

Basic Interpretations of Abdominal Radiographs (2)

腹部X光片基本判讀須知

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What is normal?

- **Stomach**
 - Almost always air in stomach
- **Small bowel**
 - Usually small amount of air in 2 or 3 loops
- **Large bowel**
 - Almost always air in rectum and sigmoid
 - Varying amount of gas in rest of large bowel



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Normal air-fluid levels

- **Stomach**
 - Always (upright, decub)
- **Small bowel**
 - Two or three levels acceptable (upright, decub)
- **Large bowel**
 - None normally (functions to remove fluid)



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Large vs small bowel

- **Large bowel**
 - Peripheral (except RUQ occupied by liver)
 - Haustral markings don't extend from wall to wall
- **Small bowel**
 - Central
 - Valvulae conniventes extend across lumen and are spaced closer together

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Abnormal Gas Patterns

- **Functional ileus**
 - One or more bowel loops become aperistaltic usually due to local irritation or inflammation
 - Localized "sentinel loops" (one or two loops)
 - Generalized (all loops of large and small bowel)
- **Mechanical obstruction**
 - Intraluminal or extraluminal
 - Small bowel obstruction
 - Large bowel obstruction

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Localized ileus Key features

- One or two *persistently* dilated loops of small or large bowel (multiple views)
- Often air-fluid levels in sentinel loops
- Local irritation, ileus in same anatomical region as pathology
- Gas in rectum or sigmoid
- May resemble early SBO

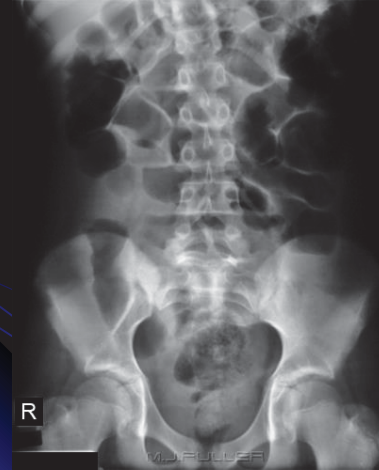


Causes of Localized Ileus by location

SITE OF DILATED LOOPS	CAUSE
Right upper quadrant	Cholecystitis
Left upper quadrant	Pancreatitis
Right lower quadrant	Appendicitis
Left lower quadrant	Diverticulitis
Mid-abdomen	Ulcer or kidney/ureteric calculi

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Generalized adynamic ileus



The large and small bowel are extensively air-filled but not dilated.

The large and small bowel "look the same".

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Generalized ileus Key features

- Entire bowel aperistaltic/hypoperistaltic
- Dilated small bowel and large bowel to rectum (with LBO no gas in rectum/sigmoid)
- Long air-fluid levels

CAUSE	REMARK
*Postoperative	Usually abdominal surgery
Electrolyte imbalance	Diabetic ketoacidosis

* almost always

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Mechanical small bowel obstruction (SBO)

- Dilated small bowel
- Fighting loops (visible loops, lying transversely, with air-fluid levels at different levels)
- Little gas in colon, especially rectum

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SBO Erect

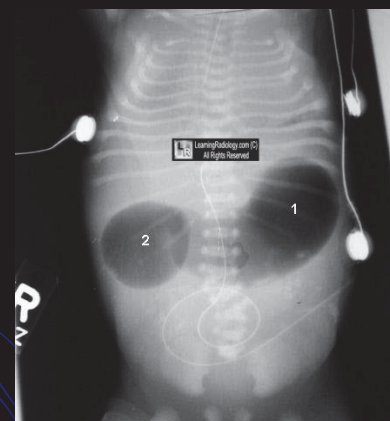


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SBO Supine

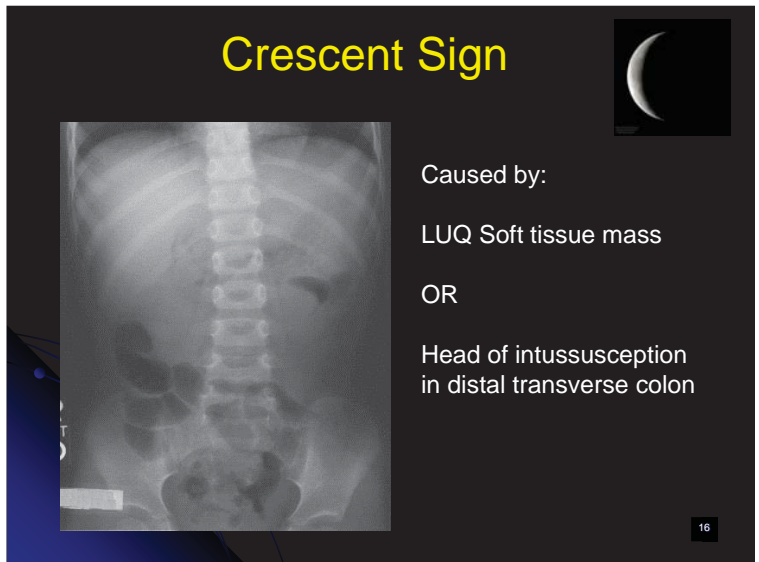
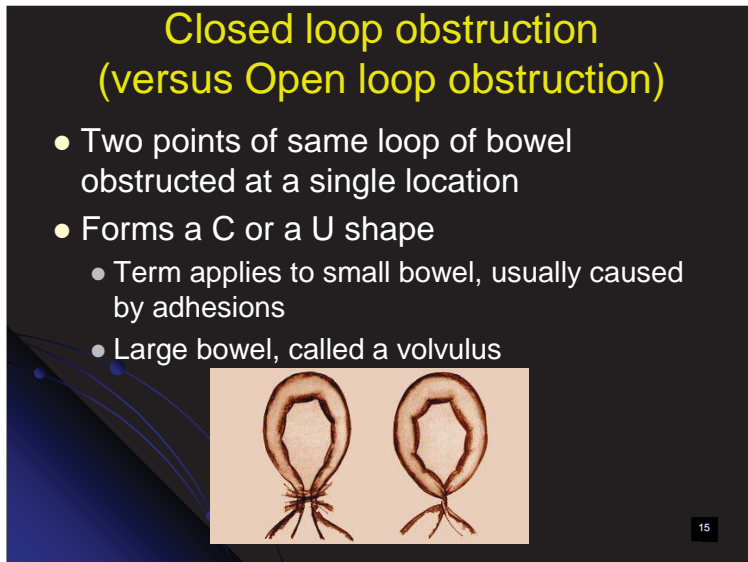
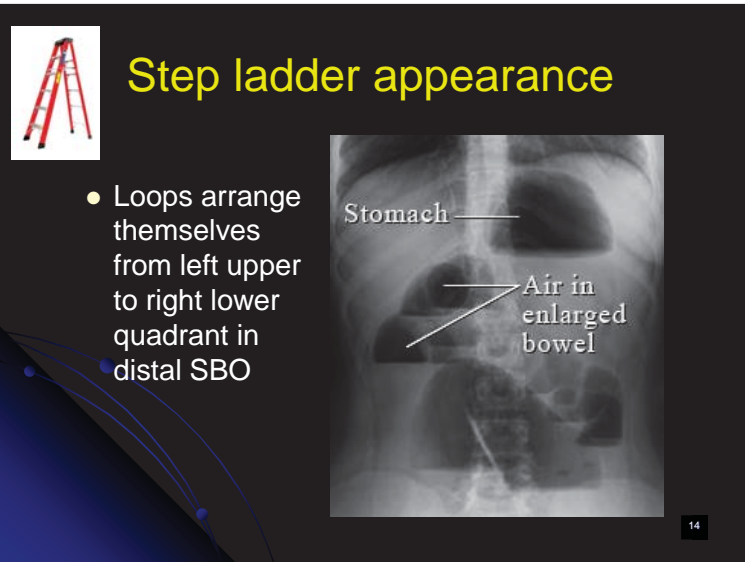


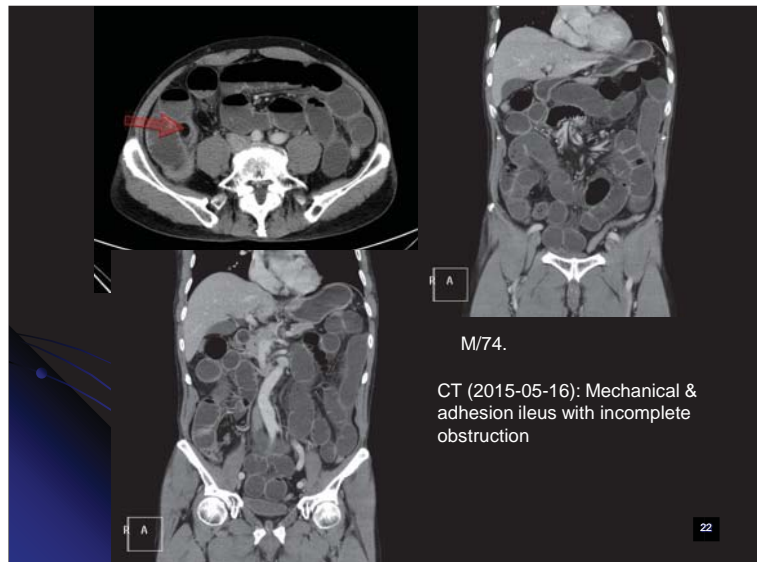
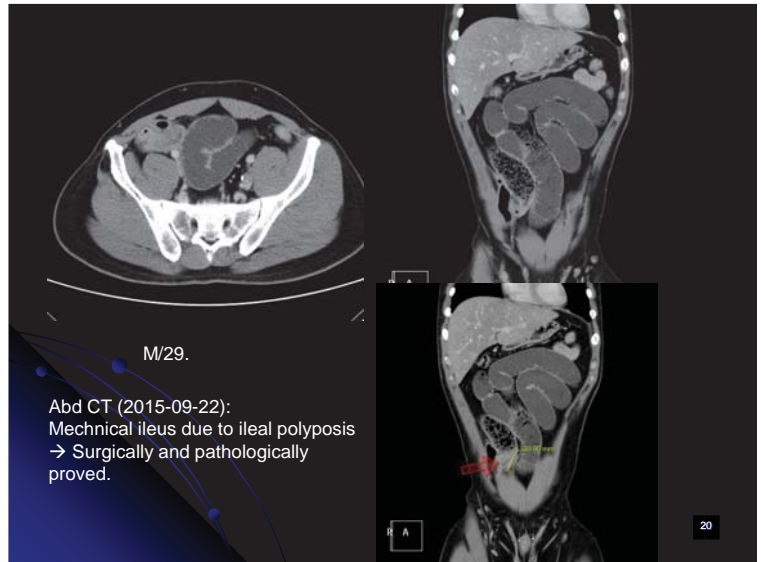
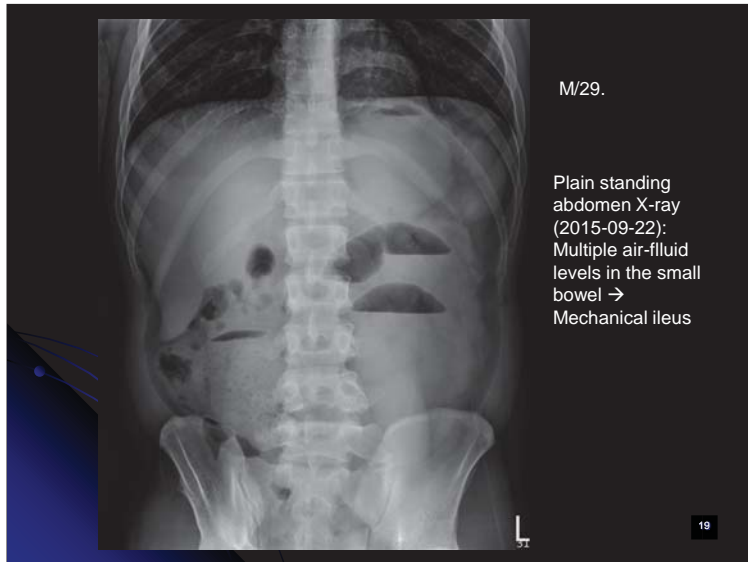
Double Bubble Sign



Duodenal Atresia

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Mechanical LBO

- Colon dilates from point of obstruction backwards
- Little/no air fluid levels (colon reabsorbs water)
- Little or no air in rectum/sigmoid



Causes of Mechanical LBO

TUMOR
VOLVULUS
HERNIA
DIVERTICULITIS
INTUSSUSCEPTION

Crescent Sign



Caused by:

LUQ Soft tissue mass

OR

Head of intussusception
in distal transverse colon

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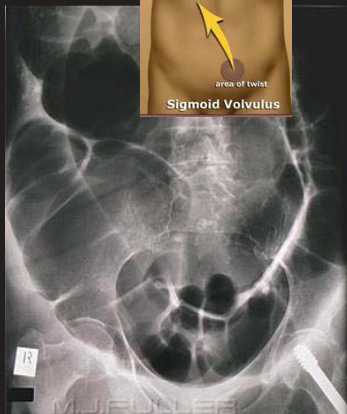
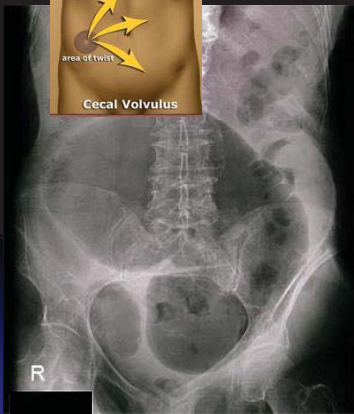


M/78.
KUB (2013-01-17)

Left inguinal
hernia of
bowel

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Volvulus



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M/88.
KUB (2012-08-27)

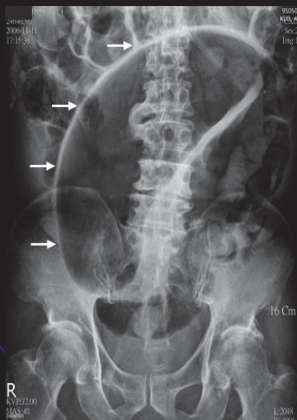
Volvulus of
sigmoid colon

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Coffee Bean Sign

Sigmoid volvulus

Massively
dilated
sigmoid loop



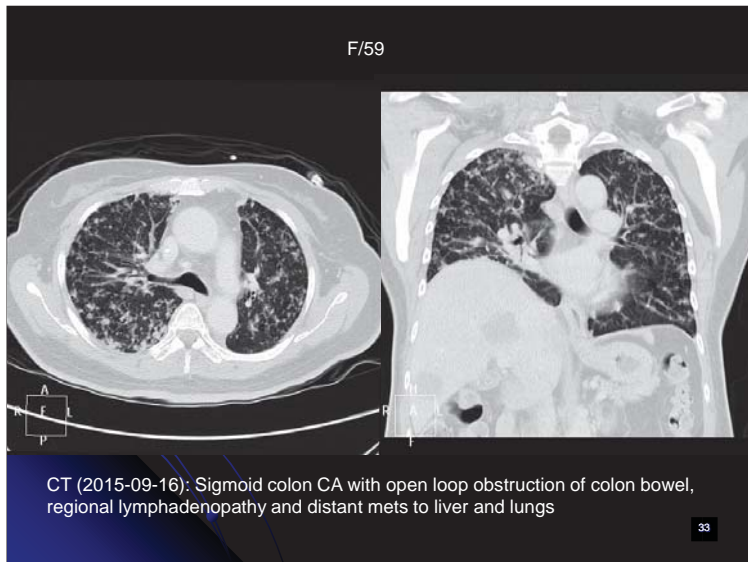
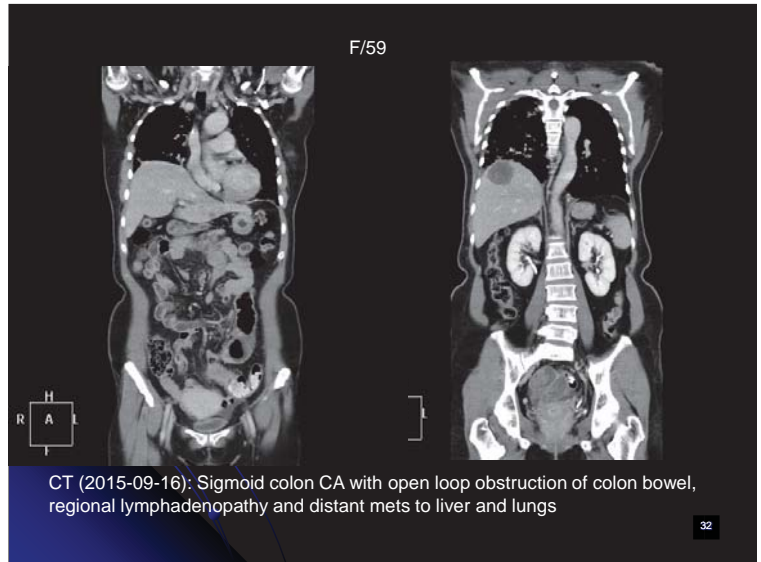
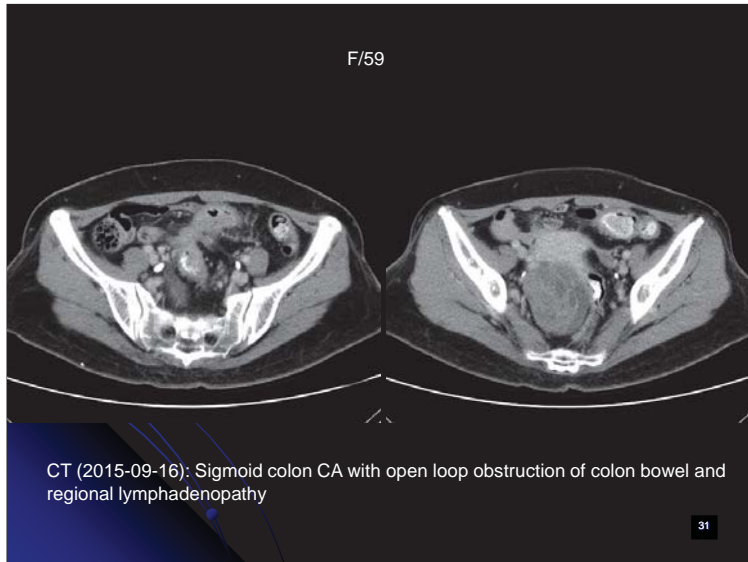
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F/59

Standing abdomen X-ray (2015-10-22): "Stepladder sign"
→ mechanical ileus of bowel

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Abnormal gas collections and abdominal fluid

- Intraperitoneal
- Extraperitoneal
- Inflammation or infection
- Ascites

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Extraluminal air

• TYPES

- Pneumoperitoneum/free air/intraperitoneal air
- Retroperitoneal air
- Air in the bowel wall (pneumatosis intestinalis)
- Air in the biliary system (pneumobilia)

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Upright film best

- The patient should be positioned sitting upright for **10-20 minutes** prior to acquiring the erect chest X-ray image.
- This allows any free intra-abdominal gas to rise up, forming a crescent beneath the diaphragm. It is said that as little as **1ml** of gas can be detected in this way.

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Intraperitoneal Free Air Causes

- Rupture of a hollow viscus
 - Perforated peptic ulcer
 - Trauma
 - Perforated diverticulitis (usually seals off)
 - Perforated carcinoma
- Post-op 5-7 days normal, should get less with successive studies *NOT ruptured appendix (seals off)

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Signs of intraperitoneal free air

- Crescent sign
- Chilaiditis sign
- Riglers (and False Rigler's)
- Football sign
- Falciform ligament sign
- Triangle sign
- Cupola sign
- Lesser sac sign

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M/21
Abdominal pain

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M/21
Abdominal pain

Subphrenic free air
→ Perforation of hollow organ

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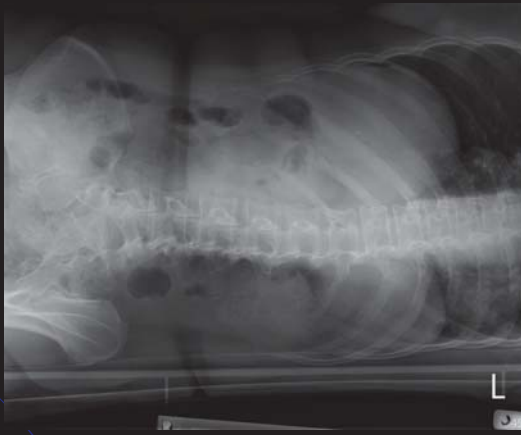


F/54.
Abdominal pain,
Standing CXR
(2015-10-08)

Minimal amount of
right subphrenic
free air

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F/54.
Abdominal pain

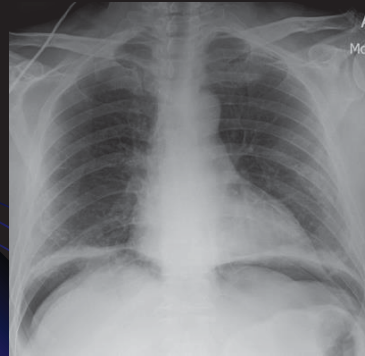


Abdomen radiograph in left decubitus view (2015-10-08) → Pneumoperitoneum
→ Intraperitoneal hollow organ perforation → Perforation of duodenal ulcer

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Crescent Sign

Free air under the diaphragm



Best demonstrated on
upright chest x rays or
left lat decub

Easier to see under
right diaphragm

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M/80.
Acute abdominal pain

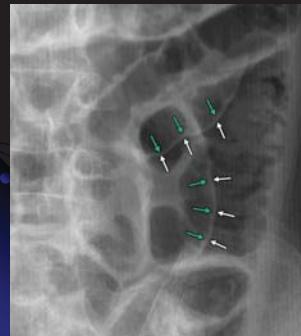
Pneumoperitoneum



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Rigler's Sign

Bowel wall visualised on both sides due to intra and extraluminal air
Usually large amounts of free air
May be confused with overlapping loops of bowel, confirm with upright view



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Football Sign



Pediatric

Seen with massive
pneumoperitoneum
Most often in children
with necrotising
enterocolitis

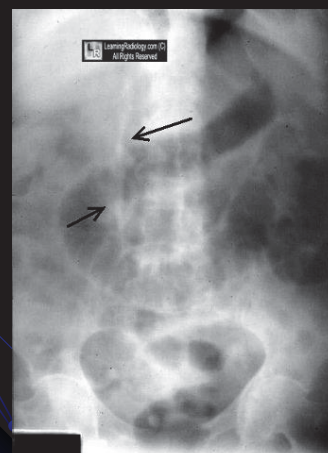
In supine position
air collects anterior
to abdominal
viscera



Adult

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Falciform ligament sign



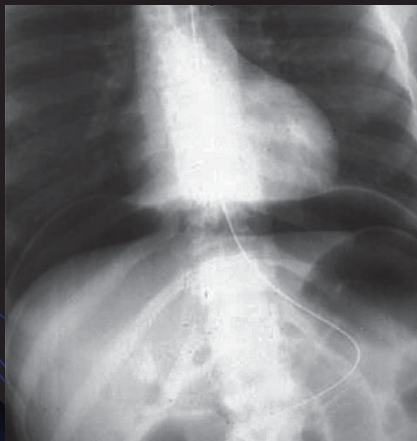
Normally
invisible.

Supine film, free
air rises over
anterior surface
of liver

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Continuous diaphragm sign

Sufficient free air, left and right hemi-diaphragms appear continuous



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Triangle Sign

- The triangle sign refers to small triangles of free gas that can typically be positioned between the large bowel and the flank



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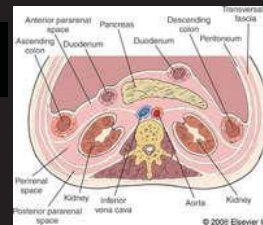
Retroperitoneal Air

- Recognized by:
 - Streaky, linear appearance outlining retroperitoneal structures
 - Mottled, blotchy appearance
 - Relatively fixed position
- May outline:
 - Psoas muscles
 - Kidneys, ureters, bladder
 - Aorta or IVC
 - Subphrenic spaces

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Causes of retroperitoneal air

- Bowel perforation (appendix, ileum, colon)
- Trauma (blunt or penetrating)
- Iatrogenic
- Foreign body
- Gas producing infection



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Pneumoretroperitoneum

- This patient has free air in the retroperitoneal space. The air is seen surrounding the lateral border of the right kidney (white arrow). There is other evidence of free gas including Rigler's sign.
- If you are not confident that the appearance is pneumoretroperitoneum, you can try an erect and decubitus view to see if the gas moves. If the gas is seen to move, it's not in the retroperitoneum.



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M/46.
Right flank pain.
KUB (2014-01-18).



CT (2014-02-04)
Rt perirenal abscess

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Causes of air in bowel wall

- **Primary Pneumatosis cystoides intestinalis (rare)**
 - usually affects left colon
 - Produces cyst-like collections of air in the submucosa or serosa
- **Secondary**
 - Diseases with bowel wall necrosis
 - Obstructing lesions of the bowel that raise intraluminal pressure
- **Complications**
 - Rupture into peritoneal cavity
 - Dissection of air into portal venous system

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Air in the bowel wall

- **Signs**
 - Best seen in profile producing a **linear lucency that parallels the bowel**
 - Air en face has a **mottled appearance** resembling gas mixed with feculent material

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Pneumatosis intestinalis

- Intramural air, best appreciated in profile



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Air in the biliary tree

- One or two tube-like branching lucencies in the RUQ, conform to location of major bile ducts



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Biliary vs Portal Venous Air



- Portal venous air usually associated with bowel necrosis
- Air is peripheral rather than central
- Numerous branching structures

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CT (2015-03-03):
Liver abscess with gas formation
→ Percutaneous catheter drainage

F/71. Abdominal pain and fever.
CXR including upper abdomen (2015-03-03)

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