Bowel Obstruction: Imaging Update

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Acute Abdomen – Bowel Obstruction
## Bowel Obstruction

- 20% of hospital admissions for acute abdomen

### Small bowel obstruction (SBO) (80%)

**Etiologies** (Miller, Am J Surg 2000):
- Adhesions (74%)
- Crohn disease (7%)
- Neoplasias (5%)
- Other: abdominal wall & internal hernias, intussusception, gallstone, hematoma, bezoar

### Large bowel obstruction (LBO) (20%)

- Carcinoma (60%, most frequently sigmoid)
- Volvulus (sigmoid > cecum)
- Other: diverticulitis, intussusception, endometriosis, radiation colitis

## Bowel Obstruction: Four Relevant Questions

1. **Is mechanical obstruction present?**
   
   DDx: adynamic ileus (laparotomy, pancreatitis, peritonitis, mesenteric ischemia, neuroleptics, opiates)

2. **Site (small bowel / large bowel)?**

3. **Cause?**

4. **Any complications?**
   
   Simple (wall viability not compromised) or strangulation obstruction (compromised vascular supply ⇒ intestinal ischemia)?

Urgent surgery or conservative management?
## Abdominal Plain Film (APF) vs CT

<table>
<thead>
<tr>
<th>Condition</th>
<th>APF (N=871)</th>
<th>CT (N=188)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bowel obstruction</td>
<td>49%</td>
<td>75%</td>
</tr>
<tr>
<td>Urolithiasis</td>
<td>9%</td>
<td>68%</td>
</tr>
<tr>
<td>Pancreatitis</td>
<td>0%</td>
<td>60%</td>
</tr>
<tr>
<td>Appendicitis</td>
<td>0%</td>
<td>50%</td>
</tr>
<tr>
<td>Pyelonephritis</td>
<td>0%</td>
<td>40%</td>
</tr>
<tr>
<td>Diverticulitis</td>
<td>0%</td>
<td>25%</td>
</tr>
<tr>
<td>Intraabdominal foreign body</td>
<td>90%</td>
<td></td>
</tr>
</tbody>
</table>

(Ahn, Radiology 2002)
Bowel Obstruction: APF vs CT

- APF: presence of bowel obstruction
  CT: site & cause of bowel obstruction
- MDCT: coronal reformations in addition to transverse views enhance confidence in diagnosis of SBO (Jaffe, Radiology 2006)
- APF: rarely findings of ischemia or infarction when strangulation present
- CT: 95% NPV exclusion of strangulation (Balthazar, Radiology 1997)
Kidney-TPL 1 month ago

SB: distended (>2.5 cm) & collapsed loops
No mass at **transition zone**
⇒ adhesive SBO: adhesive bands unidentified on CT
(diagnosis of exclusion)

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Ventral incisional hernia;
**SB faeces sign** (phytobezoar) = indicator of SBO when associated with SB dilatation
Terminal ileum: wall thickening & layering enhancement → active disease

Crohn disease: typically partial obstruction

SBO: Crohn Disease

Circumferential adenocarcinoma distal ileum

SBO: Neoplasia
Incarceration → irreducible hernia (irreducible sac of jejunal loop)

Incarcerated hernia may strangulate, clinical diagnosis difficult in obese patients

Obturator hernia

- f:m = 5:1
- 7th-8th decade of life
Paraumbilical hernia:
- Related to diastasis of rectus abdominis muscle
- Risk factors: multiple pregnancies, obesity
- High prevalence for incarceration & strangulation
SBO: Incarcerated Ventral Incisional Hernia

10 days after abdominal hysterectomy

SBO: Ventral Incisional Hernia

Multiple laparotomies after resection of sigmoid colon

Incarceration?
Abdominal Wall & Internal Hernias

Abdominal wall: herniation of viscera through defect in abdominal wall (inguinal, femoral, ventral, lumbar, obturator, incisional)
  ⇒ 95% visible or palpable
  ⇒ CT for detection of unsuspected sites, in obese patients
Internal: less common, herniation of viscera through developmental or surgically created defect of peritoneum / omentum / mesentery
  ⇒ diagnosis always based on radiology
SBO: Internal Hernias

A paraduodenal
B foramen of Winslow
C intersigmoid
D pericecal
E transmesenteric
F retroanastomotic

(Martin, AJR 2006)

- Classic older literature: paraduodenal most common, pericecal second most common
- Increasing incidence of transmesenteric, transmesocolic & retroanastomotic ⇒ new surgical procedures (Roux-en-Y loop in liver TPL & gastric bypass)

SBO: Pericecal Hernia
SBO: Pericecal Hernia

SBO: Retroanastomotic Hernia After Gastric Bypass

Mesenteric swirl best single predictor
(Lockhart, AJR 2007)
SBO: Intussusception

Mesenteric fat & vessels in bowel lumen ("bowel-within-bowel appearance")
Lead point: jejunal melanoma metastasis

Subdiaphragmatic melanoma metastasis, left renal cyst

SBO: Diagnosis?

[Images of diagnostic imagery showing intussusception and potential lead points]
1. Small bowel tumor ?
2. Impacted gallstone ?
3. Intussusception ?
4. Bowel ischemia ?
Rigler Triad in gallstone ileus: SBO, pneumobilia, ectopic gallstone

Bowel Obstruction

= 20% of hospital admissions for acute abdomen

Large bowel obstruction (LBO) (20%)
- Carcinoma (60%, most frequently sigmoid)
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- Other: diverticulitis, intussusception, endometriosis, radiation colitis
LBO: Annular Sigmoid Carcinoma

Rectal contrast = key for LBO diagnosis

Fecal Impaction (Coprostasis) ? (61 yo, m)
Decompensated LBO (61 yo, m)

Colon distended >6 cm, cecum largest

Adenocarcinoma transverse colon
Ischemic distention colitis of cecum

LBO: Fecal Impaction (Coprostasis)
LBO: Fecal Impaction (Coprostasis)

Most commonly in laxative abusers, psychiatric patients, severe generalized atherosclerosis / cerebral sclerosis.

High Grade LBO: Diverticulitis or Carcinoma?

Findings typical of diverticulitis:
- Long segment involved (>5 cm)
- Pericolic inflammation
- Symmetric wall thickening (75%)

Findings typical of carcinoma:
- Short segment involved
- Pericolic lymph nodes
LBO: Sigmoid Volvulus

“Northern exposure” sign
(Javors, AJR 1999)

“Inverted U” configuration

CT “whirl sign” ⇒ indicative of volvulus
LBO: Endometriosis

Rectosigmoid & cecum

Cecal perforation

LBO: Sigmo-Sigmoid Intussusception

Bowel within bowel, lead point = polyp (adenocarcinoma T2N0)
Ovarian carcinoma, surgery & radiotherapy 23 yrs ago: Ischemic radiation colitis of rectosigmoid

Complication of Bowel Obstruction: Ischemia

Mechanisms:
- Strangulation (predominantly venous disease)
- Prestenotic overdistension

CT findings:
- Bowel wall thickening >3 mm (non-specific)
- Bowel distention: interruption of peristaltic activity
- “Target sign”: alternating hypo- / hyperdense layers
  $\Rightarrow$ submucosal edema / hemorrhage
- Bowel wall non-enhancement $\Rightarrow$ specificity 96% (Taourel, Radiology 1996)
- Pneumatosis intestini & portomesenteric gas
- Mesenteric edema, ascites
SBO: Strangulation Ischemia

Appendectomy & cholecystectomy 54 yrs ago

Segmental ischemia & infarction of jejunum secondary to adhesive band

SBO: Strangulation Ischemia

Appendectomy 1 yr ago
Venous ischemia of ileum secondary to adhesive band
SBO: Strangulation Ischemia

Appendectomy & cholecystectomy several yrs ago

CT "whirl sign": strangulating SB volvulus
⇒ ischemia & infarction of jejunum
secondary to adhesive band

LBO: Overdistension Ischemia

LBO secondary to carcinoma
sigmoid colon T3N0;
synchronous carcinoma
ascending colon T3N2

Intraoperatively spontaneous perforation of
overdistended right colon ⇒ stercoral peritonitis
Bowel Obstruction: Conclusions

• CT instead of APF for early diagnosis
  (exception: sigmoid volvulus)

• MDCT: MPR improves visualization of transition
  prestenotic / poststenotic bowel ⇒ better
determination of site and cause of obstruction

• MDCT: improved visualization of bowel loops in
  suspected bowel wall ischemia secondary to
  strangulation or prestenotic overdistension