Definition

- Acute abdominal pain: defined as acute abdominal pain unrelated to trauma

- It is one of the most common conditions in the hospital emergency department.

- It is a syndrome characterized by the sudden onset of severe abdominal pain, requiring early medical or surgical treatment.
Causes

- **GB:** Acute cholecystitis & biliary colic - US
- **Pancreas:** Acute pancreatitis - US & CT
- **Stomach & Duodenum:** Gastritis & Peptic Ulcer
- **Spleen:** Spleenic infarction – US & CT
- **Liver:** Amebic liver abscess. Spontaneous rupture of hepatic neoplasm - US & CT
- **Renal:** Renal colic & Stones –US & CT
- **Ovaries:** ovarian cyst, torsion - US
- **Bowel:**
  - Acute appendicitis - US & CT
  - Bowel obstruction – X-ray, US & CT
  - Acute diventricular disease - CT
Common causes of acute pain in an abdominal quadrant

Right upper quadrant:

- Acute calculous / non calculous Cholecystitis.
- Amebic liver abscess.
- Spontaneous rupture of hepatic neoplasm.
- Myocardial infarction.
Common causes of acute pain in an abdominal quadrant

**Left upper quadrant:**

- Splenic infarction.
- Splenic abscess.
- Gastritis.
- Gastric ulcer.
Common causes of acute pain in an abdominal quadrant

**Right lower quadrant:**
- Acute appendicitis.
- Acute terminal ileitis.
- Acute typhlitis.
- Pelvic inflammatory disease.
- Complications of ovarian cyst.
- Endometriosis.
- Ectopic pregnancy.
Common causes of acute pain in an abdominal quadrant

**Left lower quadrant:**
- Diverticulitis.
- Epiploic appendagitis.
Pancreatitis

Ulcer

Diverticulitis

Cholecystitis

Appendicitis

Pancreatitis

Ulcer

Diverticulitis

Appendicitis
Approach

- Detailed History..
- Physical Examination..
- Investigations..
  - Hematological, Serological, chemicals, etc
  - Radiological
    - X-ray
    - US
    - CT
Bowel Obstruction
General Considerations

- Clinical assessment is often difficult.
- Laboratory investigations are often non-specific.

Clinical presentation

- Abdominal pain, distension & constipation.
- Nausea & Vomiting
- Failure to pass flatus

On examination:

- Negative bowel sound
- Tenderness
- Systemic symptoms.
General Considerations

**Imagining Modalities**

- Plain X-ray
- Ultrasoundography
- CT examinations
- Contrast studies
Plain Radiograph
Plain Abdominal X-Ray

*Plain radiographs of the abdomen* is the initial radiological approach, but had a significant diagnostic limitations (may confirm the diagnosis but lack of specificity – cannot detect the cause in most of cases).

**X-ray in general:**
- Cheap
- Easy and rapid
- Widely available
- Good diagnostic value
Value of CT

- CT is clearly superior to plain radiography
- CT can:
  - Confirming the diagnosis (site and level)
  - Revealing the cause of bowel obstruction
  - Detecting pneumoperitoneum
  - Identifying ureteric stones.
  - Examining solid organs.
- The major obstacle of CT vs plain abdominal radiography appears to be regarding:
  - Cost
  - Availability
  - Radiation dose
How to examine the X-ray

- Firstly, you should know that:
- There are 5 basic radiographic densities

1. Black—gas
2. Dark gray—fat
3. Gray—soft tissues
4. White—calcified structures & Bones
5. Dense white—metallic objects
How to examine the X-ray

- Gas pattern
  - Air fluid level
  - Extra-luminal air

- Soft tissue masses

- Calcular shadows

- Calcifications

- Skeletal pathology
Normal Gas Pattern

- **Stomach**
  - Always

- **Small Bowel**
  - Two or three loops of non-distended bowel
  - Normal diameter = 2.5 cm

- **Large Bowel**
  - In rectum or sigmoid – almost always
Gas in stomach

Gas in a few loops of small bowel

Gas in rectum or sigmoid

Normal Gas Pattern
Normal Fluid Levels

- **Stomach**
  - Always (except supine film)

- **Small Bowel**
  - Two or three levels possible

- **Large Bowel**
  - None normally
Erect Abdomen

Always air/fluid level in stomach

A few air/fluid levels in small bowel

Erect Abdomen
Large vs. Small Bowel

- **Large Bowel**
  - Peripheral
  - Haustral markings are thick don't extend from wall to wall

- **Small Bowel**
  - Central
  - Valvulae are thin & extend across lumen
Bowel obstructions

- Bowel obstructions are common and account for 20% of admissions with surgical abdomens.

- Radiology is important in confirming the diagnosis and identifying the underlying cause.
Bowel Obstruction

1. Functional Obstruction
   - Sentinel loop
   - Post operative ileus
   - Adynamic (paralytic) ileus

2. Mechanical Obstruction
   - SBO
   - LBO
Functional Obstruction
Functional Obstruction
(Sentinel loop, Post operative ileus, Adynamic (paralytic) ileus)

- Failure of passage of enteric contents through small bowel and colon that is not mechanically obstructed.
- Occur due to the paralysis of intestinal motility.

**Radiographic Features**

- Gas in dilated small bowel and large bowel to rectum (Generalized, uniform, gaseous distension of the large and small bowel).
- Involvement of large bowel and lack of a transition point help distinguish it from *small bowel obstruction*
- Long air-fluid levels
### Functional Obstruction
(Sentinel loop, Post operative ileus, Adynamic (paralytic) ileus)

- when localized, it will be: **sentinel loop**
- **Post operative ileus** is normal and expected finding after abdominal surgery.
- Recovery times have been reported at:
  - small intestine: 0-24 hours
  - stomach: 24-48 hours
  - colon: 48-72 hours
- Prolonged postoperative ileus (>72 hours) has been termed "**paralytic**" ileus by some and is concerning for small bowel obstruction, bowel perforation, peritonitis and intra-abdominal abscess.
Localized Ileus

Key Features

- One or two persistently dilated loops of large or small bowel
- Gas in rectum or sigmoid

Sentinel Loops
Localized Ileus

Pitfalls

- May resemble early mechanical SBO
  - Clinical course
  - Get follow-up
Generalized Ileus

Key Features

- Gas in dilated small bowel and large bowel to rectum
- Long air-fluid levels
- Only post-op patients have generalized ileus

Other causes:-
- Peritonitis
- Hypokalemia
- Metabolic disorder as hypothyroidism
- Vascular occlusion
Generalized Adynamic Ileus
Is It An Ileus?

- Is the patient immediately post-op?
- Are the bowel sounds absent or hypoactive?
Mechanical Obstruction
SBO & LBO
Small bowel obstruction

- Small bowel obstruction (SBO) accounts for 80% all mechanical intestinal obstruction; the remaining 20% result from large bowel obstruction.
- It has a mortality rate of 5.5%.

Clinical presentation
- Classical presentation is constipation, increasing abdominal distension with nausea and vomiting.
Radiograph features of SBO

- Abdominal radiographs are only 50-60% sensitive for small bowel obstruction.
- In most cases, the abdominal radiograph will have the following features:
  - Dilated small bowel loops proximal to the obstruction.
  - Predominantly central dilated loops.
  - Three instances of dilatation over 3 cm.
  - Valvulae conniventes are visible.
  - Fluid levels if the study is erect.
  - Fighting loops.
  - Little gas in colon, especially rectum.
CT is more sensitive than radiographs and will demonstrate the cause in ~80% of cases.

There are variable criteria for maximal small bowel obstruction, but 3.5 cm is a conservative estimate of dilated bowel.
Mechanical SBO

Causes

- Adhesions
- Hernia*
- Volvulus
- Gallstone ileus*
- Intussusception

*Cause may be visible on plain film
Mechanical SBO

Pitfalls

- Early SBO may resemble localized ileus -get F/O
Large bowel obstruction

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

Clinical presentation

- Presentation is typically with abdominal pain, distension and failure of passage of flatus & stool.
- Eventually signs of peritonism, sepsis and shock develop, when *perforation occurs*. 
## Radiograph features of LBO

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colonic distension</td>
<td>Gaseous secondary to gas-producing organisms in faeces</td>
</tr>
<tr>
<td>Collapsed distal colon</td>
<td></td>
</tr>
<tr>
<td>Small bowel dilatation</td>
<td>Depends on duration of obstruction and incompetence of the ileocaecal valve</td>
</tr>
<tr>
<td>In advanced cases</td>
<td>One may see the signs of an ischemic colon:</td>
</tr>
<tr>
<td>Intramural gas</td>
<td>(pneumatosis coli)</td>
</tr>
<tr>
<td>Portal venous gas</td>
<td></td>
</tr>
<tr>
<td>Free intra-abdominal gas</td>
<td>(pneumoperitoneum)</td>
</tr>
</tbody>
</table>
Mechanical LBO

Causes

- Tumor
- Volvulus
- Hernia
- Diverticulitis
- Intussusception
Carcinoma of Sigmoid – LBO – Decompressed into SB
<table>
<thead>
<tr>
<th>Condition</th>
<th>Air in Rectum or sigmoid</th>
<th>Air in Small Bowel</th>
<th>Air in Large Bowel</th>
<th>Air in Large Bowel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Localized Ileus</td>
<td>Yes</td>
<td>2-3 distended loops</td>
<td>Air in rectum or sigmoid</td>
<td></td>
</tr>
<tr>
<td>Generalized Ileus</td>
<td>Yes</td>
<td>Multiple distended loops</td>
<td>Yes - Distended</td>
<td></td>
</tr>
<tr>
<td>SBO</td>
<td>No</td>
<td>Multiple dilated loops</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>LBO</td>
<td>No</td>
<td>None-unless ileocecal valve incompetent</td>
<td>Yes - Dilated</td>
<td></td>
</tr>
</tbody>
</table>
The goals of imaging in a patient with suspected intestinal obstruction have been defined and are as follows:

1. To confirm that it is a true obstruction and to differentiate it from an ileus.
2. To determine the level of obstruction.
3. To determine the cause of the obstruction.
4. To look for findings of strangulation.
5. To allow a good management either medically or surgically by laparoscopy or laparoscopy.
Air in biliary tree

Gallstone

Gallstone Ileus
Post-op C-section
Adynamic Ileus
Extra-luminal Air
Free Intra-peritoneal Air
Signs of Free Air - Pneumoperitoneum

1. Air under diaphragm
2. Rigler sign: Air on both sides of bowel wall
3. Falciform ligament sign
4. Air in the biliary system
The Rigler sign, also known as the double wall sign, is seen on an x-ray of the abdomen when 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.
The **falciform ligament sign** is a sign seen with a pneumoperitoneum.

It is almost never seen in isolation. If there is enough free air to outline the falciform ligament, there is usually enough air to also provide at least a **Rigler's sign**.

The falciform ligament connects the anterior abdominal wall to the liver. The ligament continues to extend inferiorly beyond the liver where it becomes the round ligament (white arrow). Given that the falciform ligament is situated against the anterior abdominal wall, it is not surprising that it becomes outlined with air in a supine patient with free abdominal gas.
Free Air
Causes

- Rupture of a hollow viscus
  - Perforated ulcer
  - Perforated diverticulitis
  - Perforated carcinoma
  - Trauma or instrumentation

- Post-op 5–7 days
Extraperitoneal Air
thank you