Management of Small Bowel Obstruction: 
An Update

The Postgraduate Course in General Surgery
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Assistant Professor of Surgery

67 year old otherwise healthy woman presents to the ED with a chief complaint of abdominal pain, nausea and vomiting for five days.

The pain is crampy, diffuse and worsening with time; she denies any fevers, sweats, chills or hematemesis. Her last flatus and bowel movement were five days ago.

No medical problems, she takes no medications. She had an appendectomy 15 years ago.

T 36.6 po BP 100/50 HR 66 RR 22 100% on RA

Abdomen: moderately distended, no incisions, diffusely tympanic, no masses or organomegaly, non-tender without peritoneal signs.

Na 128 K 4.6 Cl 91 CO2 25 BUN 46 Cr 0.9 Glu 111 WBC 5.9 Hct 37.3 plt 283 amylase 46 lactate 1.1

Case Presentation

Abdominal plain films

CT abdomen and pelvis

bowel wall edema, collapsed colon small bowel feces sign present
What is the cause of the patient’s intestinal obstruction?

Is the obstruction strangulating or non-strangulating?

Can any tests differentiate patients whose non-strangulating obstruction will resolve with time?

How long should non-operative management be tried?

Can adhesiolysis reduce the risk of recurrent SBO, readmission, or reoperation?

When should laparoscopic lysis of adhesions be attempted?

Can adhesions be prevented?

Special cases

<table>
<thead>
<tr>
<th>Etiology</th>
<th>Incidence, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adhesions</td>
<td>60</td>
</tr>
<tr>
<td>20% within 1 month of surgery</td>
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<tr>
<td>30% within 1 year of surgery</td>
<td></td>
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<tr>
<td>25% years 1-5</td>
<td></td>
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<tr>
<td>25% after 5 years</td>
<td></td>
</tr>
<tr>
<td>Cancer</td>
<td>20</td>
</tr>
<tr>
<td>Hernia</td>
<td>10</td>
</tr>
<tr>
<td>Inflammatory Bowel Disease</td>
<td>5</td>
</tr>
<tr>
<td>Volvulus</td>
<td>3</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>2</td>
</tr>
</tbody>
</table>

Pathogenesis: adhesive disease

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Incidence, %</th>
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<tbody>
<tr>
<td>Appendectomy</td>
<td>23</td>
</tr>
<tr>
<td>Colorectal surgery</td>
<td>21</td>
</tr>
<tr>
<td>Gynecologic surgery</td>
<td>12</td>
</tr>
<tr>
<td>Foregut surgery</td>
<td>9</td>
</tr>
<tr>
<td>Small bowel surgery</td>
<td>8</td>
</tr>
<tr>
<td>Multiple laparotomies</td>
<td>24</td>
</tr>
</tbody>
</table>

lower abdominal and pelvic operations are more likely than upper GI tract procedures to develop small bowel obstructions; 5-year risk: appendectomy (11%); cholecystectomy (6%)
Is the obstruction strangulating or non-strangulating?

Silen et al., Strangulation obstruction of the small intestine. Arch Surg 1962;85:121-129. Retrospectively reviewed 480 cases treated between 1944-1959. “The results of this study indicate that the clinical differentiation between simple and strangulating obstruction is often impossible.”

Sarr et al., Preoperative recognition of intestinal strangulation. Am J Surg 1983;145:176-182. Prospectively reviewed 51 consecutive cases found to have complete bowel obstructions at surgery. “Our findings cast serious doubt on the ability of even an experienced physician to reliably recognize either the presence or the absence of intestinal strangulation.”

…the “classic signs” of strangulating obstruction are:

* continuous (rather than colicky) pain
* fever
* tachycardia
* peritoneal signs
* leukocytosis

…but alone, or in combination, sensitivity / specificity low

Predicting Strangulated Small Bowel Obstruction: An Old Problem Revisited

Tim Janickiewicz - Lan T. Vu - Alexandra E. Shawo - Benjamin Yeh - Warren J. Gasper - Hobart W. Harris

- Retrospectively reviewed 192 cases operated on for a small bowel obstruction (1996-2006) at UCSF Medical Center.
- Seventy-two preoperative clinical, laboratory and radiographic findings at admission were examined.
- A radiologist blinded to the operative outcome interpreted the CT scans and assessed: dilated loops, ascites, bowel thickening >3mm, segmental mesenteric fluid, fat stranding, small bowel feces sign, decreased enhancement, pneumatosis, transition point, closed loop obstruction, multiple transition points.
- A predictor model was created based upon operative findings: strangulated (n=44) or non-strangulated (n=148).

Predictors

<table>
<thead>
<tr>
<th>Predictors</th>
<th>Symptoms</th>
<th>Laboratory</th>
<th>Imaging Findings</th>
<th>Clinical Data</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>pain</td>
<td>WBC</td>
<td>KUB report</td>
<td>age</td>
</tr>
<tr>
<td></td>
<td>nausea/vomiting</td>
<td>hematocrit</td>
<td>CT report</td>
<td>sex</td>
</tr>
<tr>
<td></td>
<td>bloating</td>
<td>platelets</td>
<td>CT blinded review</td>
<td>previous abdominal op</td>
</tr>
<tr>
<td></td>
<td>fever</td>
<td>sodium</td>
<td>dilated loops</td>
<td>recent operation, date</td>
</tr>
<tr>
<td></td>
<td>anorexia</td>
<td>potassium</td>
<td>ascites</td>
<td>immunosupression</td>
</tr>
<tr>
<td></td>
<td>altered mental status</td>
<td>chloride</td>
<td>thick wall bowel</td>
<td>reason for operation</td>
</tr>
<tr>
<td></td>
<td>diaphoresis</td>
<td>bicarbonate</td>
<td>segmental mesenteric fluid</td>
<td>operative findings</td>
</tr>
<tr>
<td></td>
<td>hematochezia</td>
<td>glucose</td>
<td>free air</td>
<td>pathology report</td>
</tr>
<tr>
<td>Signs</td>
<td>max/min temperature</td>
<td>creatinine</td>
<td>stranding</td>
<td>days to OR</td>
</tr>
<tr>
<td></td>
<td>HR/tachycardia</td>
<td>BUN</td>
<td>small bowel feces sign</td>
<td>days to discharge</td>
</tr>
<tr>
<td></td>
<td>BP/hypotension tenderness</td>
<td>LDH</td>
<td>reduced enhancement</td>
<td>reoperation?</td>
</tr>
<tr>
<td></td>
<td>rebound</td>
<td>amylase</td>
<td>pneumatosis</td>
<td>outcome</td>
</tr>
<tr>
<td></td>
<td>guarding</td>
<td></td>
<td>transition point</td>
<td></td>
</tr>
<tr>
<td></td>
<td>distension</td>
<td></td>
<td>closed loop</td>
<td></td>
</tr>
<tr>
<td></td>
<td>tympany</td>
<td></td>
<td>multiple transition points</td>
<td></td>
</tr>
<tr>
<td></td>
<td>mass?</td>
<td></td>
<td>IV contrast</td>
<td></td>
</tr>
</tbody>
</table>
Univariate analysis (N=192)

**Symptoms**
- pain
- nausea/vomiting
- bloating
- fever
- anorexia
- altered mental status
- hematochezia

**Signs**
- max/min temperature
- HR/tachycardia
- BP/hypotension
- rebound
- guarding
- distension
- tympany
- mass?

**Laboratory**
- WBC
- hematocrit
- platelets
- sodium
- potassium
- chloride
- bicarbonate
- glucose
- Creatinine
- BUN
- LDH
- amylase

**Imaging Findings**
- KUB report
- UGI report
- CT report
- CT blinded review
- dilated loops
- ascites
- thick wall bowel
- segmental mesenteric fluid
- free air
- small bowel feces sign
- reduced enhancement
- pneumatosis
- transition point
- closed loop
- multiple transition points

**Clinical Data**
- age
- sex
- previous abdominal op
- recent operation
- date
- immunosupression
- reason for operation
- operative findings
- pathology report
- days to OR
- days to discharge
- reoperation?
- outcome

Multivariate analysis (N=120)

**Symptoms**
- pain
- nausea/vomiting
- bloating
- fever
- anorexia
- altered mental status
- diarrhea
- hematochezia

**Signs**
- max/min temperature
- HR/tachycardia
- BP/hypotension
- rebound
- guarding
- distension
- tympany
- mass?

**Laboratory**
- WBC
- hematocrit
- platelets
- sodium
- potassium
- chloride
- bicarbonate
- glucose
- Creatinine
- BUN
- LDH
- amylase
- lactate
- pH
- pCO2
- pO2
- base deficit

**Imaging Findings**
- KUB report
- UGI report
- CT report
- CT blinded review
- dilated loops
- ascites
- thick wall bowel
- segmental mesenteric fluid
- free air
- small bowel feces sign
- reduced enhancement
- pneumatosis
- transition point
- closed loop
- multiple transition points
- IV contrast

**Clinical Data**
- age
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- previous abdominal op
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- date
- immunosupression
- reason for operation
- operative findings
- pathology report
- days to OR
- days to discharge
- reoperation?
- outcome

Can any tests differentiate patients whose non-strangulating obstruction will resolve non-operatively?

**OLD: CLINICAL PRESENTATION**

- Complete obstruction
  - absence of significant flatus or stool for 12 hours and no colonic gas seen on KUB

- Partial obstruction
  - 20% success rate with non-operative treatment
  - 20-40% risk of strangulation

**NEW: ORAL WATER SOLUBLE CONTRAST**

- Instill 50-150cc of gastrograffin (water-soluble contrast) orally or via NGT. Obtain abdominal plain films at 4, 8, and/or 24 hours.

- Presence of gastrograffin in the colon at 8 hours predicts non-operative resolution with 95% sensitivity and 99% specificity. PPV = 99%, NPV = 85%.

- At 24 hours, 99% sensitivity, 97% specificity, 99% PPV, 97% NPV
Can any tests differentiate patients whose non-strangulating obstruction will resolve non-operatively?

Possible therapeutic role for gastrograffin:

**Table**

<table>
<thead>
<tr>
<th>Reference</th>
<th>Proportion needing surgery</th>
<th>Weight (%)</th>
<th>Odds ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Armstrong et al.</td>
<td>0.16</td>
<td>0.9</td>
<td>1.0</td>
</tr>
<tr>
<td>Rigattieri et al.</td>
<td>0.16</td>
<td>0.8</td>
<td>1.0</td>
</tr>
<tr>
<td>Rector et al.</td>
<td>0.21</td>
<td>0.5</td>
<td>1.0</td>
</tr>
<tr>
<td>Duff et al.</td>
<td>0.22</td>
<td>0.2</td>
<td>1.0</td>
</tr>
<tr>
<td>Duff et al.</td>
<td>0.22</td>
<td>0.2</td>
<td>1.0</td>
</tr>
<tr>
<td>Total</td>
<td>0.22</td>
<td>0.2</td>
<td>1.0</td>
</tr>
</tbody>
</table>

**Graph**

**Figure**

**Text**

How long should non-operative management be tried?

85-95% of patients with adhesive SBO who are destined to recover without surgery will show marked improvement within 72 hours.

**EAST guidelines 2009:** 3-5 days

**Bologna guidelines 2010:** 3 days

…but, one can wait up to 10 days without increase in strangulation rate (Shou-Chuan, *World J. Gastroent.*, 2003)

Can adhesiolysis reduce the risk of recurrent SBO, readmission, or reoperation?

Review of 500 patients Norway operated upon for adhesive SBO from 1961-1995.

All patients interviewed at median follow-up of 11 years, 85% follow-up rate.

For patients with > 2 prior bouts of adhesive SBO:

**Treatment**

- Conservative: 112
- Surgical: 130

<table>
<thead>
<tr>
<th>Survey</th>
<th>N</th>
<th>0.55 (0.35-0.86)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.05</td>
<td>25</td>
<td></td>
</tr>
</tbody>
</table>

Surgery:

- reduced risk of readmission (RR 0.55)
- but did not change risk of future operations (RR 0.79)
Can adhesiolysis reduce the risk of recurrent SBO, readmission, or reoperation?

Surgery had no effect on total readmissions (32% vs 34%) but spaced out readmissions over time (median 0.7 vs 2 years) and had no difference in reoperation rate (14% vs 11%).

When should laparoscopic lysis of adhesions be attempted?

**Better Candidates**
- Better candidates for Lysis of Adhesions may include:
  - Perforation or peritonitis
  - Bowel diameter >4cm
  - Massive abdominal distension
  - Known dense adhesions
  - Complete obstruction
  - Intra-abdominal malignancy
  - Crohn's disease
  - Vertical midline incision
  - Incarcerated hernia
  - Multiple prior laparotomies

**Worse Candidates**
- Worse candidates for Lysis of Adhesions may include:
  - Perforation or peritonitis
  - Bowel diameter >4cm
  - Massive abdominal distension
  - Known dense adhesions
  - Complete obstruction
  - Short duration since last operation
  - Intra-abdominal malignancy
  - Crohn's disease
  - Vertical midline incision
  - Incarcerated hernia
  - Multiple prior laparotomies

Benefits in selected patients:
- Less mortality (1.7% vs. 3.4%), 25% less complications, 27% shorter LOS, less pain.
Risks:
- Missed or delayed enterotomy

Can adhesions be prevented?

Perform operations laparoscopically if possible

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Laparoscopic</th>
<th>Open</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cholecystectomy</td>
<td>0.2%</td>
<td>7.1%</td>
</tr>
<tr>
<td>Hysterectomy</td>
<td>0%</td>
<td>15.6%</td>
</tr>
<tr>
<td>Colectomy</td>
<td>4.3%</td>
<td>9.5%</td>
</tr>
<tr>
<td>Appendectomy</td>
<td>1.4%</td>
<td>1.3%</td>
</tr>
<tr>
<td>Adnexal surgery</td>
<td>0%</td>
<td>23.9%</td>
</tr>
</tbody>
</table>

Hyaluronic acid / carboxymethylcellulose (Seprafilm)

- Studied prospectively in patients for whom there was a planned reoperation
  - J-pouch with ileostomy -> ileostomy takedown
  - Hartman's procedure -> colostomy takedown

Proven to reduce incidence, extent, and severity of adhesions
This translated to a reduction in complications, surgical time

- Dis Colon Rectum 2003; 46:1200-7
- Dis Colon Rectum 2005; 48:1130-9

- Studied prospectively in 1,791 patients who underwent intestinal resection
No difference in postop SBO rates (12% vs. 12%) after mean 3.5 years
Reduction in incidence of SBO requiring surgery (1.8% vs. 3.4%, p<0.05)
Higher anastomotic leaks when wrapped around fresh anastomosis

- Dis Colon Rectum 2006; 49:1-11
Can adhesions be prevented?

Icodextrin 4% solution (Adept)

- FDA approved in the United States
- Instill 1,000mL and leave in abdominal cavity
- Separates damaged surfaces for a few days, then resorbed
- Studied prospectively in laparoscopic gynecological surgery with planned second-look after 4-8 weeks with lactated ringers as control. Shown to reduce adhesions and improve fertility.

*Fertil Steril* 2007; 88: 1413-1426

- Studied prospectively in Hartman’s procedure. Shown to reduce adhesiolysis time during the Hartman’s takedown.

*Colorectal Dis* 2009; 11(2):168-72

- Studied prospectively in 169 Italian patients undergoing adhesiolysis for SBO versus lactated ringers. After mean 42 months, significant reduction in readmission for recurrent SBO.

*Trials* 2008; 9:74

Special cases

<table>
<thead>
<tr>
<th>virgin abdomen</th>
<th>intra-abdominal malignancy</th>
<th>intussusception</th>
</tr>
</thead>
<tbody>
<tr>
<td>• confirm diagnosis, no ileus</td>
<td>• 1/3 caused from adhesions that can be lysed</td>
<td>• 8-10cm in length, spontaneous resolution expected</td>
</tr>
<tr>
<td>• exam to rule out hernias</td>
<td>• 1/3 caused from tumor that can be resected or bypassed</td>
<td>• operate for obstruction, pain, intransigence</td>
</tr>
<tr>
<td>• CT abdomen/pelvis to look for intussusception, tumor, Crohn’s, malrotation, etc.</td>
<td>• 1/3 nothing can be done surgically</td>
<td>• Crohn’s: treat medically initially. Surgery for intransigence</td>
</tr>
<tr>
<td>• diagnostic laparoscopy and LGI</td>
<td>• 1/3 caused from adhesions that can be lysed</td>
<td>• tumors</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>hernia</th>
<th>tumors</th>
</tr>
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<tbody>
<tr>
<td>• operate on all hernias causing SBO</td>
<td>• GIST, leiomyomas, lipomas, hemangiomas, adenomas, adenocarcinomas, lymphomas, carcinoids, metastases</td>
</tr>
<tr>
<td>• relative contraindication for laparoscopy</td>
<td>• early postoperative (within 30 days of surgery)</td>
</tr>
<tr>
<td>• adhesions are avascular, parietal, retroperitoneal, transmesenteric, transomental, congenital hernias</td>
<td>• risk of strangulation low</td>
</tr>
<tr>
<td></td>
<td>• success rate of nonoperative management is 85% at 7 days, 90% at 14 days</td>
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<td></td>
<td>• CAVEAT: if original operation was laparoscopic, you should operate.</td>
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Special cases

- Confirm diagnosis, no ileus
- Exam to rule out hernias
- CT abdomen/pelvis to look for intussusception, tumor, Crohn's, malrotation, etc.
- Diagnostic laparoscopy and LGI

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portal venous gas

mesenteric swirl pattern