

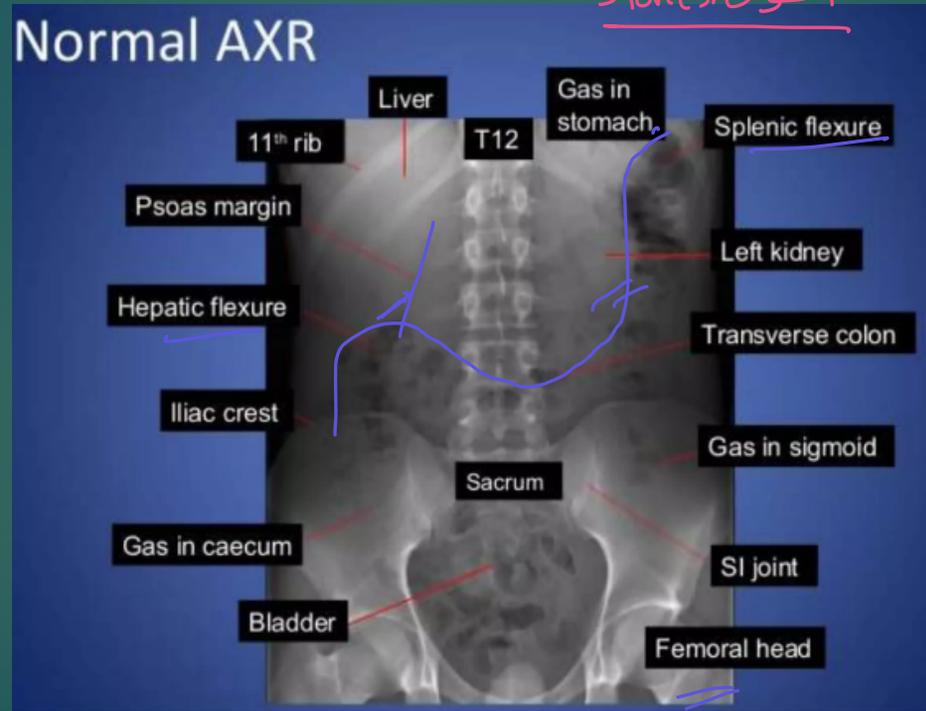
# Abdomen radiology

2024-2025

اللون الأخضر ← تعديل جديد  
اللون الوردي ← تبييض سابق

تبييض قديم

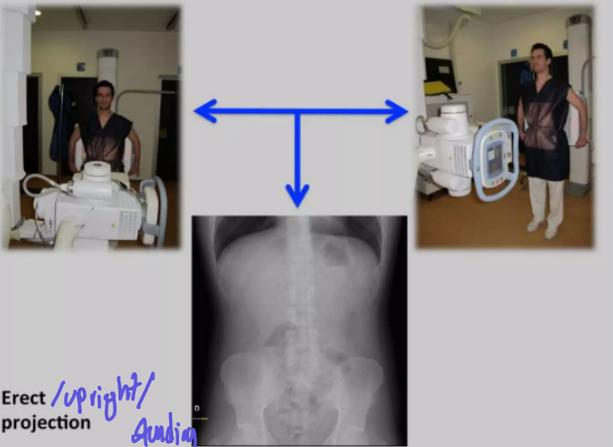
# Normal abdomen xray



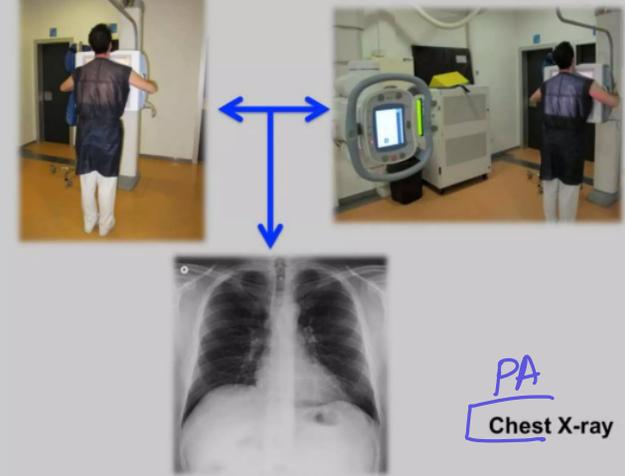
RUB (lower costal margin  
↓  
stones) )  
↓  
symphysis )  
pubis



Supine projection → AP



Erect /upright/  
projection *standing*



PA  
Chest X-ray



*lateral*  
Left decubitus  
with horizontal  
beam  
projection



Supine  
decubitus with  
horizontal  
beam  
projection

Positions of abdomen x-ray

Cross-table  
lateral decubitus =

حلول فوقه free gas را اسوفه

# Pathology

pneumo  
pneumonia  
at  
is

## **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).

normal → post op up to 10 days

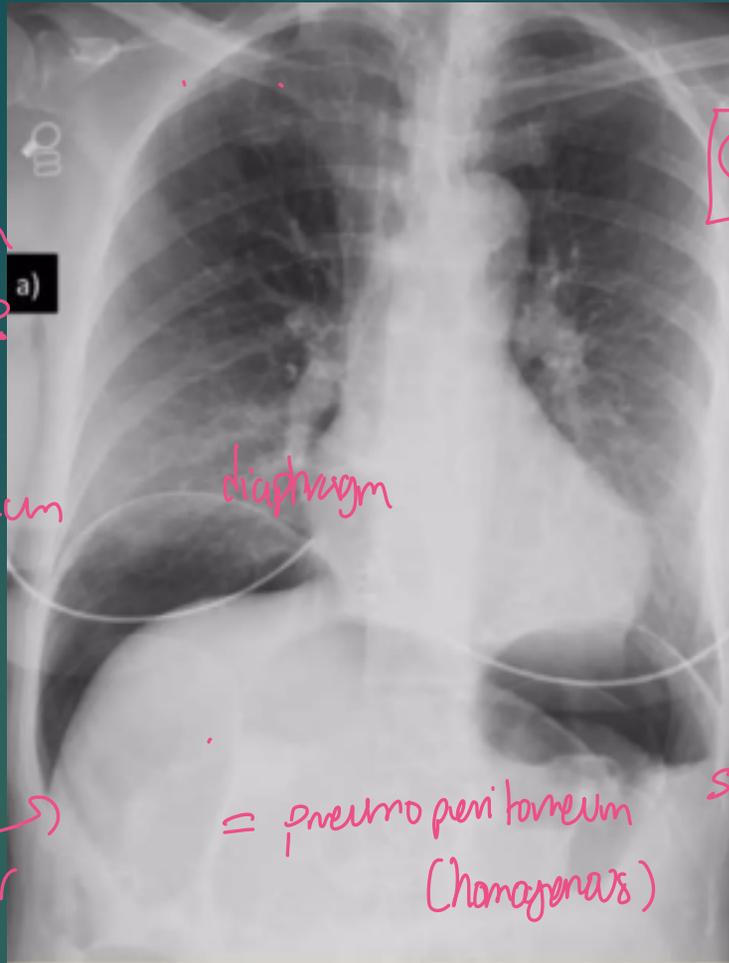
بین ارجح  
فی CXR

ما هي  
[CXR] For  
abdomen  
Pathology?

نفسوف  
pneumoperitoneum

better

liver



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

domes of dia  
diaphragm



free gas  
in dome

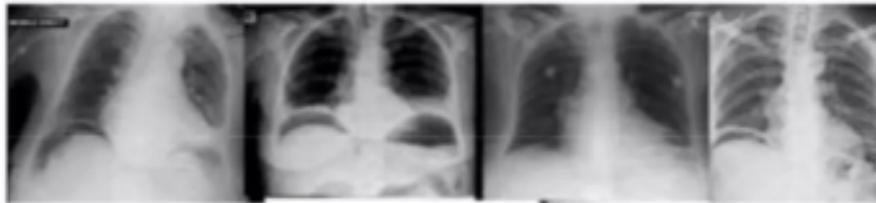
Abdomen  
xray

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

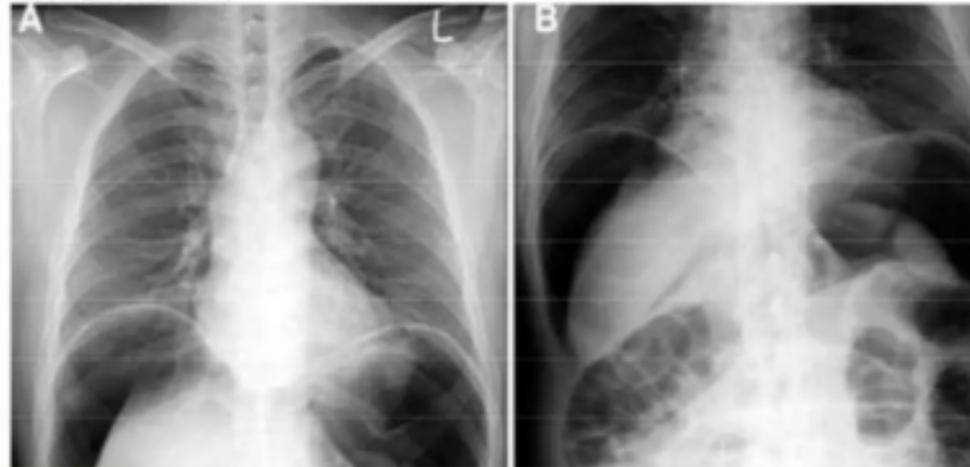
لنا البقايا بقدر الفرقه عن  
gas bubbles ← both  
on sides

**Crescent Sign:**  
plain film showing  
appearance of a  
sliver of air usually  
beneath the both  
hemidiaphragms in  
pneumoperitoneum

erect CXR  
↓  
diaphragm واضح



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

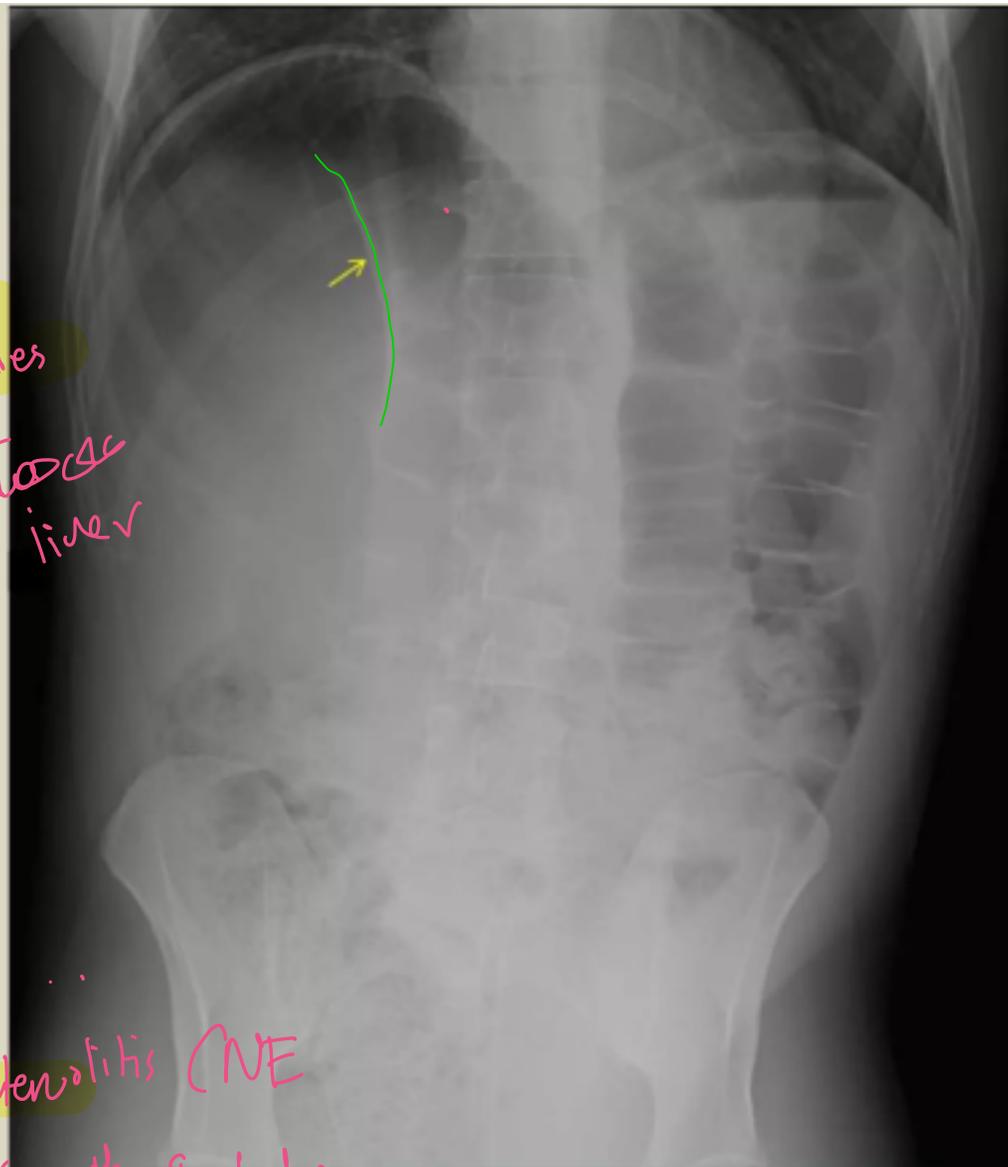


Silver / Sign

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

gas on both sides

↑↑↑↑  
liver



MC case is -  
▷ post-operative  
▷ Impacted a hollow organ

in children

in necrotizing enterocolitis (NE)  
Cystitis / overgrowth of bacteria

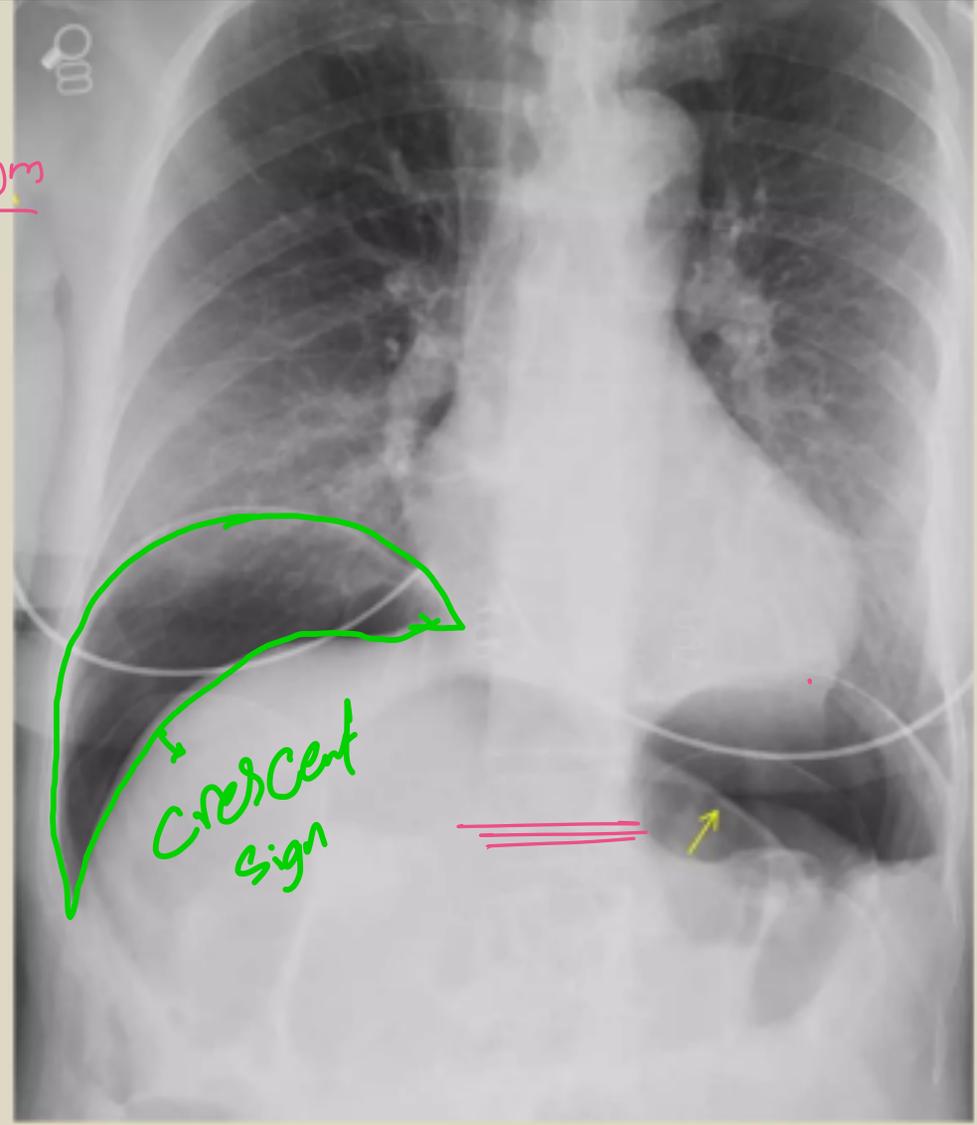
Crescent sign

3-11

central CS  
portion of diaphragm

# 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

① distended abdomen  
② increased lucency

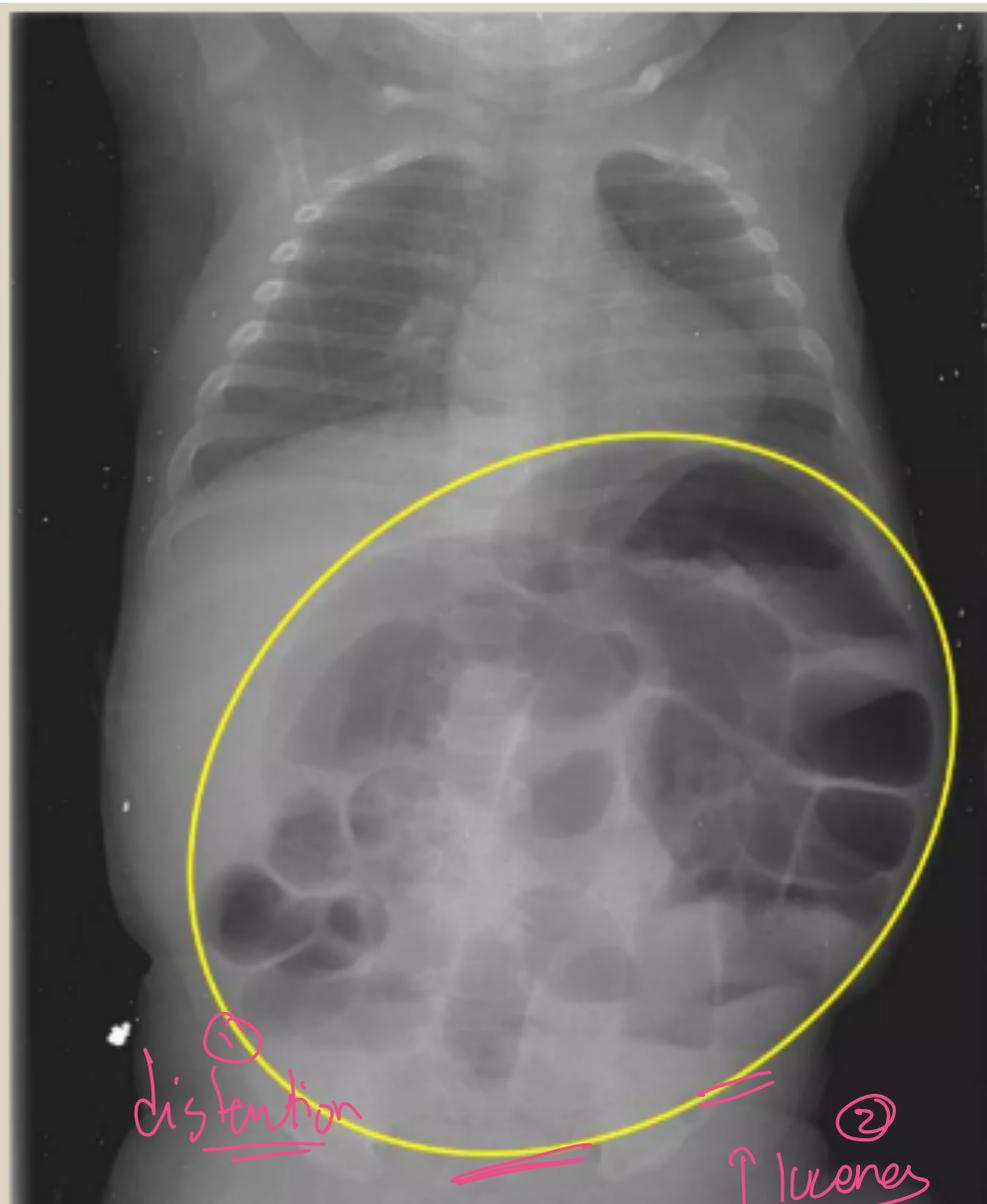


## Football Sign -

abdominal radiography showing a large oval

radiolucency demarcated

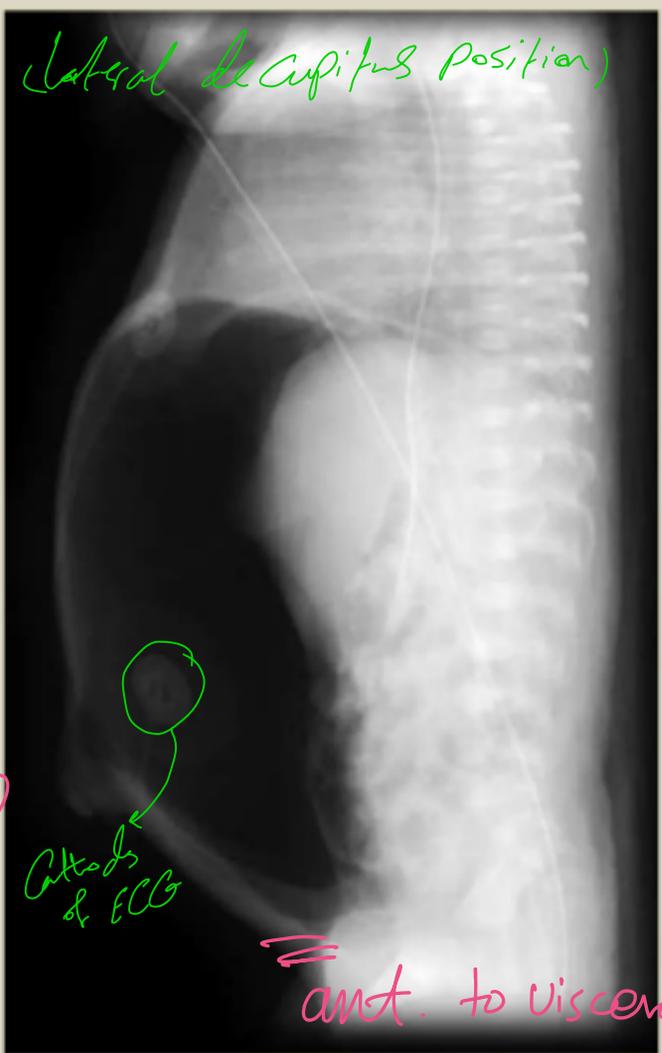
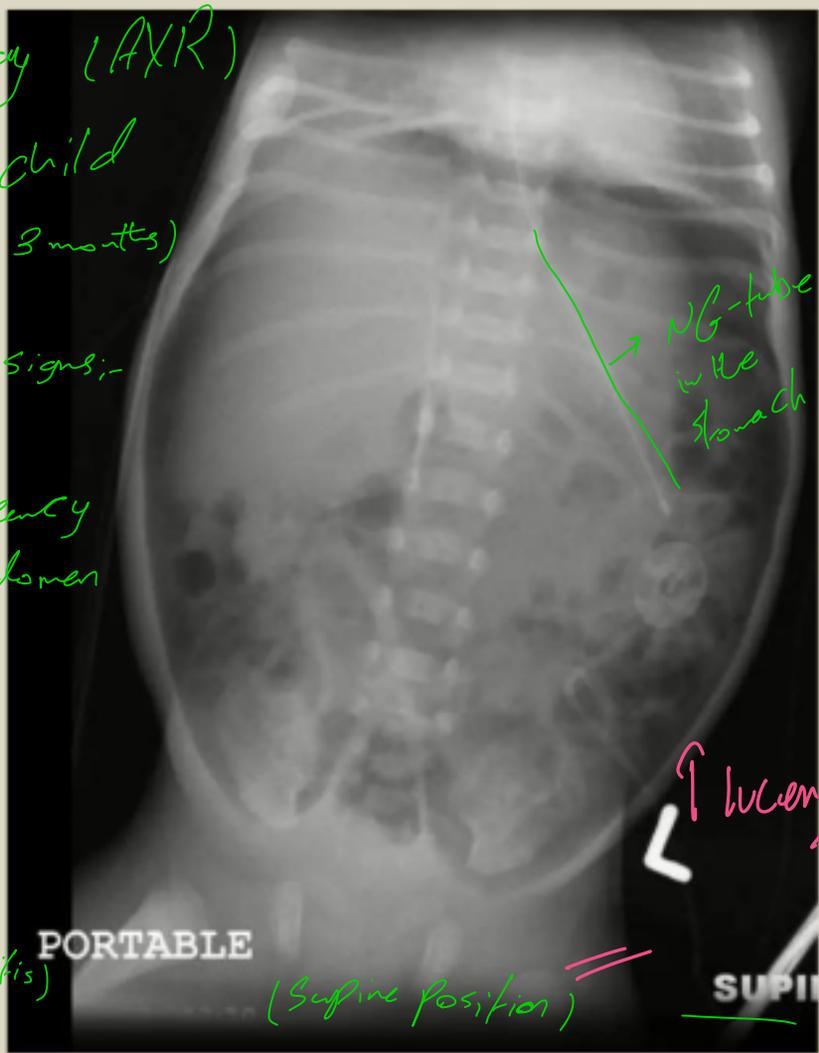
by the parietal  
peritoneum of the  
abdominal wall.



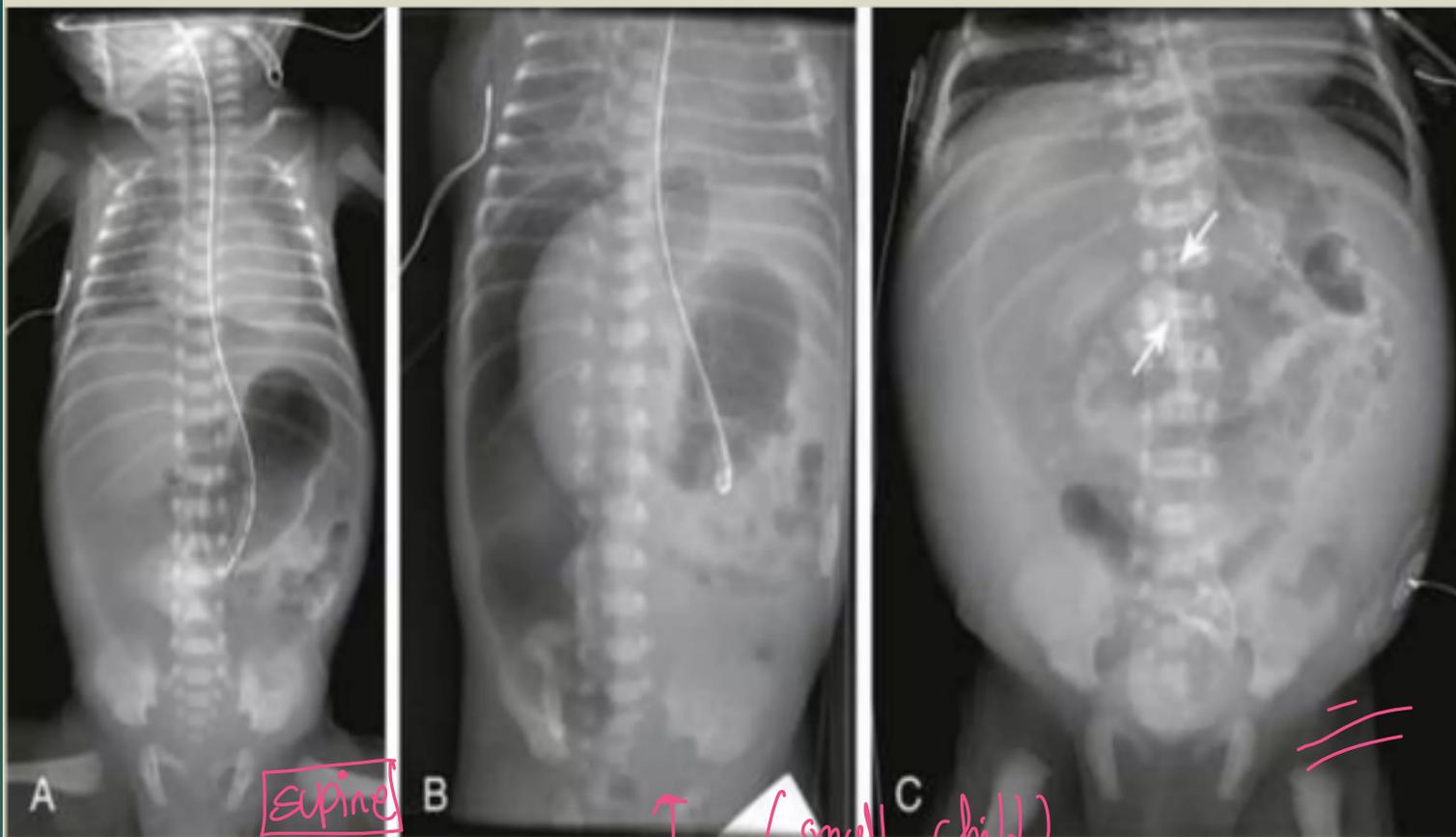
• abd. X-ray (AXR)  
in young child  
(age < 3 months)

• Radiological signs:-  
① Abdomen distended  
② Increase lucency  
of the abdomen

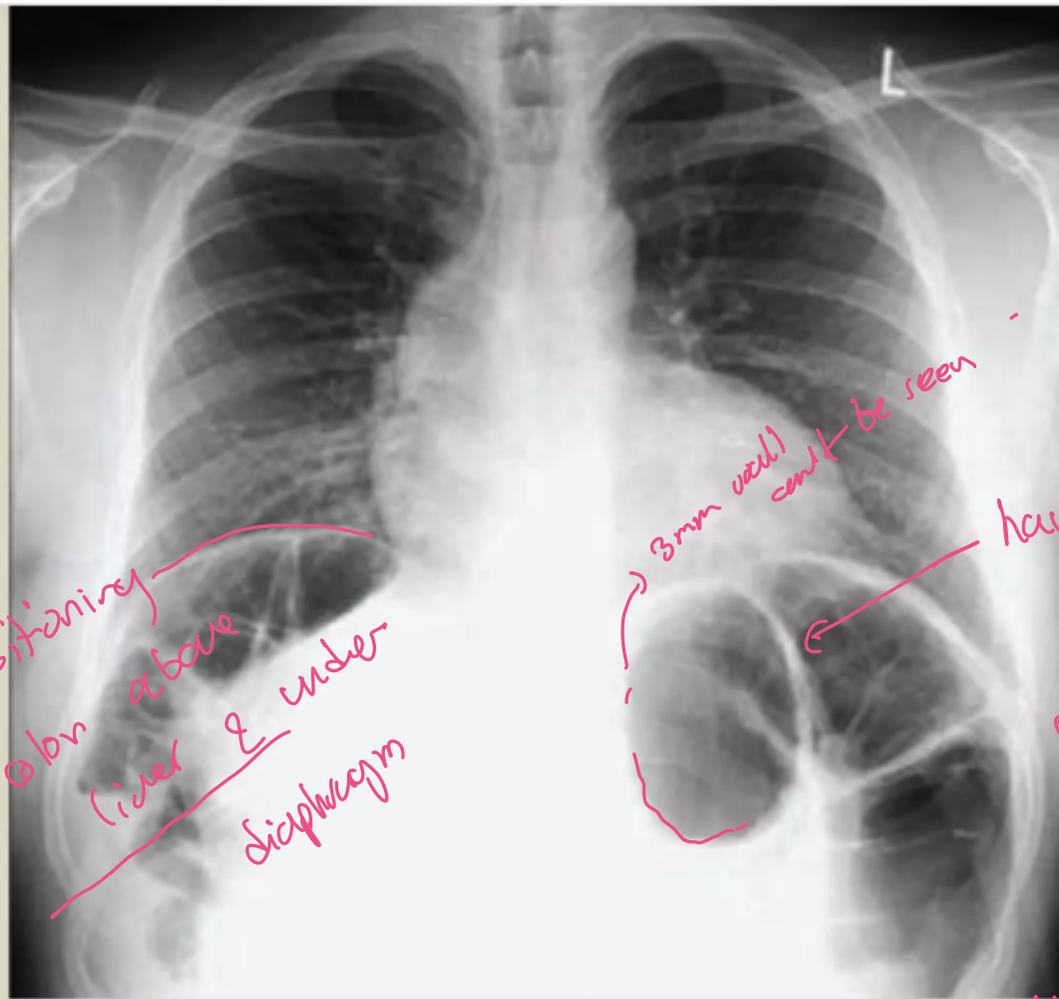
• Diagnosis :-  
(Pneumo-peritonium)  
Jejuno-  
(NEC)  
(Necrotising Enterocolitis)



**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.

variation / congenital

تفريغ (PA-view) ←

if irritable colon

pressure → SOB  
(lungs)

crescent sign

VS

Chilaiditi's sign

VS

Subphrenic abscess

DDX :-  
✓ pneumoperitoneum  
✓ subphrenic abscess

half moon

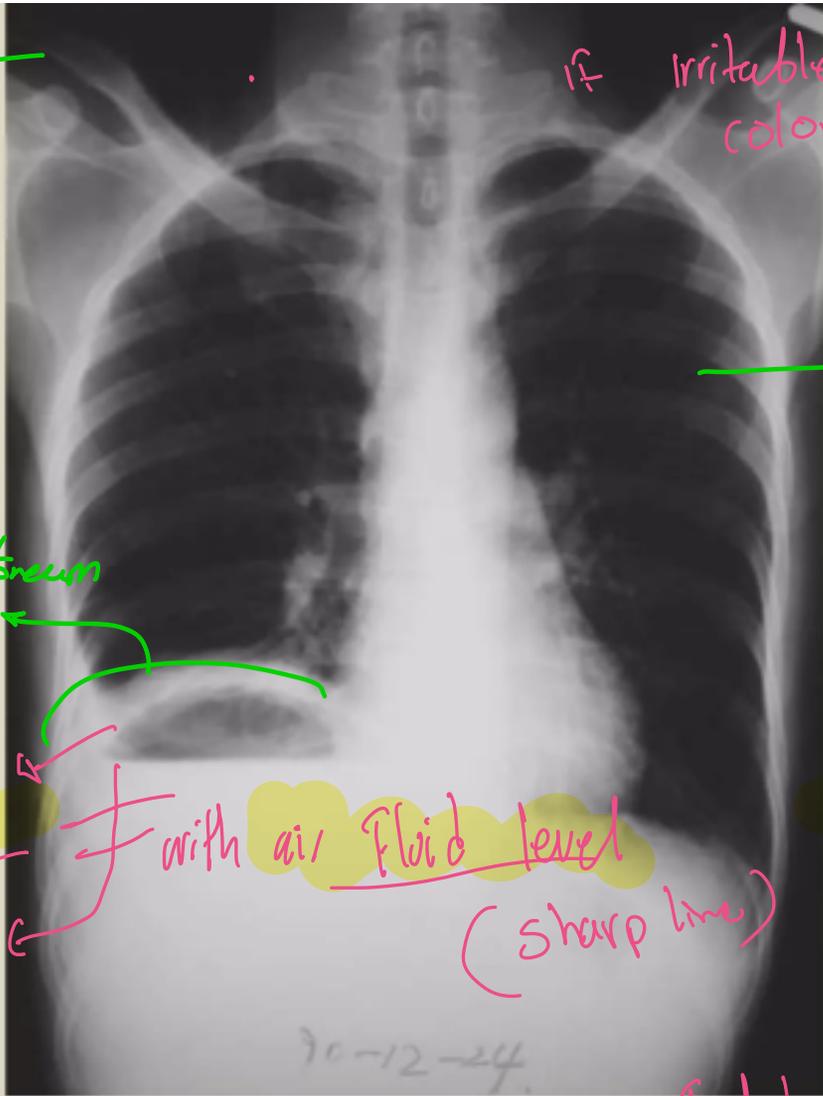
diaphragm) قَسَّ

with air fluid level (sharp line)

→ very dense lungs (over exposure)

عول  
(localized)  
not pneumo (diffuse)

Subphrenic abscess infected fluid



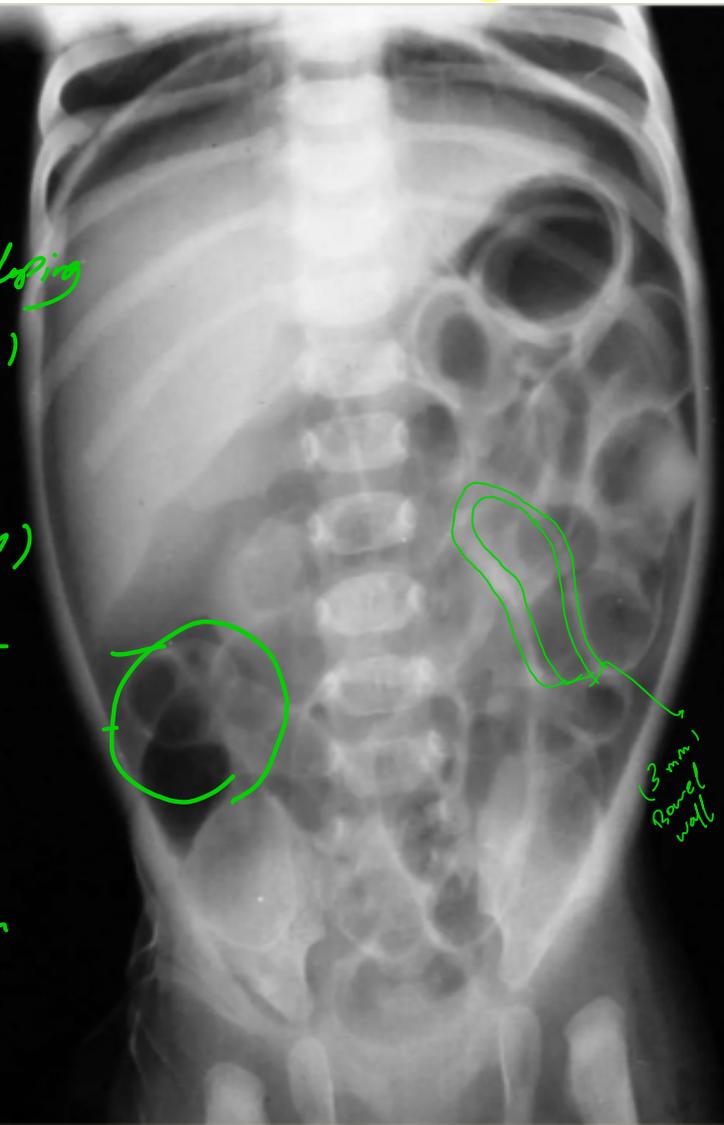
70-12-24

o pseudo-Rigler sign  
↳ (no present  
2-adjacent bowels  
(one bowel wall overlapping  
the other bowel wall))

↓  
Misdiagnosed as  
(pneumo-peritoneum)

Rigler sign "True"  
appearance of 2-layers  
of bowel wall and  
the space in-between  
(3mm)

↓  
(true pneumo-  
peritoneum)



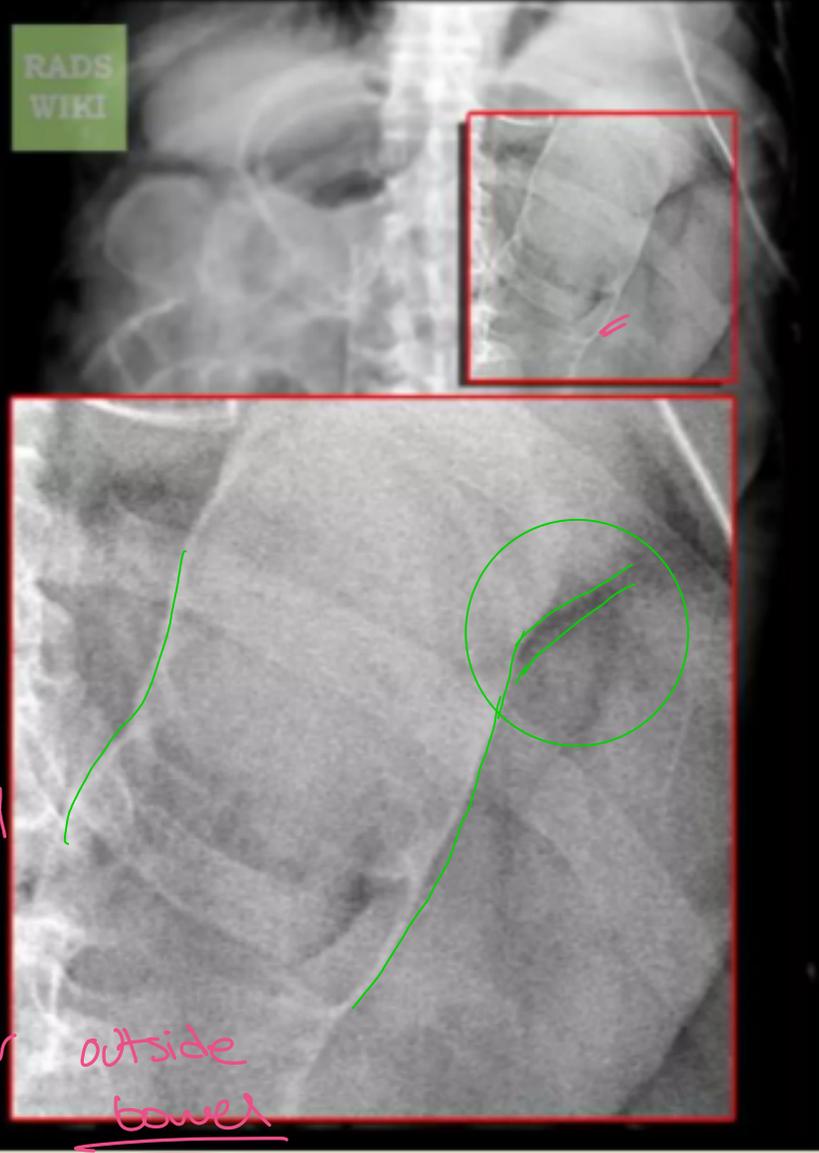
RADS  
WIKI



air ab's bowel  
air outside

**Rigler sign.**

RADS  
WIKI



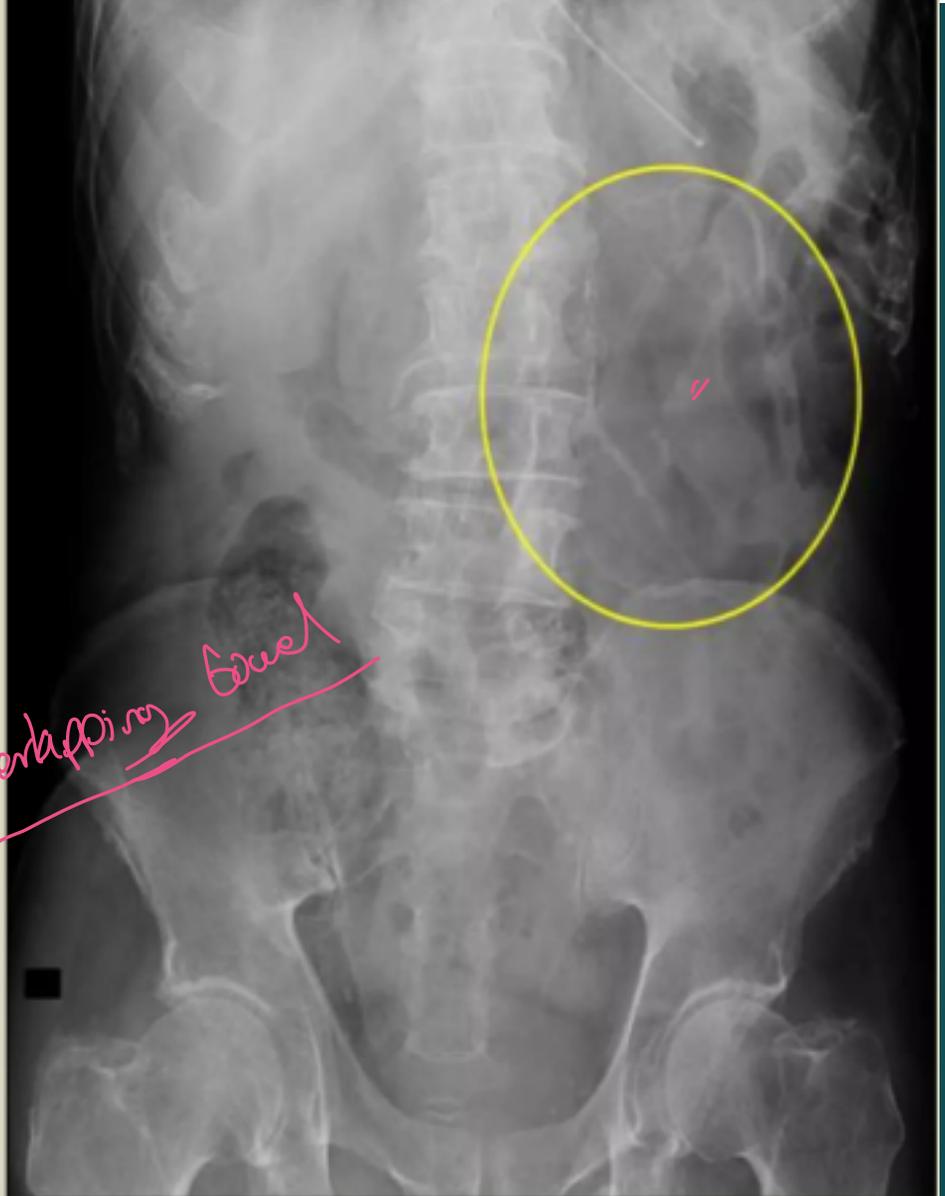
air  
outside  
bowel

# 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.

bowel not overlapping bowel



**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).

*overlapping  
bowel*



# **Pneumoretroperitoneum.** <sup>صالحين</sup>

Kidney + psors

## **Clinical**

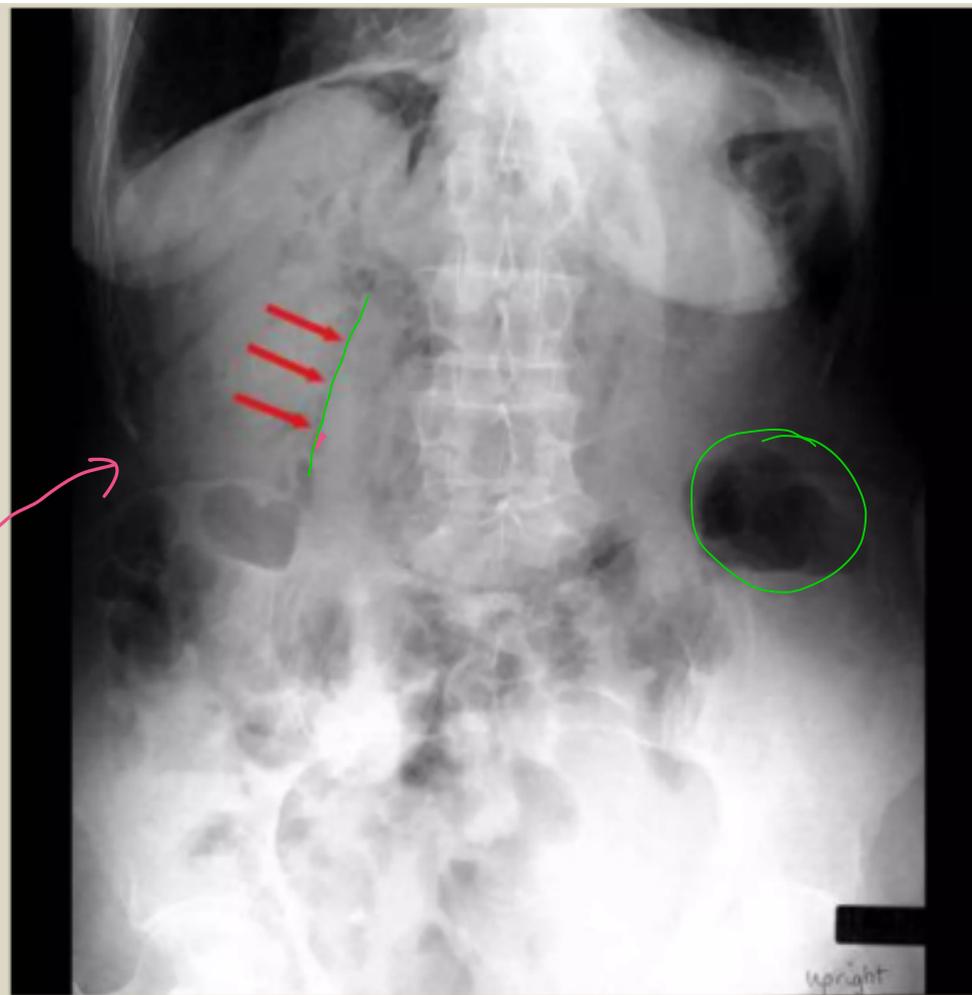
The most common cause of pneumoretroperitoneum is perforation of the second, third, or fourth portion of the duodenum or retroperitoneal colon secondary to trauma, diverticulitis, or ulceration.

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

## **Radiological findings**

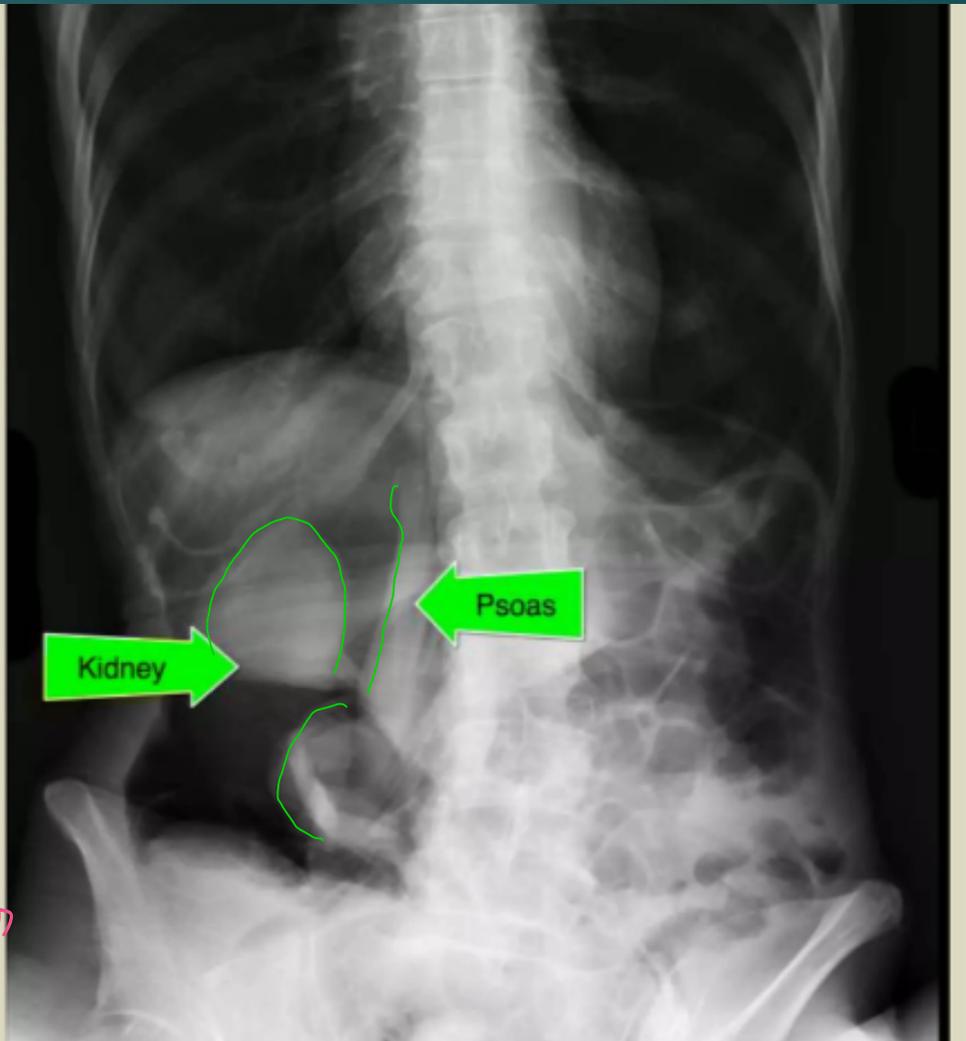
Pneumoretroperitoneum is most often seen on the right side where the air can outline the right kidney and the undersurface of the liver. In contrast to pneumoperitoneum, air in the retroperitoneum does not move freely with change in position. The gas can extend up into the mediastinum or neck because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

Outline  
psoas



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

**Massive  
retroperitoneal  
Air.**



Handwritten notes in pink ink:  
- A circled number '15019' with an equals sign below it.  
- The word 'Kidney' written vertically.  
- The phrase 'retroperitoneal gas' written diagonally.

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



# Pneumbilia

## Clinical

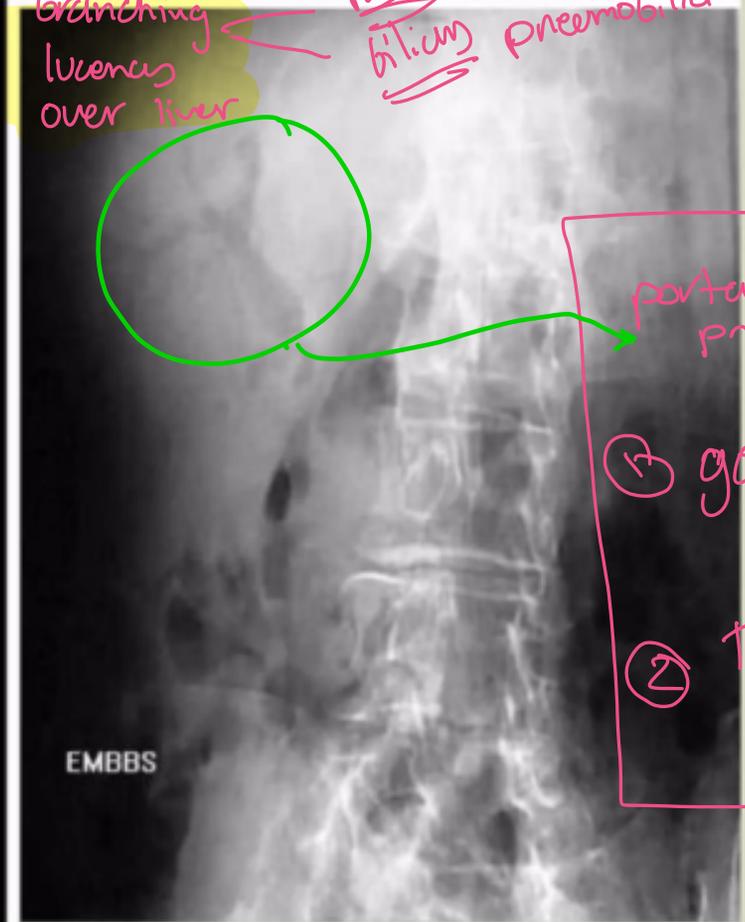
Gas in the biliary tree is most commonly secondary to surgical procedures such as choledochenterostomy or sphincterotomy of the sphincter of Oddi. It may also arise in the setting of trauma, infection by gas producing organisms (i.e. emphysematous cholecystitis), fistulas connecting the biliary system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

# Pneumobilia

(post op) ERCP surgery  
fistula



branching lucencies over liver



portal pneumobilia  
biliary pneumobilia } PDX

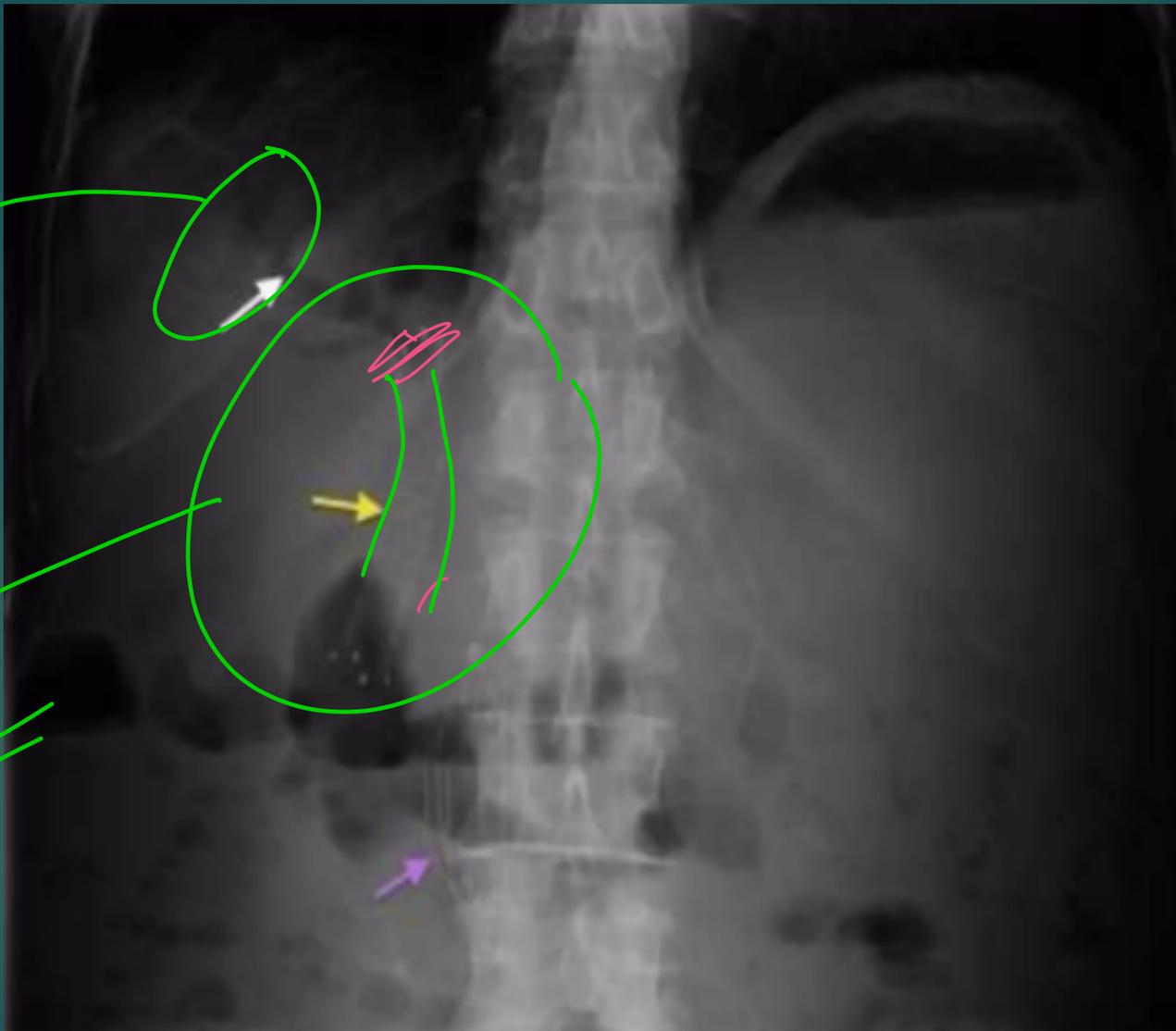
portal pneumobilia  
↑  
① goes in wall  
② + branching lucencies

• fistula between  
Ampulla of Vater  
and Bile duct  
as leads  
chronic inflammation  
in Bile ducts &  
Gall bladder  
that cause  
fibrosis inside.



Branching  
lucency

Gas in  
portal vein



**Pneumbilia**

# 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.

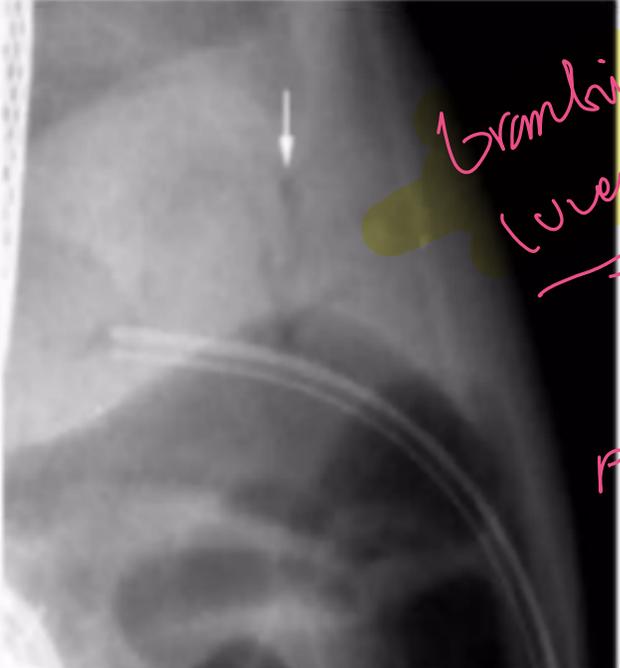
# Necrotizing Enterocolitis: portal venous gas

perforation

(air intowel)

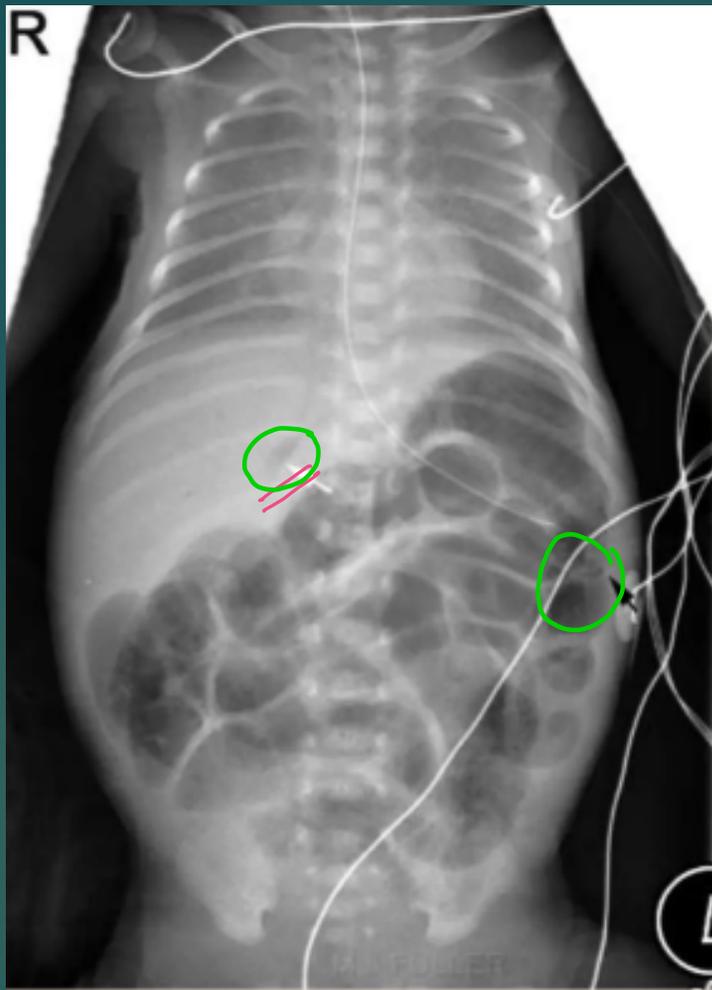
Supine abdominal radiograph shows a small bubble of portal venous gas projected over the liver (arrow)

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



branching  
lumen





***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 in 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.*



B

↳ = portal pneumatosi not biliary pneumobilia

## **Bowel loops pathology.**

**Dilated stomach.**

**Dilated small and large bowel loops.**

**Volvulus.** → Emergent Case

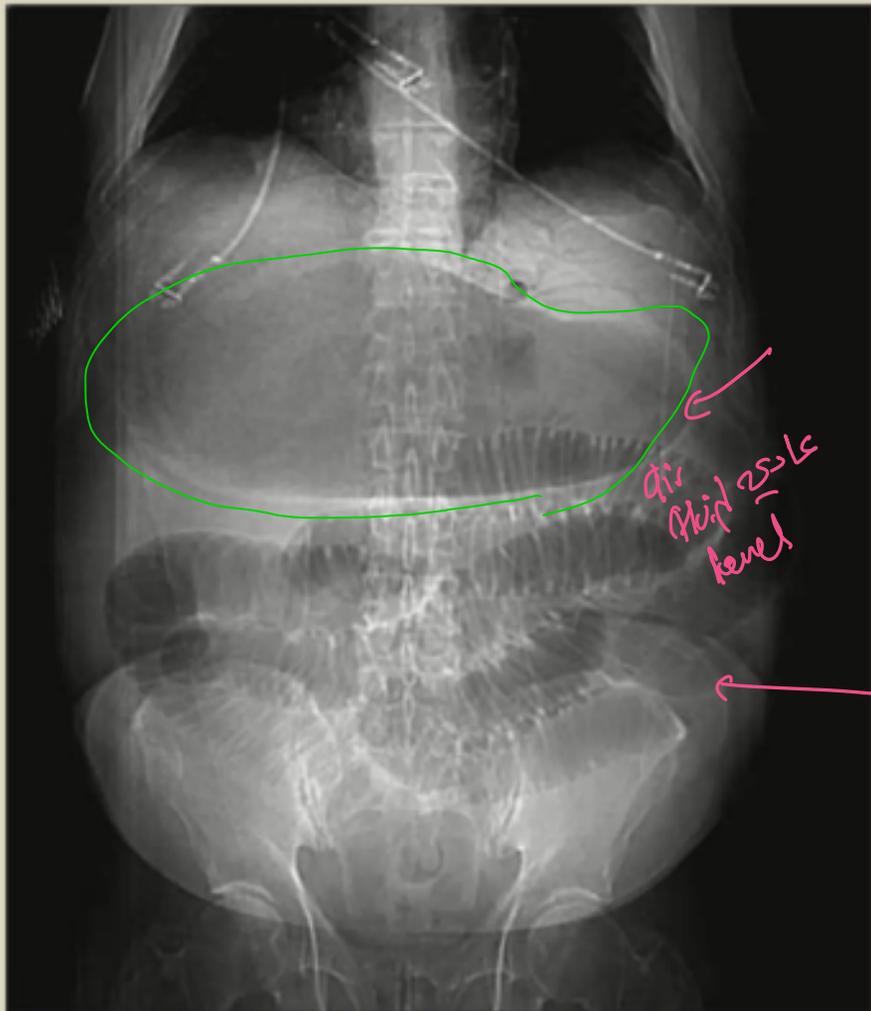
**Inflammatory bowel disease.**

**Hernia.**

**Constipation with fecal impaction.**

المعدة التي يتكون  
obstruction  
بمقدار (Dilatation)  
↓  
قبل الإصدار

المعدة التي بمقدار الإصدار  
بمقدار (Dilatation)



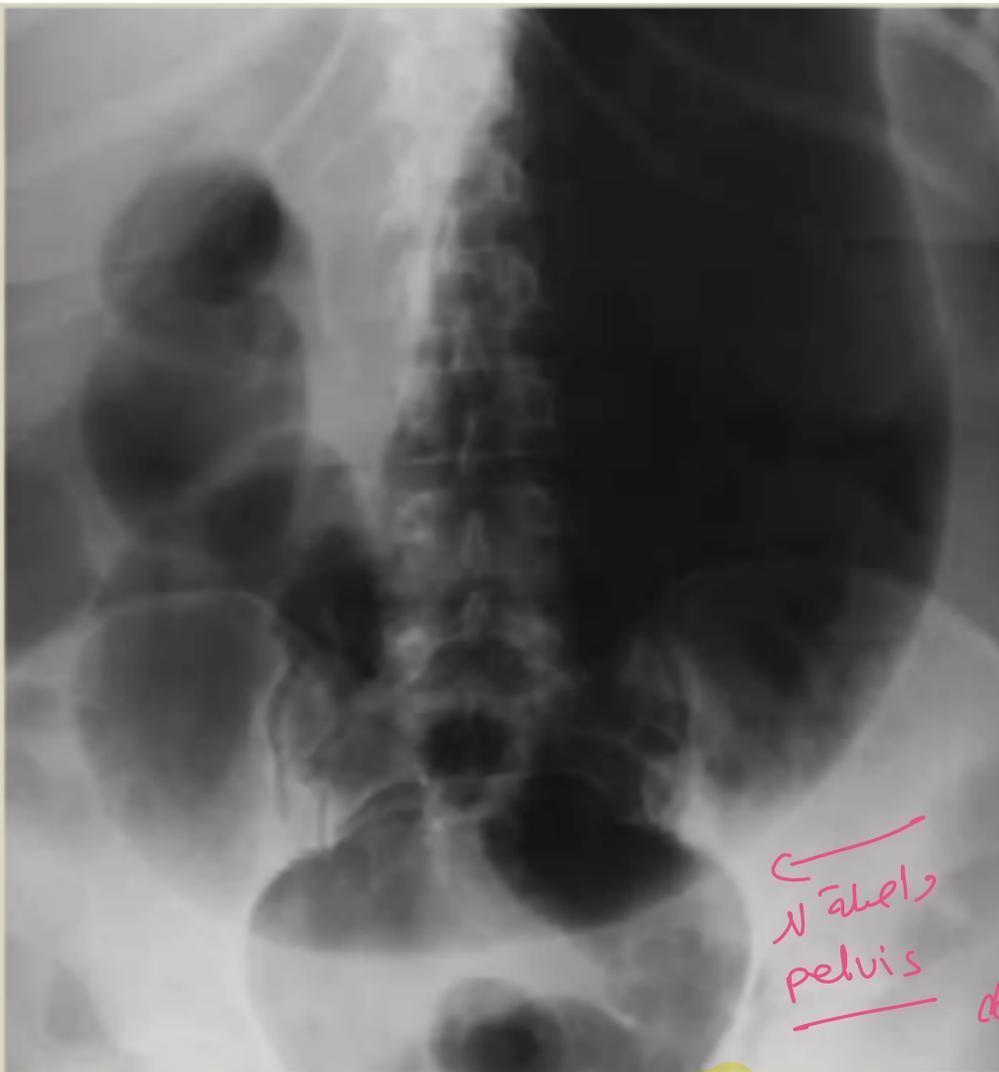
Supine  
PA-view  
عشان أشوف ال  
(air distribution)

air filled bowel

abnormal bowel

intestinal obst.  
outlet obst.

CT scout image showing massive gastric dilation.



←  
Nabel, pelvis

don't use subjective terms

Gastric dilatation.

(moderate - severe)

newborn

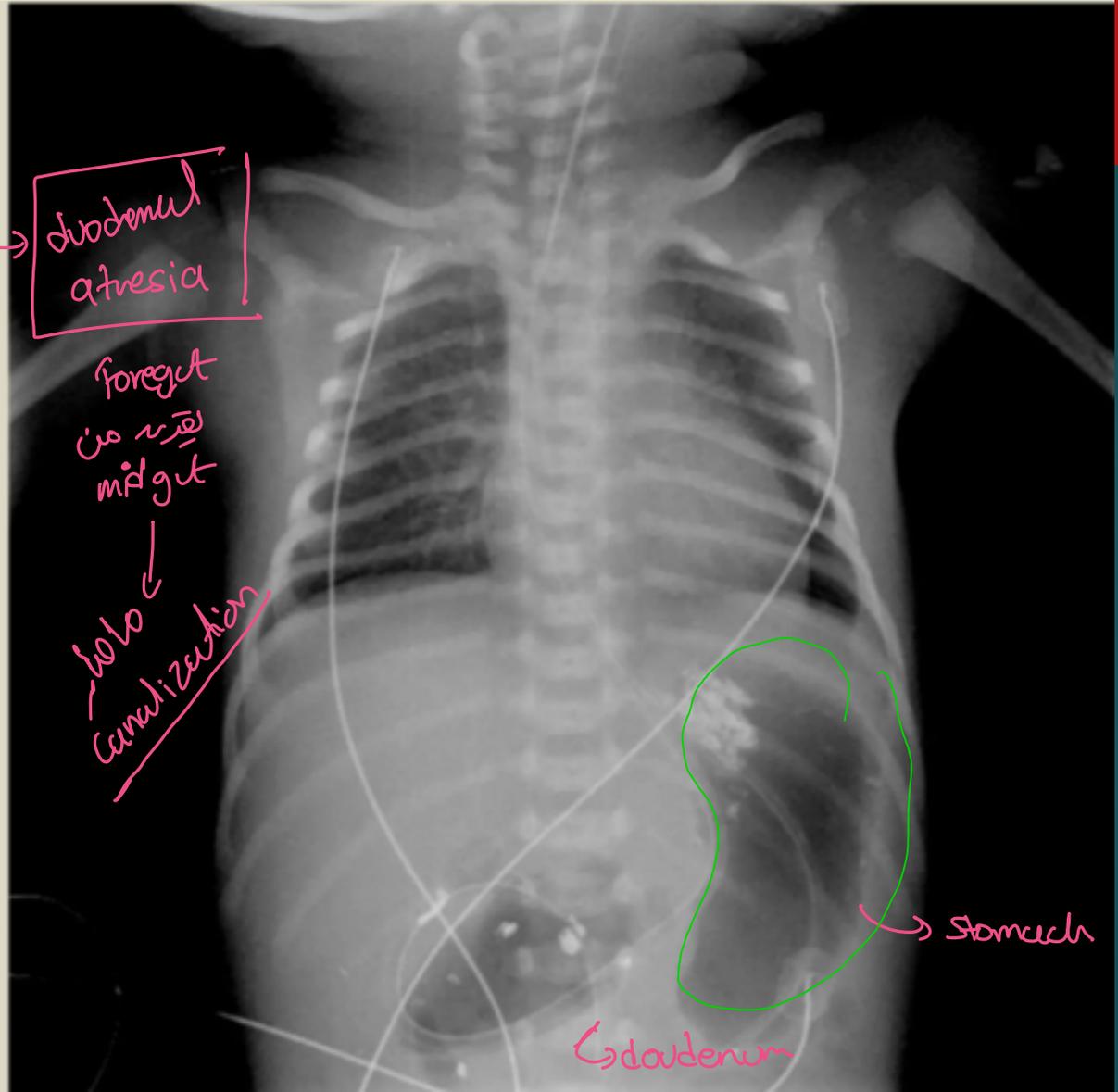
### Double Bubble

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.

duodenal atresia

foregut  
no air in  
midgut

no  
canalization



stomach

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.

→ - >3 air fluid lvs → erect

- centrally located

- continuous valvulae

- NZV

SBO \* حرقى

عن

LBO

suspicion: abd distention ①  
② nausea + vomiting (signs...)

↑  
CXR of abd:

① erect

② supine

gas distribution

not

air fluid level

> 3 = obst. ✓

? **Small bowel obstruction - features**

? Centrally located multiple dilated loops of gas filled bowel

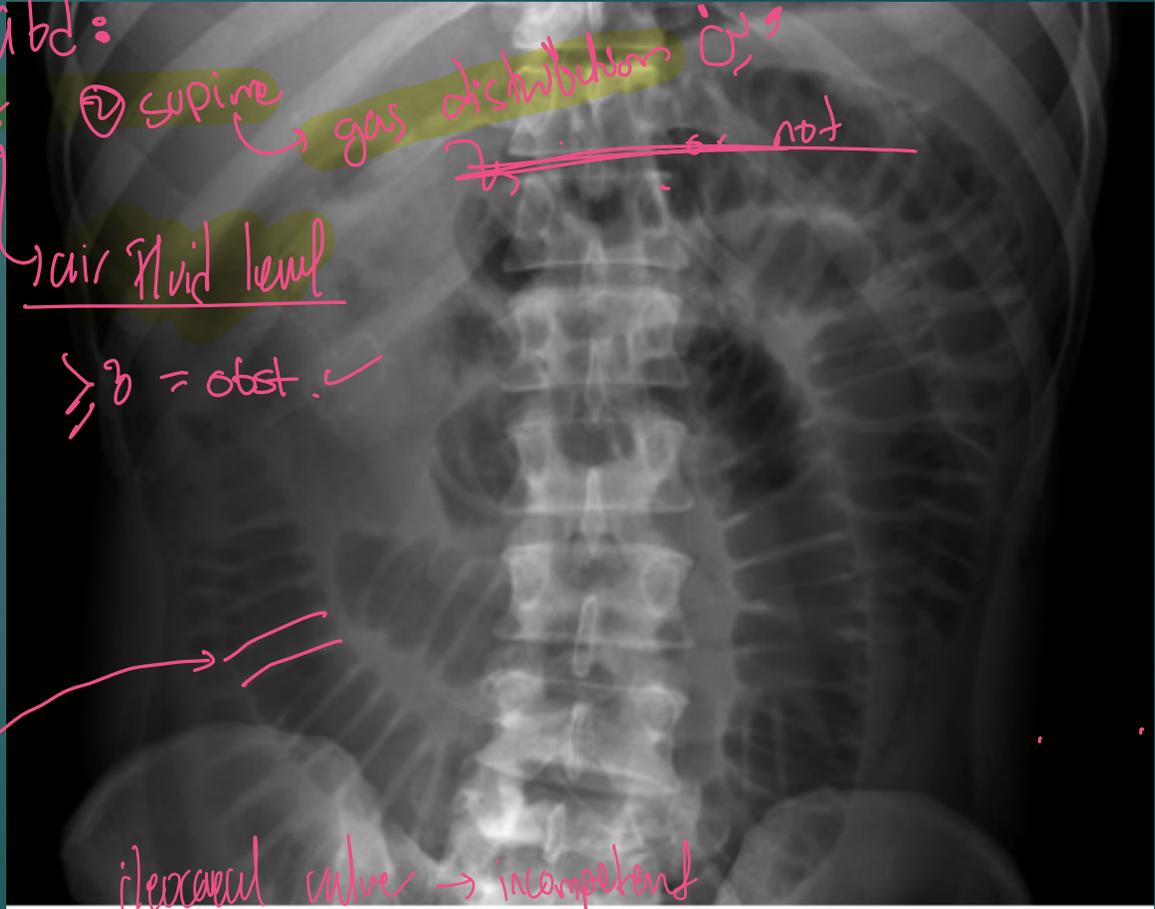
? Valvulae conniventes are visible - confirming this is small bowel

? Evidence of previous surgery - (not always)

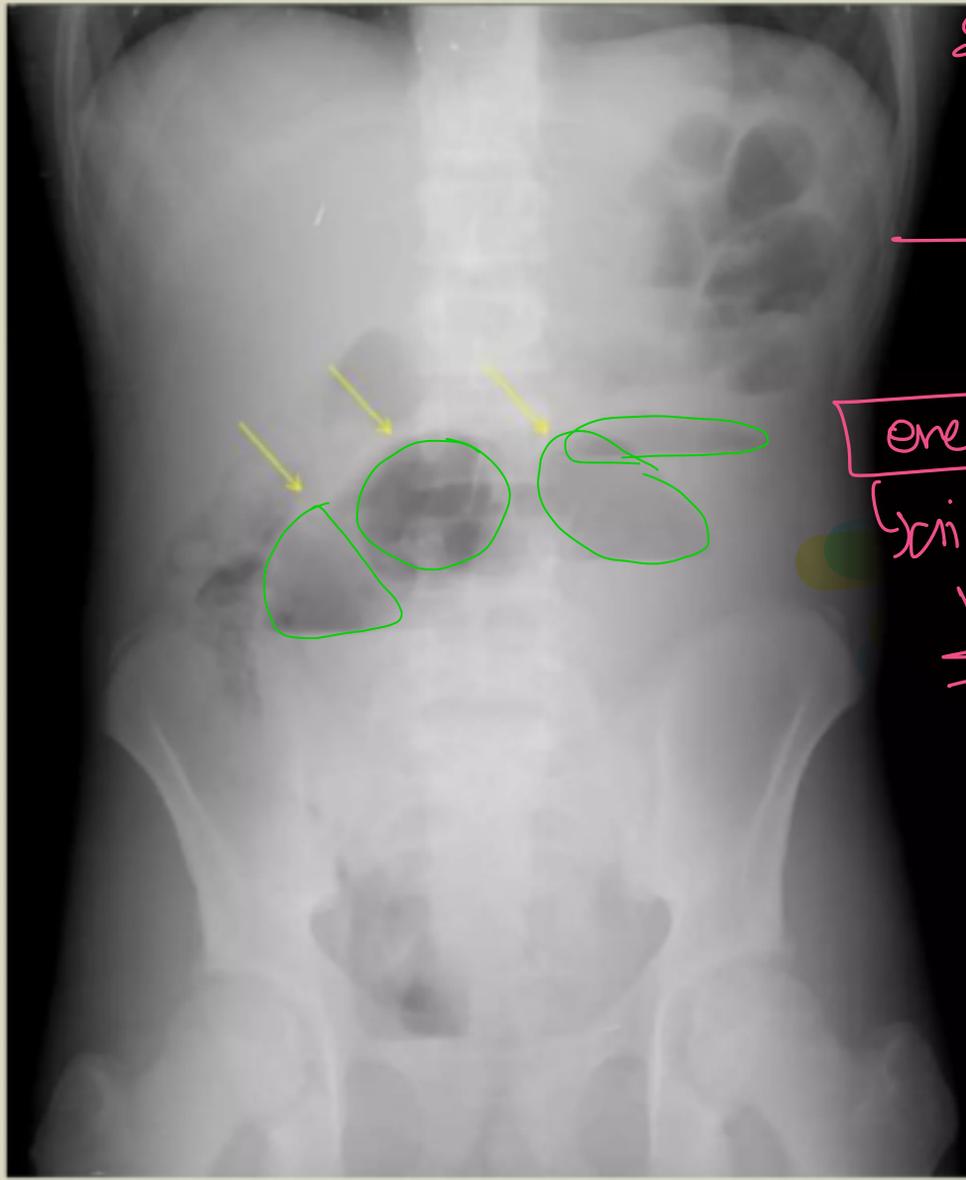
? note the anastomosis site - this suggests adhesions is the likely cause of obstruction

bands are continuous

ileocaecal valve → incompetent



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



Small bowel  
dilatation

↓  
center

large bowel  
dilatation

↓  
periphery

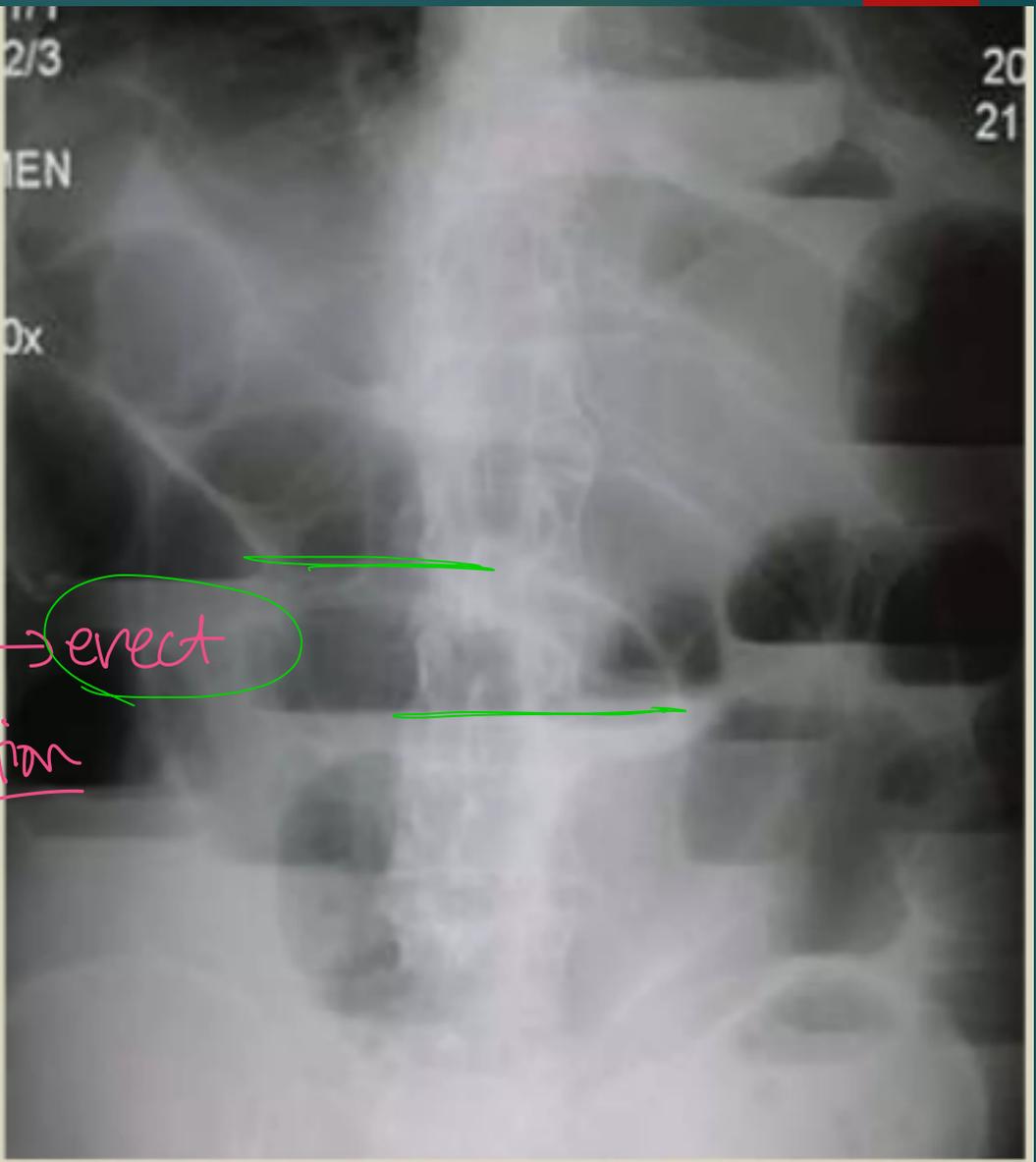
erect

air fluid

level يعني

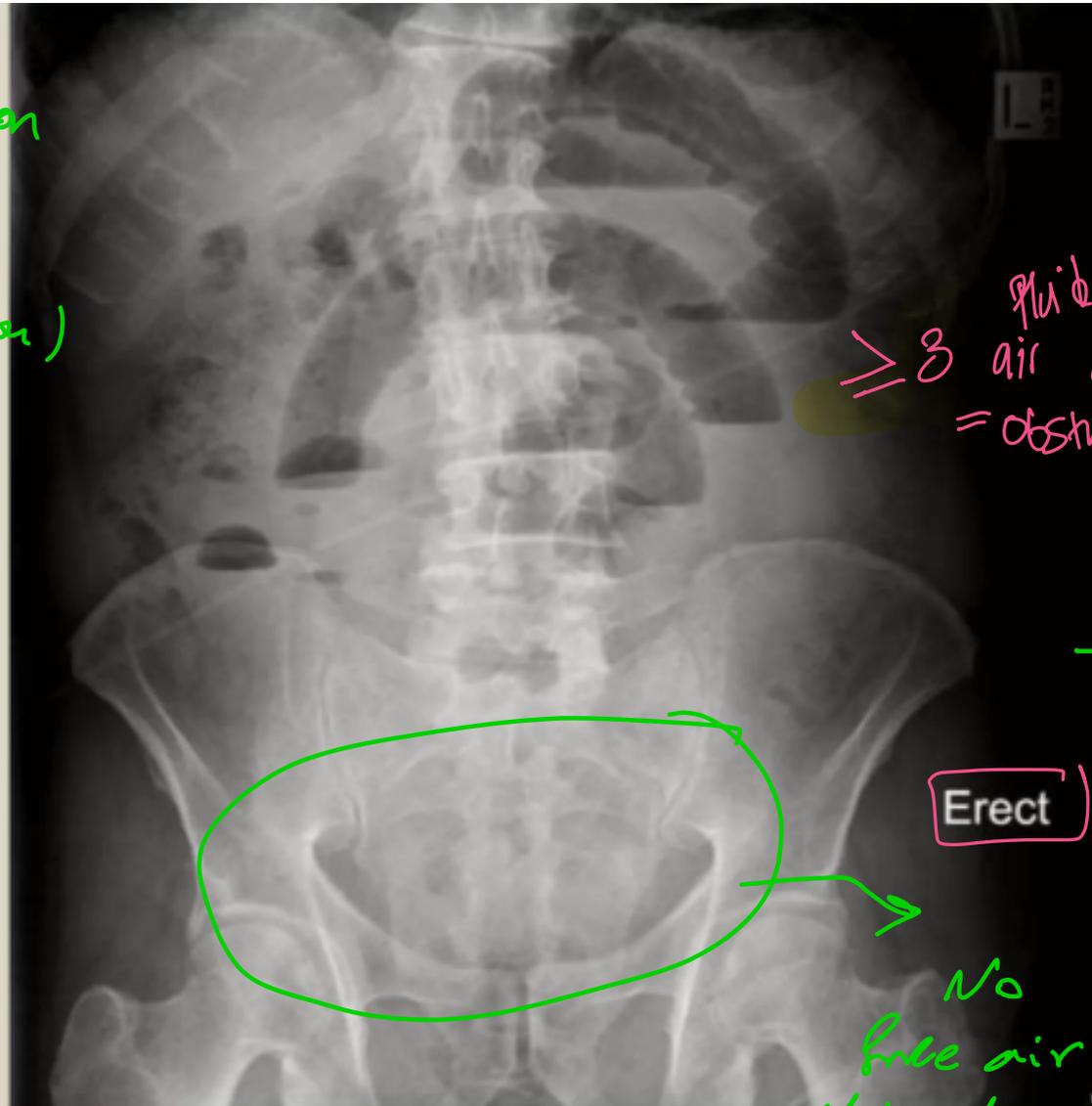
**Upright abdominal X-ray demonstrating a small bowel obstruction. Note multiple air fluid levels.**

not gas distribution



in erect position  
ما بين معي بالصورة  
(level of obstruction)

↓  
منه بين هذا الاله  
supine position



fluid  
≥ 3 air levels  
= obstruction  
SBO  
emergency  
radio busy

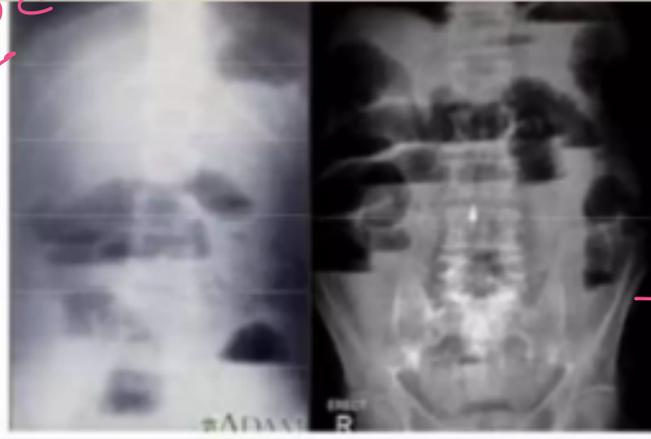
Reporting:-  
→ AXR in erect  
position, with  
multiple air-fluid  
levels (more than 8)  
Central location

Erect  
No  
free air  
at the lower level

small  
Bowel  
obstruction

Small Bowel Obstruction.

evacuation by rectum



→ erect

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

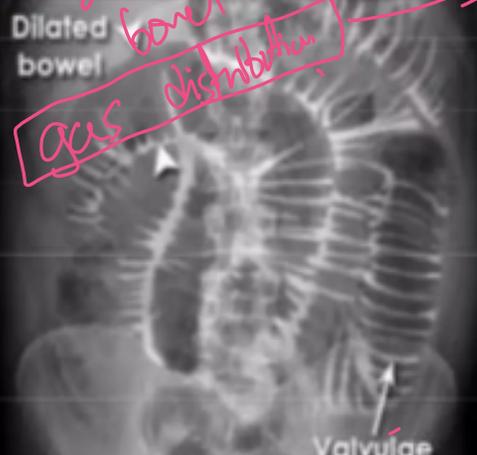
The white lines passing across the full width of the bowel are 'valvulae conniventes' - these are only found in the small bowel.

Small bowel obstruction



Small bowel obstruction

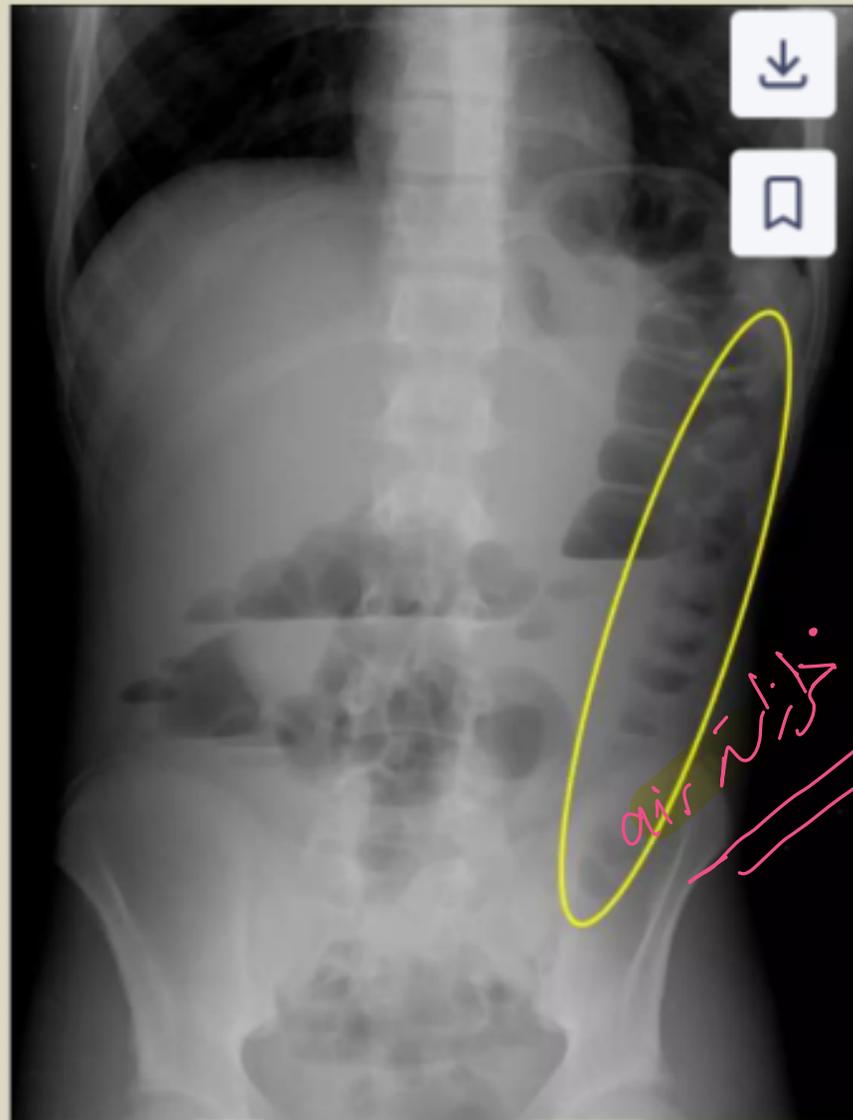
Dilated bowel



Valvulae

supine

**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

MC cause of S.I. dist = (mechanical + general)  
adhesions to null due to  
post op

## 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~~ <sup>dilated</sup> 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.'

?

Functional obstruction due to post to 

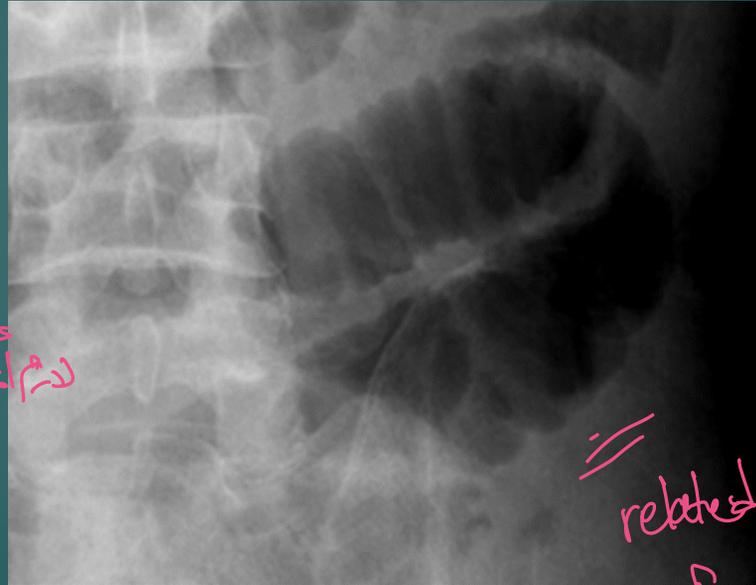
Sentinel  
loop

= functional  
ileus

? 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

↑ dilated



related to anatomy  
of nearby structures

dilatation و توسع = pancreas  
or appendix

***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  $>9\text{cm}$  is abnormal

Dilatation of any other part of the colon  $>6\text{cm}$  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 <sup>maybe</sup> small bowel dilatation

proximally. Dilatation of the caecum  $>9\text{cm}$ , and  $>6\text{cm}$  for the rest of the colon is considered abnormal.

SBO

# 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.

sigmoid is

Obstruction

Rectal gas

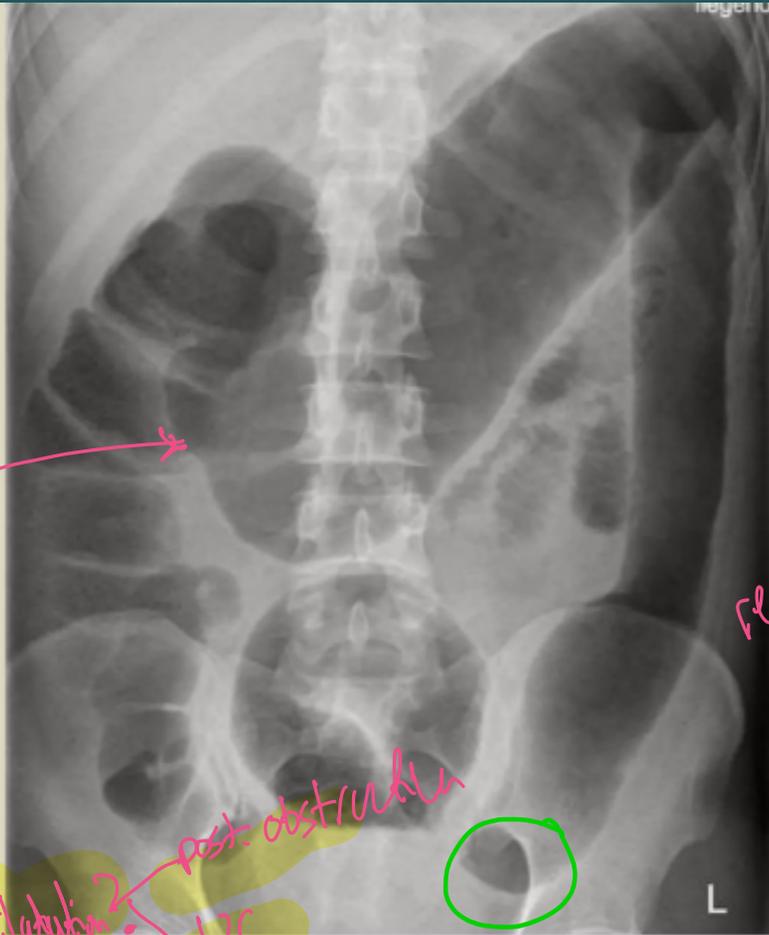
why?

air?

partial obst.

not complete

incomplete evacuation distally



recto sigmoid

post-obstruction

VC

large dilatation?

megacolon  
descriptive term  
not diagnostic

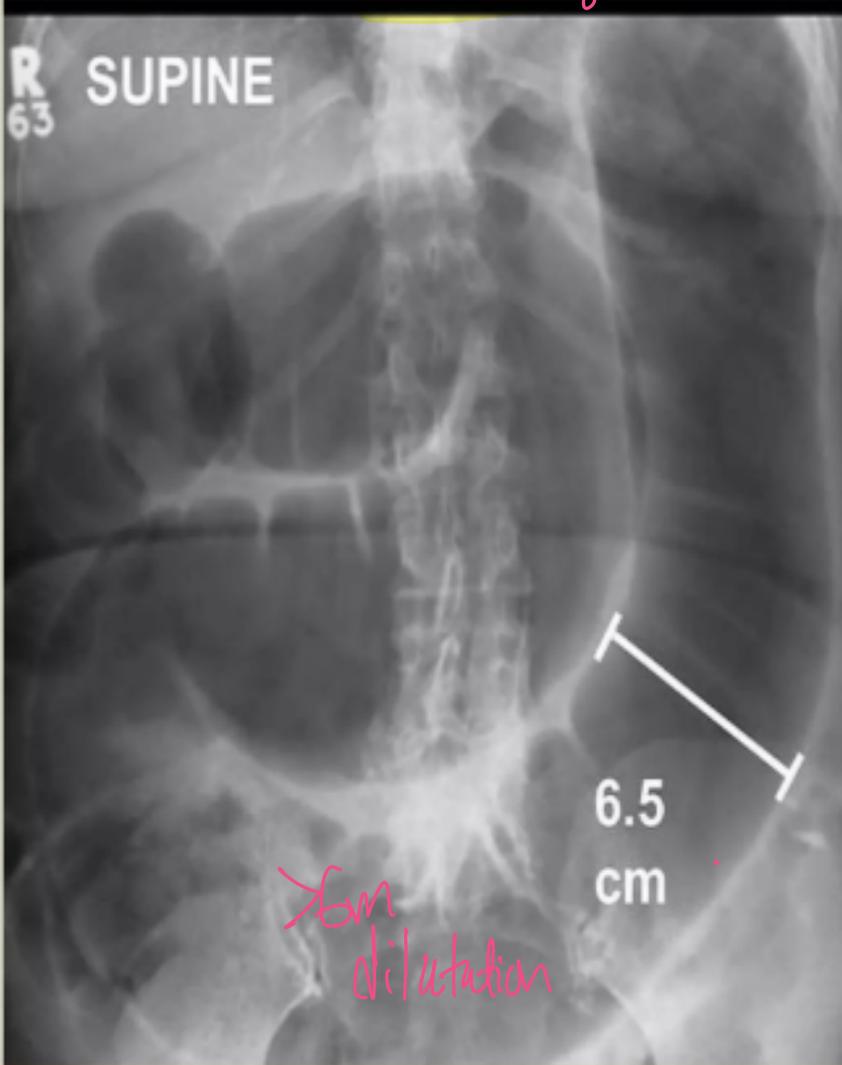
9 CM

no specific sign

**Toxic Megacolon Abdominal X-ray - large bowel obstruction.**

R  
63

SUPINE



6.5  
cm

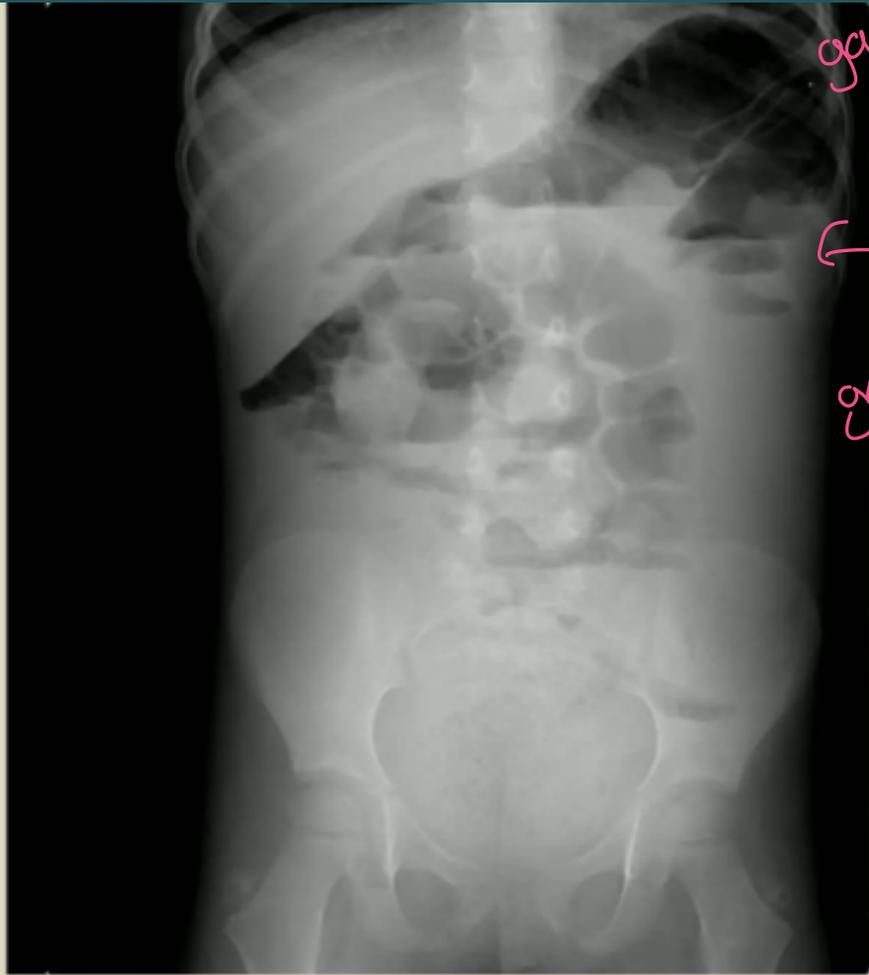
>6cm  
dilatation

UPRIGHT



incomplete rings = haustra

**(Large Bowel) Obstruction.**



gas ✓

gas x

cut-off

وجاءت بدموع  
والعبرين  
الدموي

**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'

(emergency)

closed on both proximal

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.

+ distal seg.

## Sigmoid volvulus (MC)

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**.

CPX is  
twisted ischaemia → right upper

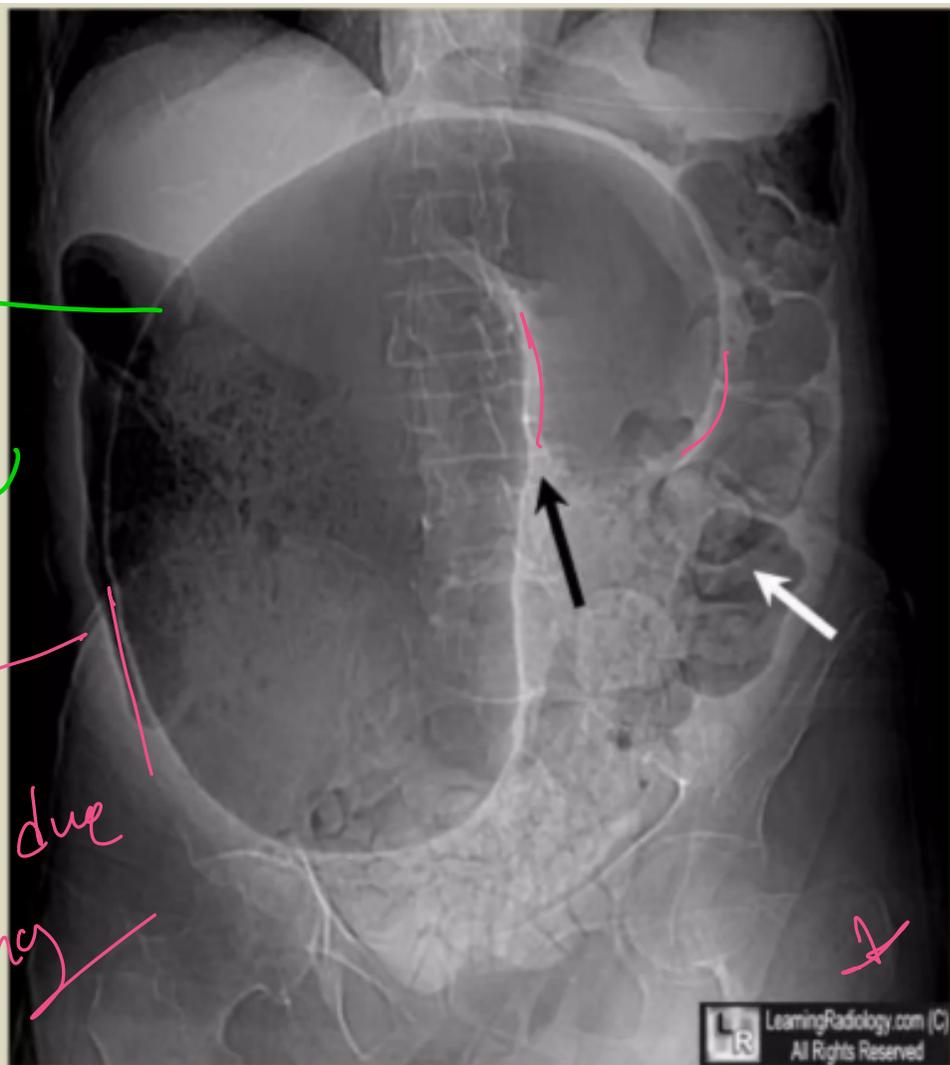


**Coffee-bean Sign** - plain film showing dilated sigmoid colon in sigmoid volvulus.

Radio-report:-

Large dilated  
Bowel  
(Coffee-Bean Sign)

closed loops due  
to twisting



3 wall sign

(wall)  
هذا الجزيء  
لنقوا في  
بعض

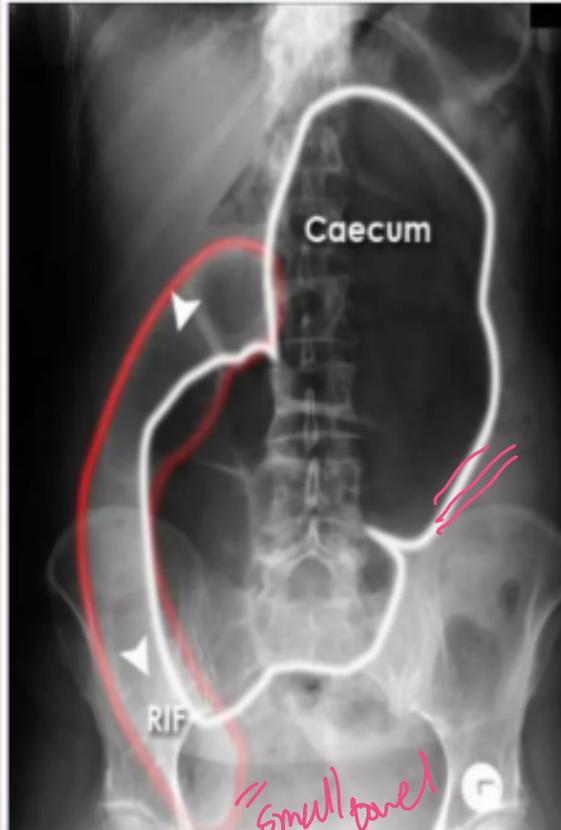
Sigmoid Volvulus.

**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.

منه  
منه

### Caecal volvulus

Hover on/off image to show/hide findings



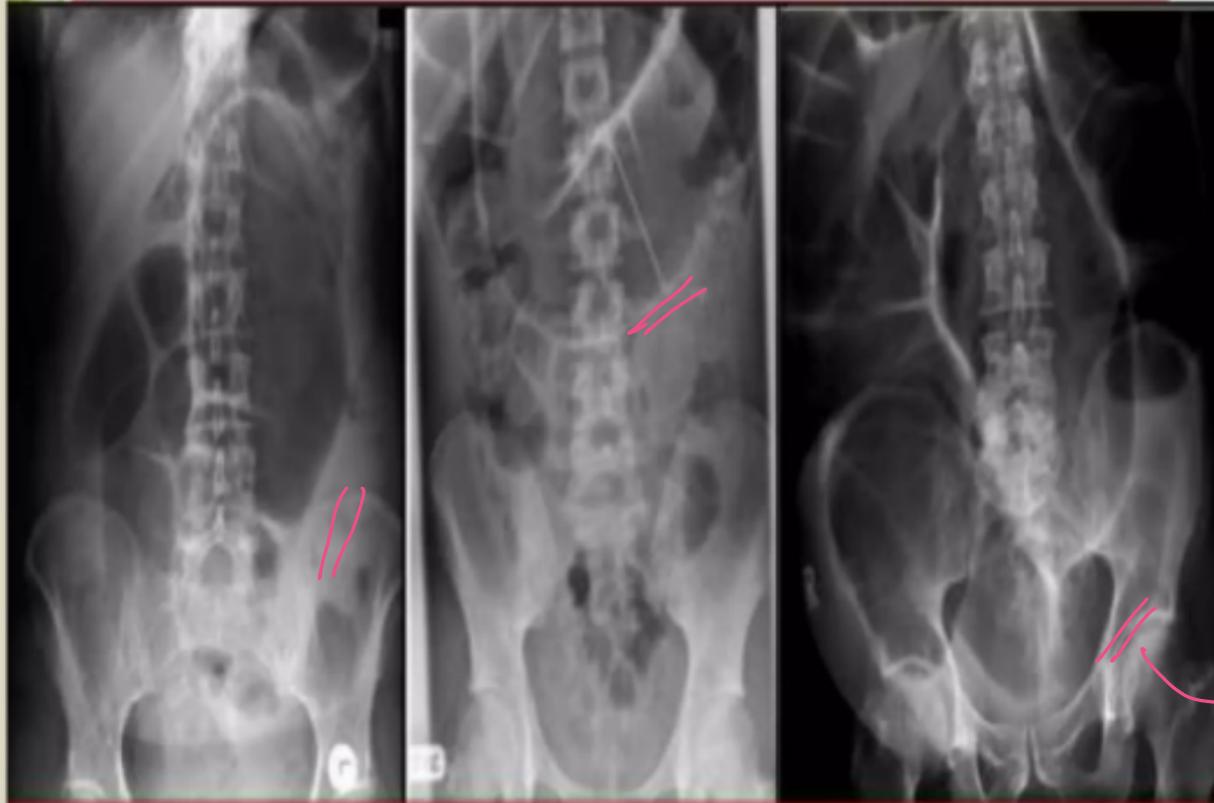
لا فين ع ريف 2 loops

### 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

= 3 wall sign

الدَّيْبَةُ عِنْدَ  
الْسِّيْجُودِ

# **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

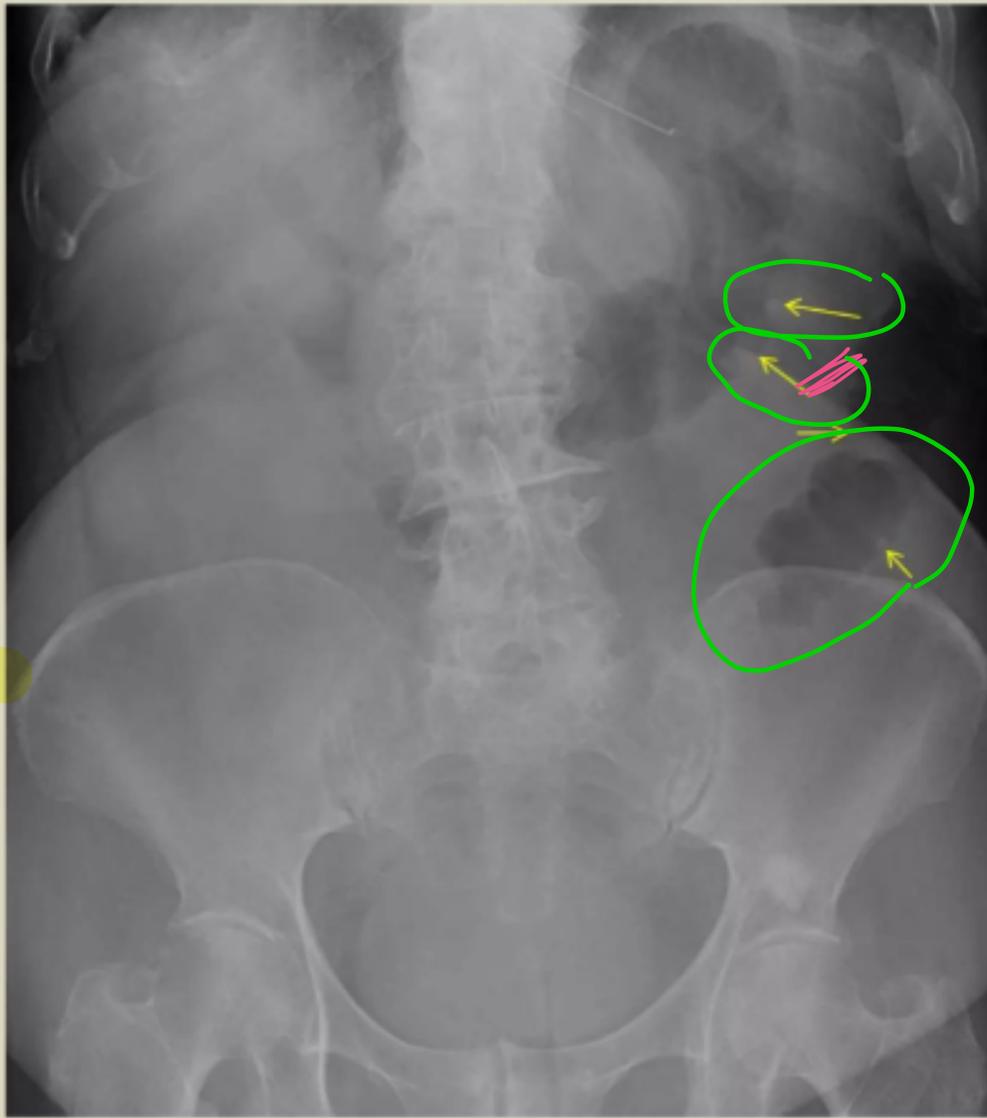


### Mucosal thickening - 'thumbprinting'

- ◆ 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.'

<sup>o</sup>  
in  
inflammation  
UC

**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



severe chronic inflammation

### 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.

→ it's a narrow stiff Bowel (without obstruction)

# Toxic megacolon

Hover on/off image to show/hide findings



description

no Px

## 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).