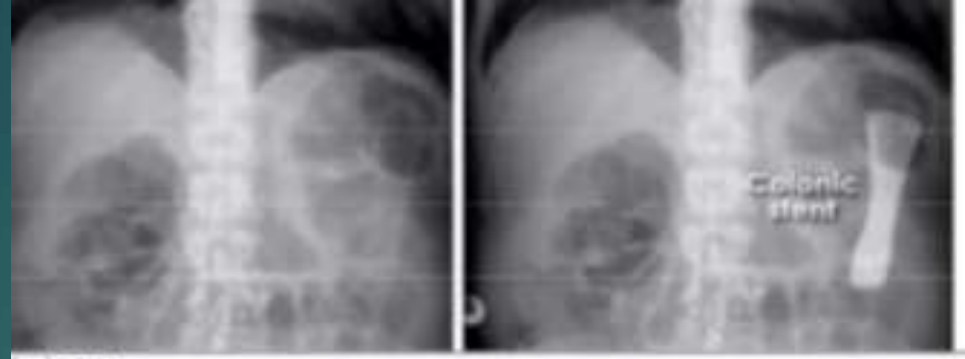
Looks for metallic F.B.

Looks for IUD(intra-abdominal or intra-pelvic).

Looks for any surgical stitches for previous surgery.

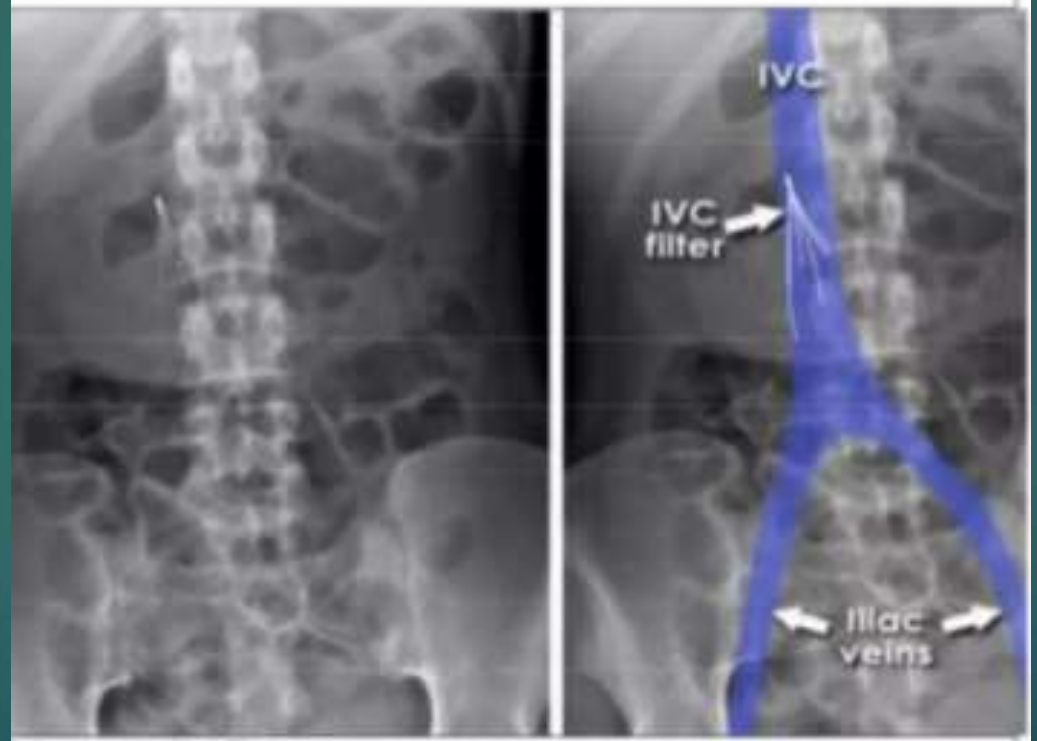
Looks for lung base pathology.


Nasogastric tube
Splenic impression on descending colon



lonic stent

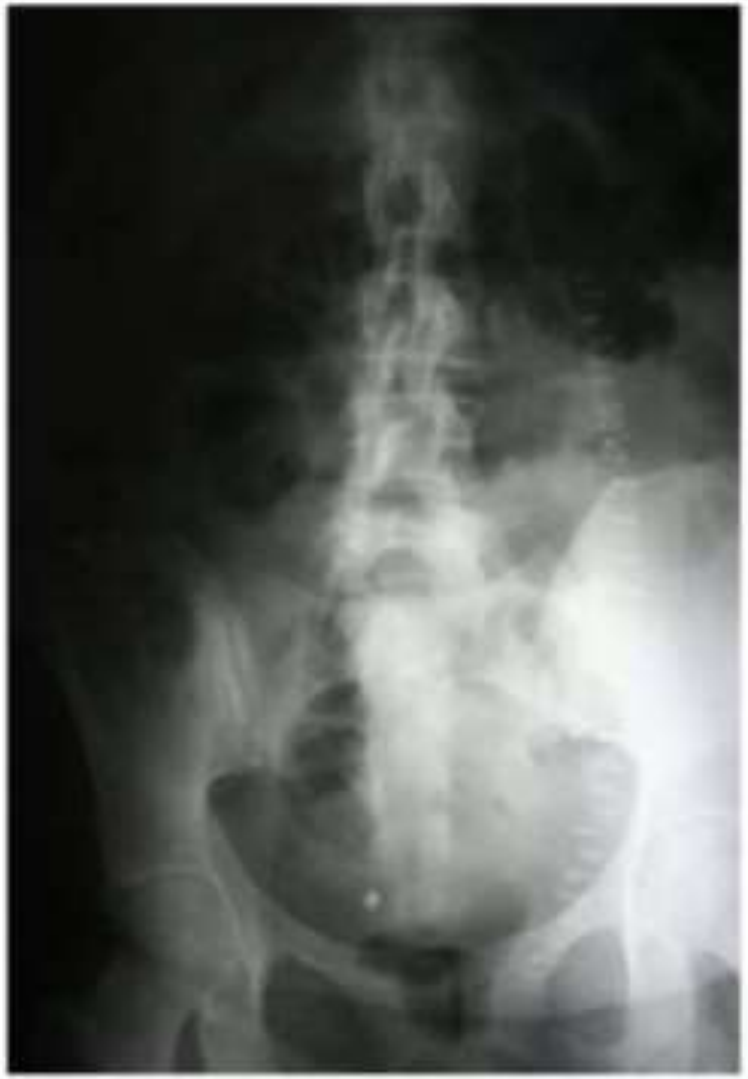
- Large bowel obstruction can be treated with placement of a metallic colonic stent
- This is often used as a temporary measure allowing a patient to recover from the effects of obstruction prior to definitive colonic resection



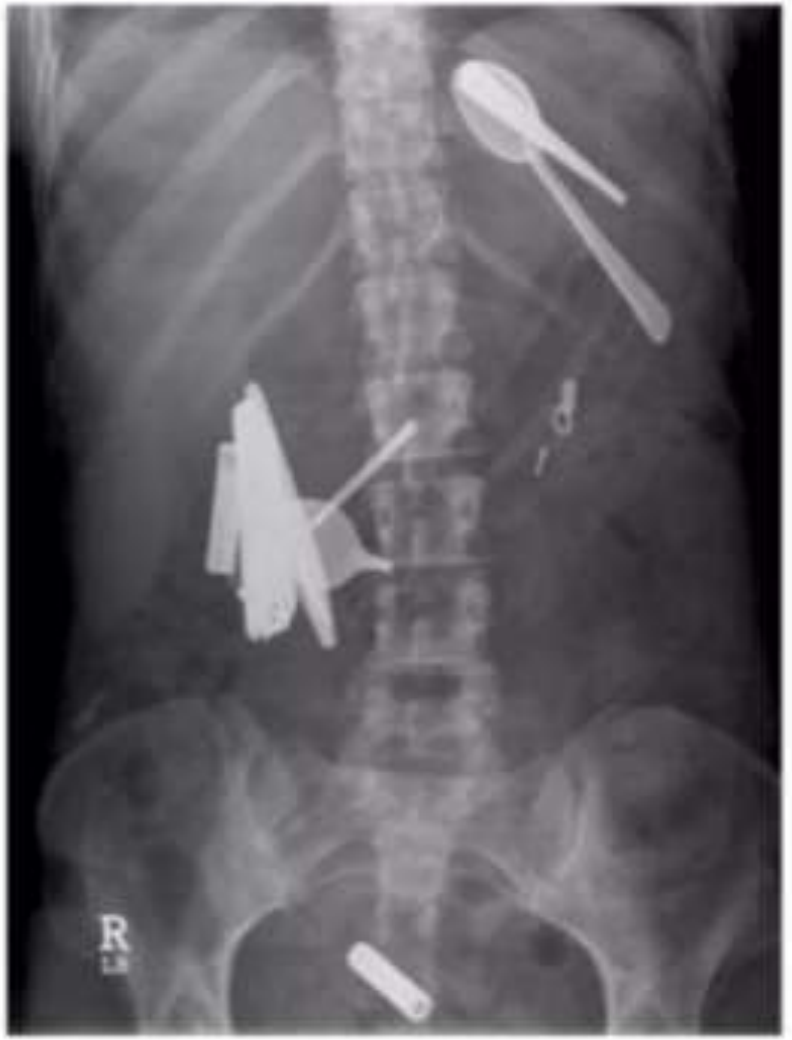
erior vena cava (IVC) filter

IVC filter may be used to reduce the risk of large pulmonary emboli
commonly used in patients who have had pulmonary embolism but for whom anticoagulation is contraindicated
filters are self-expanding wire structures shaped like an umbrella
all clots may pass between the wires of the filter but large clots are prevented from reaching the pulmonary arteries

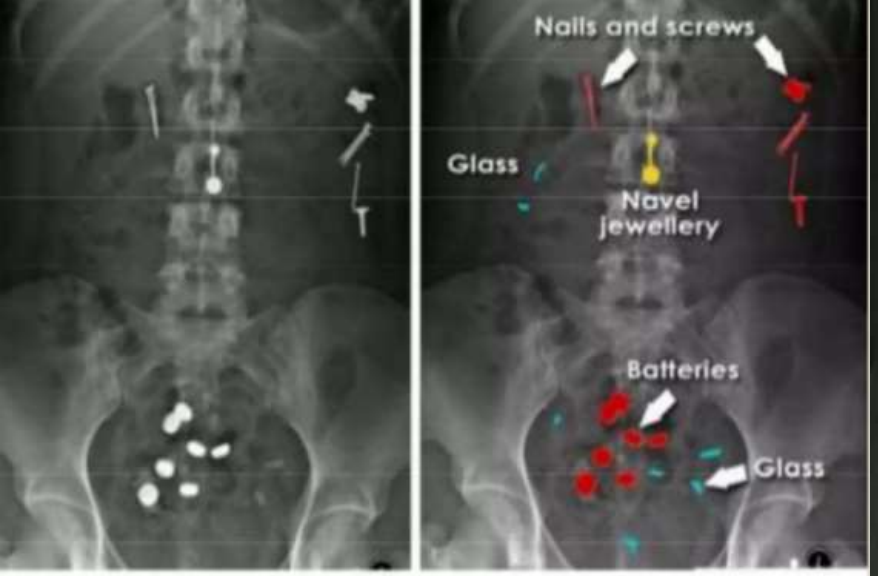
Assess the Film in Detail:



Sterilisation and Surgical Clips

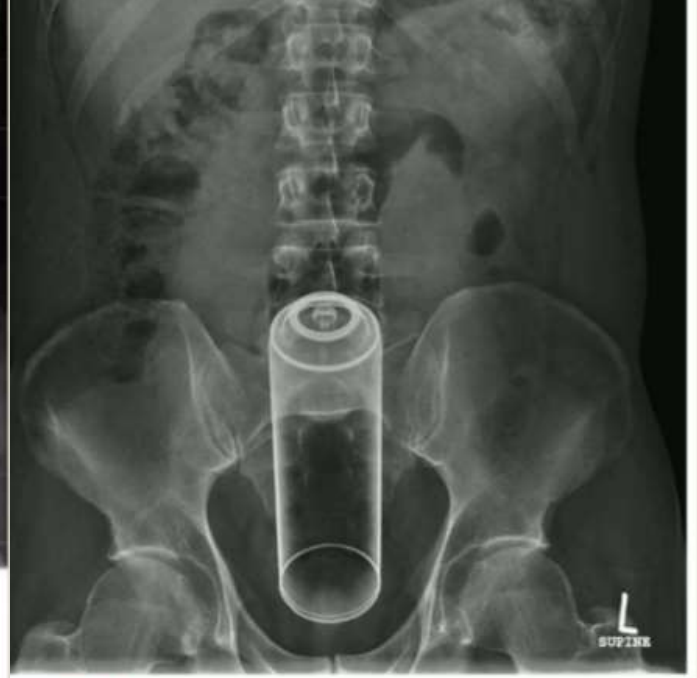


Intra-abdominal foreign bodies

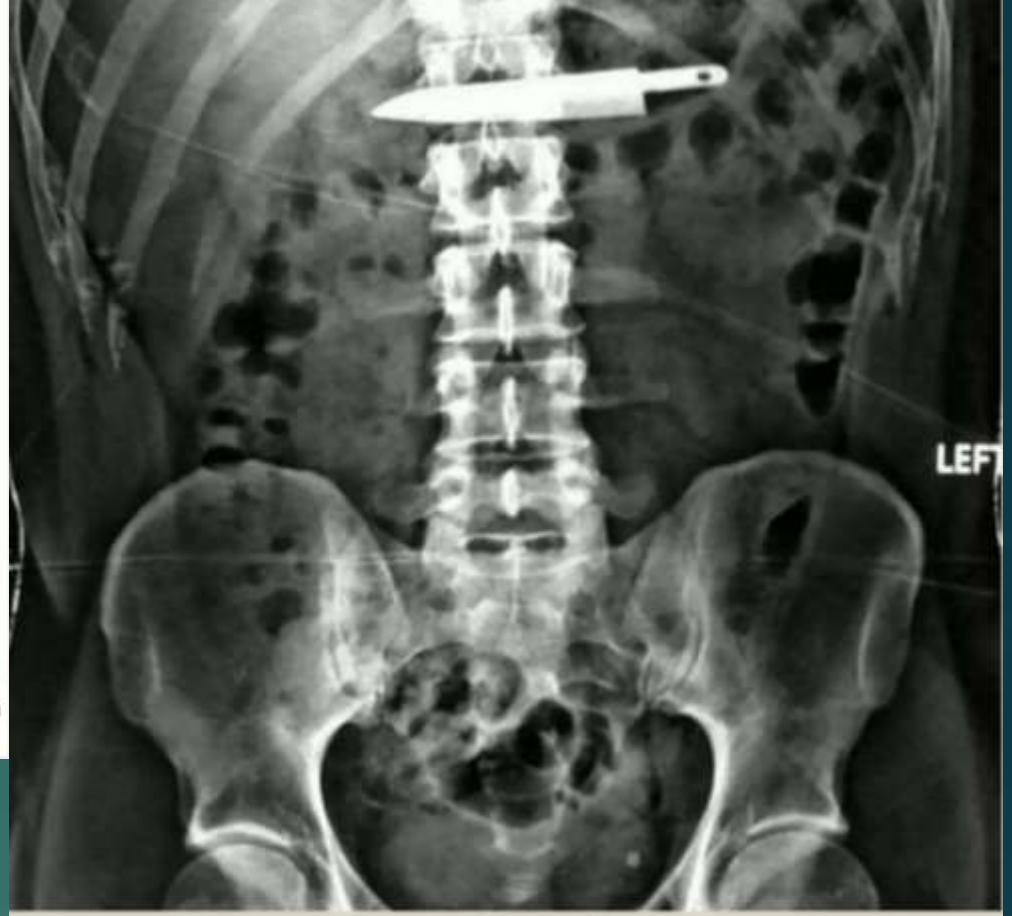


Foreign body - ingested

- This psychiatric patient has ingested numerous radio-opaque objects
- The navel jewellery is external!



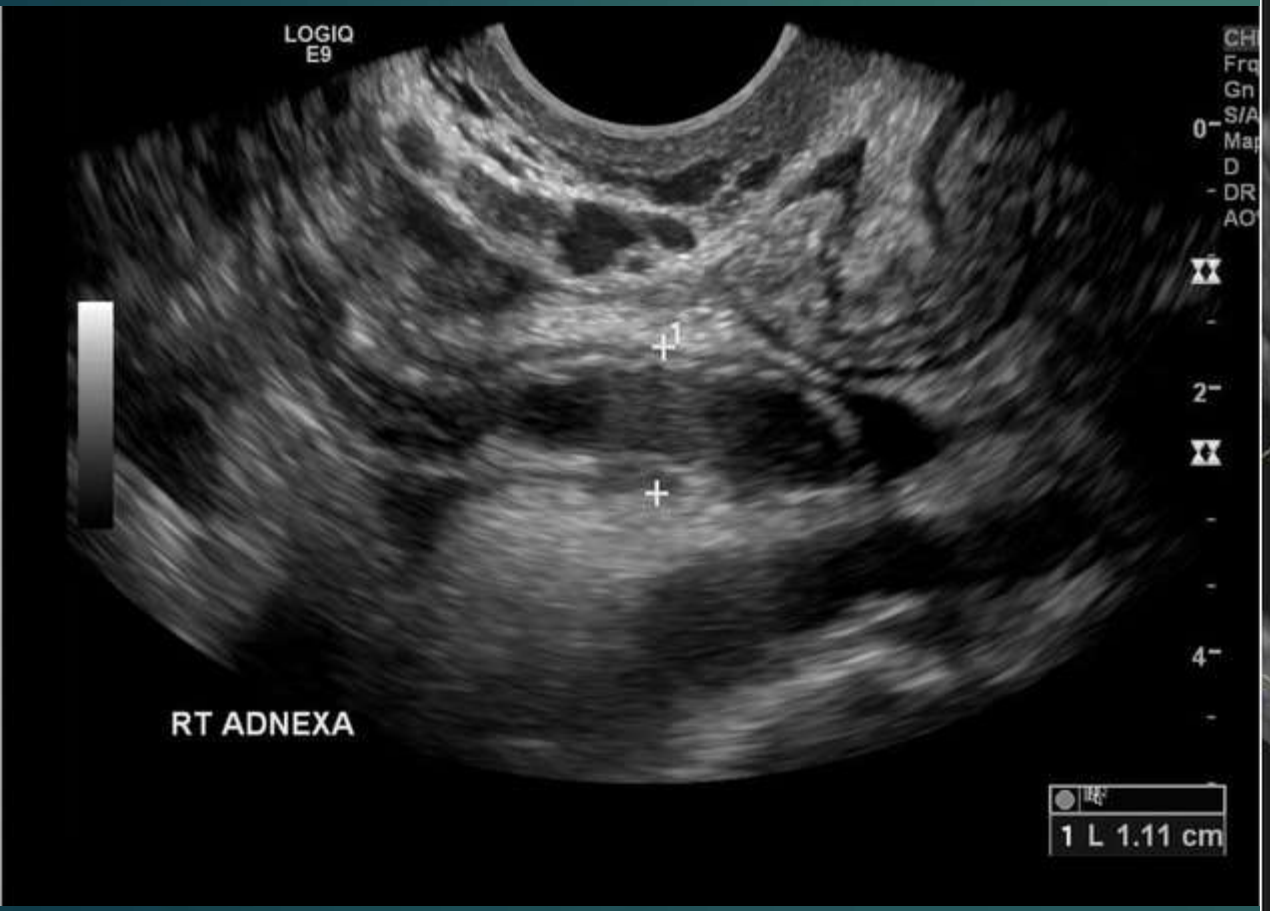
ure 60-16. Radiograph of a patient who inserted an aerosol can
the rectum.

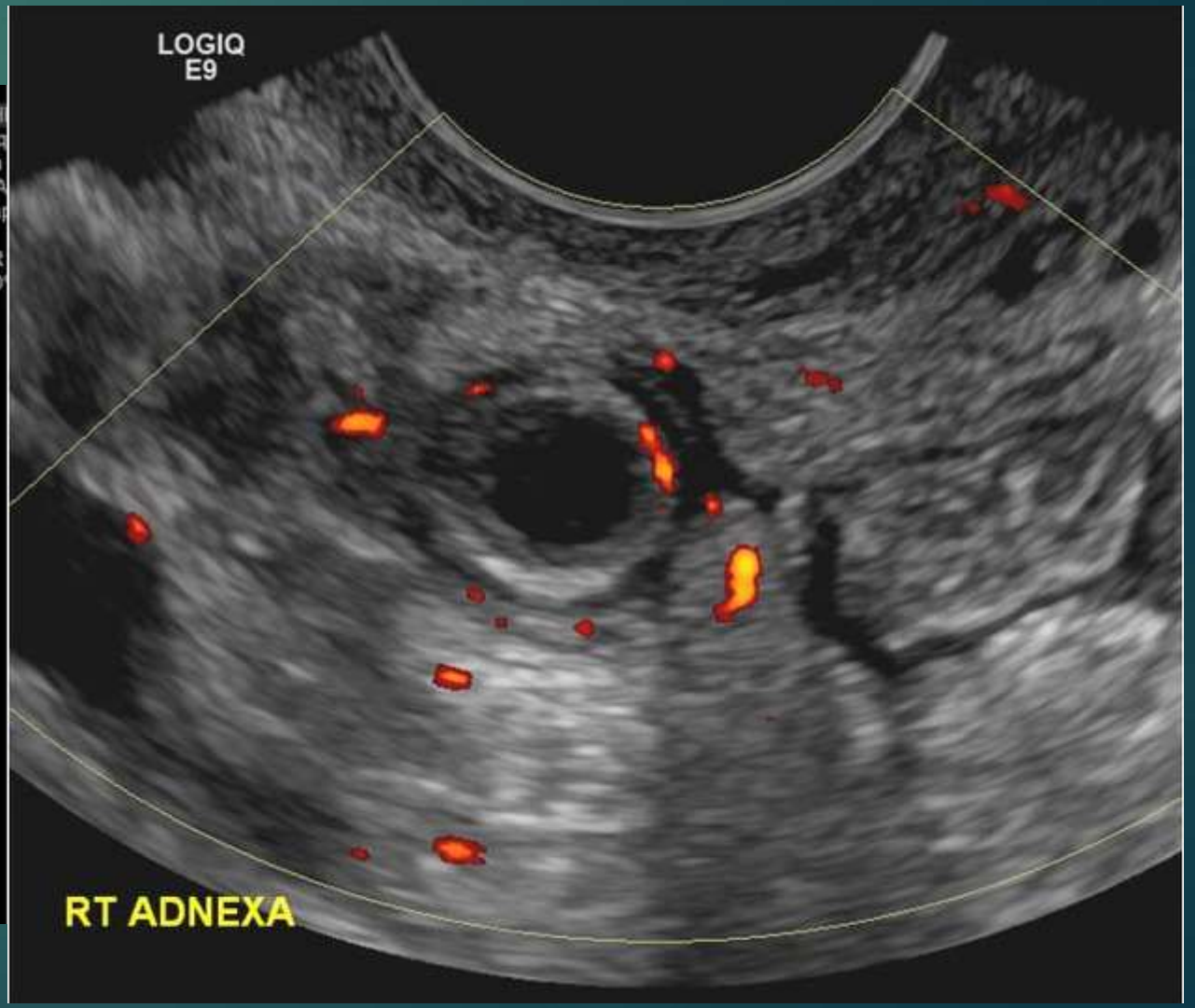


Intra-abdominal knife.

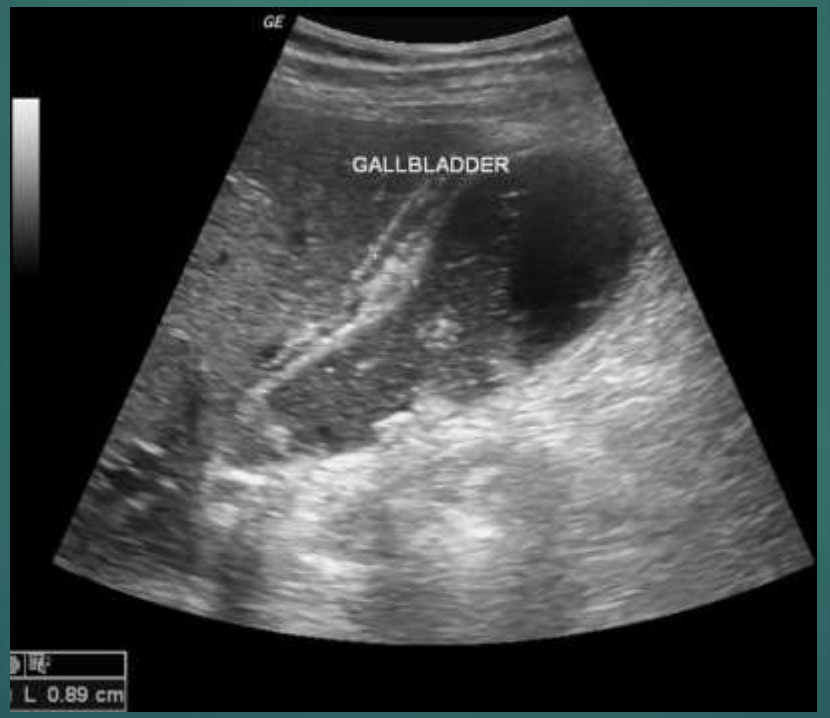
OTHER GASTROENTEROLOGY PATHOLOGIES

ACUTE APPENDICITIS

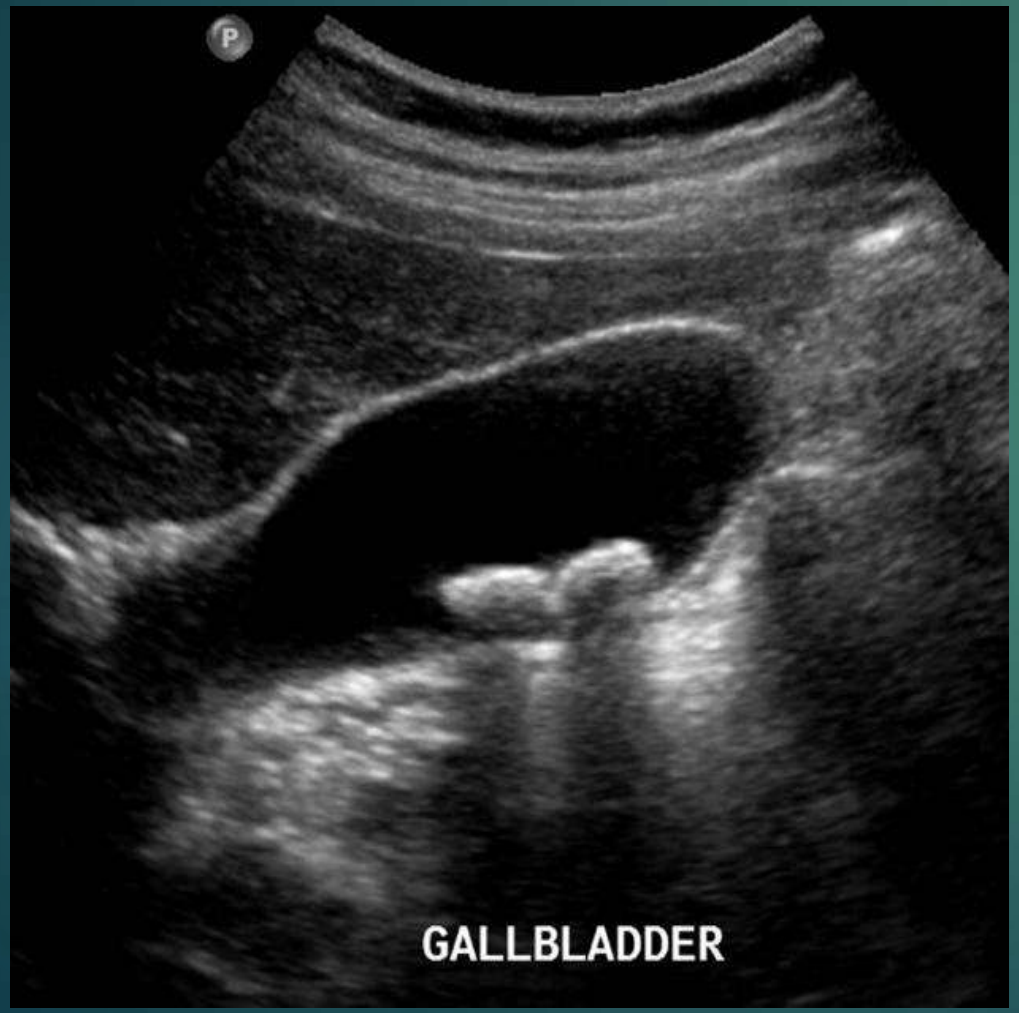


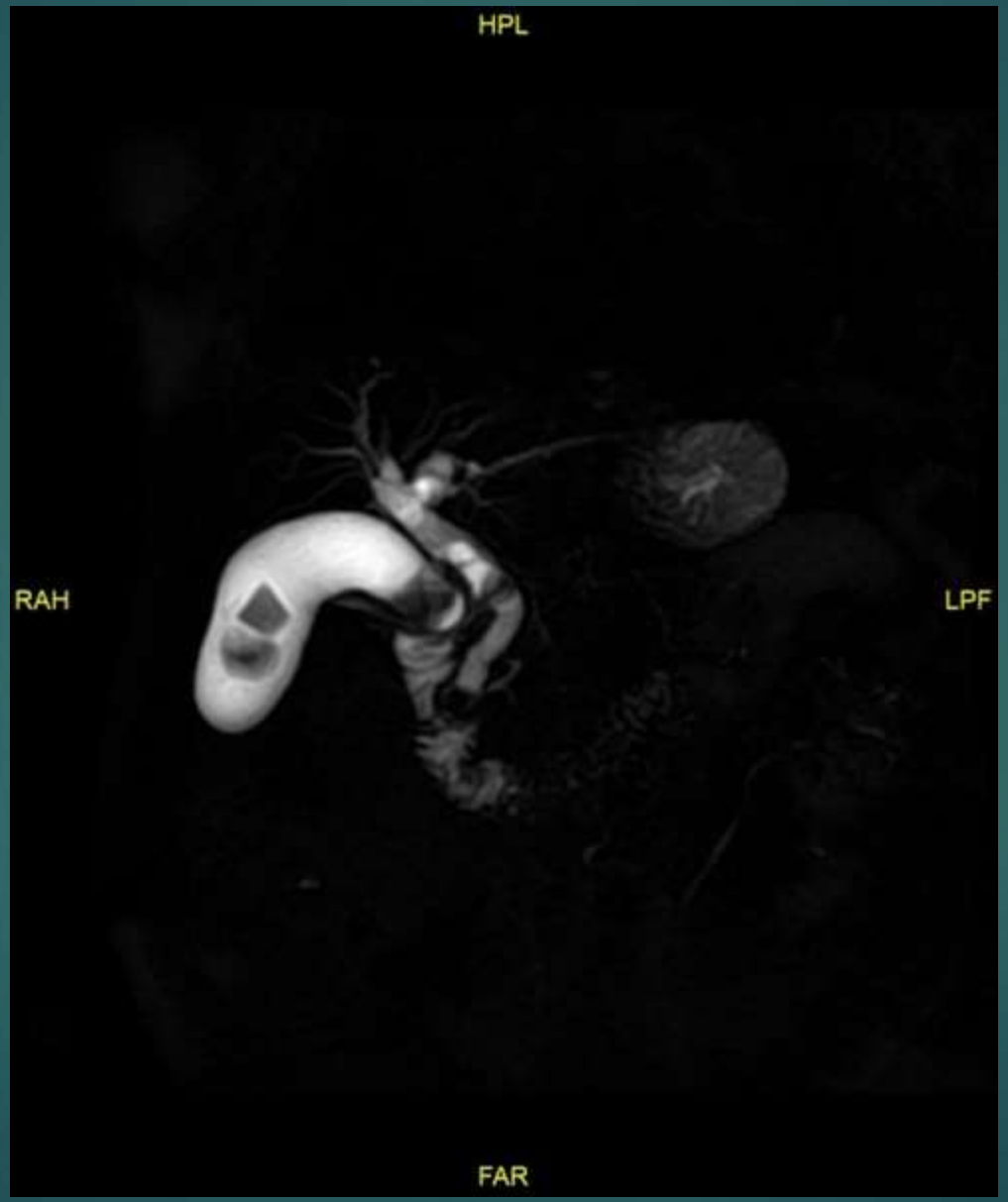


ACUTE CHOLECYSTITIS



GALL BLADDER STONE




HPL
RAH
LPF
FAR