Mechanical Small Bowel Obstruction

Rose Kakoza, Harvard Medical School Year III
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Anatomy

- Esophagus
- Jejunum
- Ileum
- Stomach
- Duodenum
- Colon
- Appendix
- Rectum

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A mechanical blockage arising from a structural abnormality that presents a physical barrier to the progression of gut contents
Epidemiology

- ~ 20% of patients admitted for acute abdomen have an intestinal obstruction.
  - SBO is responsible for 80% of these cases.
- Adhesions and hernia are the most common causes of SBO
Etiology

1. Intraluminal

2. Intramural
   - Benign
   - Malignant

3. Extrinsic
Etiology

1. **Intraluminal:**

Foreign body
Bezoar
Gallstone
Wormball (*Ascaris lumbricoides*)
Fecal impaction
Etiology

2. Intramural:

Benign:

- Adenoma
- Leiomyoma
- Lipoma
- Intussusception
- Neonatal atresias and strictures
- Thickening of the bowel wall with luminal compromise may be seen, as in patients with Crohn disease
- Intramural hematoma
2. Intramural, continued:

Malignant

- Primary adenocarcinoma
- Metastases (notably gastric and colonic carcinomas, ovarian cancers, and malignant melanomas)
- Lymphoma
Etiology

3. Extrinsic:

Adhesions (~70%)
Hernia
Congenital intraperitoneal bands
Adjacent mass
Volvulus
Classification

- **Grading the Severity of Obstruction:**
  - Low-grade or incomplete obstruction
  - High-grade obstruction
  - Complete SBO
Simple Obstruction (Low grade)
- bowel obstruction with an intact blood supply

Strangulating obstruction (High grade, Complete)
- bowel obstruction with resultant ischemia
Terminology

- Closed-loop obstruction
  - High-grade

*Radiology* Balthazar et al. 185 (3): 769
Morbidity and Mortality

- Simple SBO is associated with a mortality rate of 3-5%.
- Strangulated/Ischemic SBO is associated with a mortality rate of up to 30%.

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Treatment

- Simple SBO: Conservative medical management

- Ischemic SBO: Surgery
Role of Imaging

- Distinguish simple from ischemic SBO.
ALGORITHM FOR ASSESSING SUSPECTED BOWEL OBSTRUCTION

Abdominal Pain, distension and vomiting

Abdominal Plain Films

Diagnostic

Abnormal with ominous findings e.g. closed loop obstruction, Ischemia, Impending Perforation

Treat

Normal

Low clinical suspicion

Observation

CT Abdomen

Nondiagnostic

UGI + SBFT

Diagnostic

Treat

Abnormal

High clinical suspicion

Suggestive of small bowel obstruction

CT Abdomen

Non-diagnostic

Barium Enema

Suggestive of large bowel obstruction

http://mycourses.med.harvard.edu/vp_view.asp?frame=Y&case_id={5C97C091-D5E1-4ECB-8703-FEED8B464757}
Key Questions

1. Is the small bowel obstructed?
2. Are there signs of ischemia?
3. What is the cause of the obstruction?
Abdominal Plain Films

- First line radiological test in suspected SBO
- Diagnostic of SBO in 50-60% of cases
  - False negative rate of up to 20%
- Better for diagnosis of high-grade obstruction
- Difficult to define the level of obstruction
Is the small bowel obstructed?
Abdominal Plain Film: Signs of Obstruction

- Mechanical Obstruction
  - Lumen >3 cm
  - Transition Point
Abdominal Plain Film: Signs of Obstruction

“The Rule of 3’s”

- Lumen > 3 cm
- Folds > 3 mm
- > 3 air-fluid levels

www.mypacs.net/cases/ SMALL-BOWEL-OBSTRUCTION-...
Abdominal Plain Film: Signs of Obstruction

- String of beads sign

Are there signs of ischemia?
Abdominal Plain Film: Signs of Ischemia

- Pseudotumor sign
What is the cause of the obstruction?
Abdominal Film: Identifying Cause

Companion Patient 5

www.medicine.cmu.ac.th/.../intussfig2-3.html
Abdominal CT

- Sensitivity for high-grade obstruction is 81-94%
- Sensitivity for low-grade obstruction is 48-50%
- Superior to abdominal X-ray, US and MRI for locating the site of obstruction
Is the small bowel obstructed?
Abdominal CT: Signs of SBO

- Lumen >3 cm
- Transition point
- Normal caliber post-stenotic bowel

Abdominal CT: Signs of SBO

- String of beads sign

Abdominal CT: Signs of SBO

- Small bowel feces sign

Radiology. 1997 Nov;205(2):519-22
Are there signs of ischemia?
Abdominal CT: Signs of Ischemia

- Target sign
- Intestinal pneumatosis


Companion Patient 9
Abdominal CT: Signs of Ischemia

- Local mesenteric congestion and hemorrhage

Abdominal CT: Signs of Ischemia

- The “beak sign”
  - Transition point

Radiology. 1997 Nov;205(2):519-22
Abdominal CT: Signs of Ischemia

- **Whirl sign**
  - Mesenteric rotation

Companion Patient 12

What is the cause of the obstruction?
Abdominal CT: Identifying Cause

- Most sensitive test for the cause of SBO
  - Can identify cause of obstruction in 73-95% of cases
- Adhesions are suspected if no lesion is seen at the transition point
Abdominal CT: Identifying Cause

- Signs of neoplasia
  - Peritoneal nodules
  - Ascites
  - Intrinsic mass


Companion Patients 13, 14, and 15
Small Bowel Follow-Through

- Useful for suspected low-grade obstruction
- Determining severity of obstruction

Companion Patient 16

http://brighamrad.harvard.edu/Cases/bwh/images/212/123ChowUGI1a.gif
Applying the Algorithm: Patient E.C.

**History:**
70 year old woman with multiple medical comorbidities and a history of multiple abdominal operations which include a partial gastrectomy with Billroth II reconstruction, a hysterectomy, and a cholecystectomy. She presented to the ED with a one day history of crampy abdominal pain, and vomiting.

**Physical Exam:**
Moderate distress. AAOx3. Anicteric, facial sym. No JVD or LAD supple. Coarse B/L RRR mild dist, tend to palp diffusely, guarding. No edema.

**Social History:**
Retired nurses aide. 80 pack year smoking history, quit 12 years ago. No EtOH, IVDU.

**Family History:**
Mother -> Hodgkin's disease. Brother -> CAD MI.
Differential Diagnosis

- Gastrointestinal
  - Appendicitis
  - Biliary Tract Disease
  - SBO
  - Acute pancreatitis
  - Diverticulitis
Differential Diagnosis

- **Genitourinary**
  - Renal Colic
  - Acute urinary retention

- **Gynecologic**
  - Acute pelvic inflammatory disease
  - Ectopic pregnancy
Differential Diagnosis

- **Vascular**
  - Abdominal aortic aneurysm
  - Mesenteric ischemia

- **Extraabdominal Diagnoses**
  - Cardiopulmonary (pneumonia, PE, MI)
  - Abdominal wall (rectus sheath hematoma, hernia)
Differential Diagnosis

- **Toxic Metabolic**
  - Diabetic ketoacidosis
  - Adrenal crisis

- **Neurogenic**
  - Rectus nerve entrapment

- **Nonspecific abdominal pain**
## Causes of Acute Abdominal Pain Stratified by Age

<table>
<thead>
<tr>
<th>Final Diagnosis</th>
<th>≥50 Years (N = 2406)</th>
<th>&lt;50 Years (N = 6317)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biliary tract disease</td>
<td>21%</td>
<td>6%</td>
</tr>
<tr>
<td>Nonspecific abdominal pain (NSAP)</td>
<td>16%</td>
<td>40%</td>
</tr>
<tr>
<td>Appendicitis</td>
<td>15%</td>
<td>32%</td>
</tr>
<tr>
<td>Bowel obstruction</td>
<td>12%</td>
<td>2%</td>
</tr>
<tr>
<td>Pancreatitis</td>
<td>7%</td>
<td>2%</td>
</tr>
<tr>
<td>Diverticular disease</td>
<td>6%</td>
<td>&lt;.1%</td>
</tr>
<tr>
<td>Cancer</td>
<td>4%</td>
<td>&lt;.1%</td>
</tr>
<tr>
<td>Hernia</td>
<td>3%</td>
<td>&lt;.1%</td>
</tr>
<tr>
<td>Vascular</td>
<td>2%</td>
<td>&lt;.1%</td>
</tr>
<tr>
<td>Gynecologic</td>
<td>&lt;.1%</td>
<td>4%</td>
</tr>
<tr>
<td>Other</td>
<td>13%</td>
<td>13%</td>
</tr>
</tbody>
</table>

http://www.accessmedicine.com
## Differential Diagnosis

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Intraluminal Causes</th>
<th>Intramural Causes</th>
<th>Extramural Causes (Extrinsic Compression)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neonates and infants &lt;24 mo</td>
<td>Meconium ileus, milk curd obstruction, foreign bodies</td>
<td>Congenital atresias, stenoses, and diaphragms; duplication cysts; intussusception; Henoch-Schönlein purpura</td>
<td>Inguinal hernia, congenital bands, midgut volvulus, postoperative adhesions</td>
</tr>
<tr>
<td>Children and young adults</td>
<td>Foreign bodies, <em>A lumbricoides</em></td>
<td>Crohn disease, tuberculosis, benign neoplasms, primary and secondary malignant neoplasms</td>
<td>Inguinal hernia, congenital and postoperative adhesions, midgut volvulus, complications of appendicitis</td>
</tr>
<tr>
<td>Elderly persons</td>
<td>Foreign bodies, gallstones, food bolus</td>
<td>Crohn disease, tuberculosis, primary and secondary malignant neoplasms, potassium strictures, radiation strictures, complications of surgical anastomosis</td>
<td>Postoperative adhesions; femoral, inguinal, umbilical, or incisional hernia; colonic and ovarian neoplasia; adhesion to an inflammatory process (eg, appendicitis or diverticulitis)</td>
</tr>
</tbody>
</table>

http://www.emedicine.com/radio/topic781.htm
Is the small bowel obstructed?
Patient E.C.: Abdominal Plain Films

Dilated loops of small bowel located centrally (blue arrows)

Prominent valvulae conniventes

Our Patient
Narrowed Differential

- Small bowel obstruction
  - Adhesions
  - Neoplasia
  - Hernia
  - Inflammatory process (diverticulitis)
ALGORITHM FOR ASSESSING SUSPECTED BOWEL OBSTRUCTION

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→ Abdominal Plain Films

- Diagnostic
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→ Treat

- Abnormal

- Normal
  - Low clinical suspicion
  - High clinical suspicion

→ Observation

- CT Abdomen

- Suggestive of small bowel obstruction

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→ Treat

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Is the small bowel obstructed?
Patient E.C.: Signs of SBO

- Increased luminal diameter
- Transition Point
- String of beads sign

Our Patient

PACS, BIDMC
Patient E.C.: Signs of Ischemia

Small bowel feces sign

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PACS, BIDMC
Are there signs of ischemia?
Patient E.C.: Signs of Ischemia

Whirl Sign

(Scroll through next six slides)
Patient E.C.: Signs of Ischemia

Whirl Sign

PACS, BIDMC  Our Patient
Patient E.C.: Signs of Ischemia

Whirl Sign

PACS, BIDMC
Patient E.C.: Signs of Ischemia

Whirl Sign

PACS, BIDMC

Our Patient
Patient E.C.: Signs of Ischemia

Whirl Sign

PACS, BIDMC Our Patient
Patient E.C.: Signs of Ischemia

Whirl Sign
Patient E.C.: Signs of Ischemia

Whirl Sign

Our Patient
Patient E.C.: Signs of Ischemia

Whirl Sign
(scroll through next four slides)

PACS, BIDMC  Our Patient
Patient E.C.: Signs of Ischemia

Whirl Sign

PACS, BIDMC Our Patient
Patient E.C.: Signs of Ischemia

Whirl Sign

PACS, BIDMC

Our Patient
Patient E.C.: Signs of Ischemia

Whirl Sign

PACS, BIDMC Our Patient
Patient E.C.: Signs of Ischemia

Whirl Sign

PACS, BIDMC

Our Patient
Patient E.C.: Signs of Ischemia

Whirl Sign

PACS, BIDMC

Our Patient
What is the cause of the obstruction?
Patient E.C.: Identifying Cause

- No identifiable cause seen at the transition point

PACS, BIDMC
Patient E.C.: Follow-up

- Underwent emergent exploratory laparoscopy and LOA
Remember…

- “The Rule of 3’s”
  - Lumen > 3 cm
  - Folds > 3 mm
  - > 3 air-fluid levels

- Key Questions
  1. Is the small bowel obstructed?
  2. Are there signs of ischemia?
  3. What is the cause of the obstruction?
References

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