Basic Interpretations of Abdominal Radiographs (2)

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

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)

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

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

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

<table>
<thead>
<tr>
<th>SITE OF DILATED LOOPS</th>
<th>CAUSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right upper quadrant</td>
<td>Cholecystitis</td>
</tr>
<tr>
<td>Left upper quadrant</td>
<td>Pancreatitis</td>
</tr>
<tr>
<td>Right lower quadrant</td>
<td>Appendicitis</td>
</tr>
<tr>
<td>Left lower quadrant</td>
<td>Diverticulitis</td>
</tr>
<tr>
<td>Mid-abdomen</td>
<td>Ulcer or kidney/ureteric calculi</td>
</tr>
</tbody>
</table>

Generalized adynamic ileus
The large and small bowel are extensively air-filled but not dilated.
The large and small bowel "look the same".

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

<table>
<thead>
<tr>
<th>CAUSE</th>
<th>REMARK</th>
</tr>
</thead>
<tbody>
<tr>
<td>*Postoperative</td>
<td>Usually abdominal surgery</td>
</tr>
<tr>
<td>Electrolyte imbalance</td>
<td>Diabetic ketoacidosis</td>
</tr>
</tbody>
</table>

* almost always

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

SBO Erect
SBO Supine

Double Bubble Sign
Duodenal Atresia
Closed loop obstruction (versus Open loop obstruction)

- Two points of same loop of bowel obstructed at a single location
- Forms a C or a U shape
  - Term applies to small bowel, usually caused by adhesions
  - Large bowel, called a volvulus

Crescent Sign

Caused by:
LUQ Soft tissue mass
OR
Head of intussusception in distal transverse colon
M/29.

Plain standing abdomen X-ray (2015-09-22):
Multiple air-fluid levels in the small bowel → Mechanical ileus

Abd CT (2015-09-22): Mechanical ileus due to ileal polyposis → Surgically and pathologically proved.

M/29.

Abdominal pain. KUB (2015-05-16)
Status post appendectomy → Mechanical ileus

M/74.

CT (2015-05-16): Mechanical & adhesion ileus with incomplete obstruction

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

**Volvulus**

- Cecal Volvulus
- Sigmoid Volvulus

**Coffee Bean Sign**

Sigmoid volvulus

Massively dilated sigmoid loop

**Left inguinal hernia of bowel**

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

**Volvulus of sigmoid colon**

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

**Standing abdomen X-ray (2015-10-22): “Stepladder sign”**

F/59

- Mechanical ileus of bowel
Abnormal gas collections and abdominal fluid

- Intraperitoneal
- Extraperitoneal
- Inflammation or infection
- Ascites

Extraluminal air

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

**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)*

**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

**M/21**

Abdominal pain

Subphrenic free air ➔ Perforation of hollow organ

**F/54**

Abdominal pain, Standing CXR (2015-10-08)

Minimal amount of right subphrenic free air
F/S4.
Abdominal pain

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

Crescent Sign
Free air under the diaphragm

Best demonstrated on upright chest x rays or left lat decub
Easier to see under right diaphragm

M/80.
Acute abdominal pain

Pneumoperitoneum

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

Football Sign
Seen with massive pneumoperitoneum
Most often in children with necrotising enterocolitis
In supine position air collects anterior to abdominal viscera

Falciform ligament sign
Normally invisible.
Supine film, free air rises over anterior surface of liver
**Continuous diaphragm sign**
- Sufficient free air, left and right hemi-diaphragms appear continuous.

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

**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

**Causes of retroperitoneal air**
- Bowel perforation (appendix, ileum, colon)
- Trauma (blunt or penetrating)
- Iatrogenic
- Foreign body
- Gas producing infection

**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.

**Patient Information**
- M/46.
- Right flank pain.
- CT (2014-02-04) Rt perirenal abscess.
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

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

Pneumatosis intestinalis

- Intramural air, best appreciated in profile

Air in the biliary tree

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

Biliary vs Portal Venous Air

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

F/F1, Abdominal pain and fever.
CXR including upper abdomen (2015-03-03)
CT (2015-03-03): Liver abscess with gas formation → Percutaneous catheter drainage
Abdominal masses and Foreign bodies

M/69
Massive ascites. Centralization of small bowel

F/74, abdominal discomfort
Massive ascites. Centralization of small bowel

F/57.
KUB (2015-09-16)
Pleomorphic Calcifications

F/57.

F/78. KUB
Calcified uterine myomas

F/53. KUB
Calcified uterine myomas
Chondrosarcoma at the right retroperitonum

Miss-swallowing of a coin passing through the stomach.

Gossypiboma

Pregnancy with a fetus

Thank for your attention!