Small and Large Bowel Obstruction

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Small Intestine Function

- Transport
 - Distension stimulates contractions
- Mixing and peristalsis
- Absorption
 - Carbs, proteins direct absorption
 - Lipids converted to chylomicrons
 - Fat soluble vitamins
 - Vitamins & Minerals
 - Ca⁺², FeSO₄, B12, Bile Salts

Colon Function

- Water AbsorptionRight side primarily
- Transport





Sleisenger & Fordtran's Gastrointestinal and Liver Disease, 7th ed.

The strength layer of the bowel in intestinal anastomoses is the:

- A. Mucosa
- B. Submucosa
- C. Muscularis mucosae
- D. Muscularis externa
- E. Serosa

Why a 1 Layered Closure Works!





FIGURE 24-45.

The blood supply to the jejunum and ileum: the ileocolic artery lies at the base of the mesentery of the intestine; the stem of the superior mesenteric artery swings into the mesentery.





The inferior mesenteric vein drains to the:

- A. Portal Vein
- B. Splenic Vein
- C. External Iliac Vein
- D. Internal Iliac Vein

 $\mathsf{IMV} \rightarrow \mathsf{Splenic} \ \mathsf{v} \rightarrow \mathsf{Portal} \ \mathsf{v}$

Which of the following statements about small bowel motility is true?

- A. Oral feeding stimulates production of migrating motor complexes (MMC's)
- B. If motility is impaired, absorption of nutrients is also impaired
- C. The frequency of MMC's returns to normal within 6 24 hours after surgery
- D. Vagotomy-induced diarrhea is due to increased secretion secondary to denervation
- E. The Migrating Motor Complex is Electric, Boogy-woogy-woogy

Motility - Slow Waves

- Caused by cyclic activation and deactivation of the cell Na⁺/K⁺ Pump
- NOT Contractions
- Depolarization during each slow wave brings the membrane potential of smooth muscle cells closer to threshold
 - Increases probability of action potential → contraction
- "Spikes" are superimposed on slow waves and are action potentials (contractions)

Motility Small Bowel



- A. Slow Waves and spikes
 - A. Gastric 3/min
 - B. SB 7-12/min
 - C. Colon 12/min
- B. Electric activity
- C. Contraction

Intestinal Motility

- Peristalsis
 - Transport
 - Most regulation at level of stomach and duodenum
 - Small bowel and Colon rely more on enteric nervous system coordinating peristalsis
- Segmentation
 - Mixing
 - Non-propagated, back-and-forth contraction
 - Decreases in rate from proximal to distal

Intestinal Motility - Reflexes

- Gastroileal
 - Increased TI motility and emptying into colon
- Ileogastric
 - TI distention decreases gastric motility
- Intestinintestinal
 - Overdistension of intestine decreases intestinal motility overall

Intestinal Motility

- Fasting
 - Migrating Myoelectric Complex
 - Occur every 75-90 minutes Stomach to TI
 - Clears accumulated fluid
- Colon
 - Segmental contractions Responsible for Haustra
 - Facilitates water and salt absorption
 - Mixing motions, little peristalsis with segmentation
 - Mass Movements 3-4 per day (peristalsis)
 - Contents moved distally for long distances
 - Gastrocolic reflex through PNS when stomach stretches
 - Enteric nerves primarily inhibitory

Which of the following stimulates colonic motility?

- A. Cholecystokinin
- B. Secretin
- C. Somatostatin
- D. Vasointestinal Peptide
- E. All of the Above

Secretin stimulates HCO_{3}^{-} by the Pancreas and bile from liver, Somatostatin is an inhibitory hormone that shuts secretion off and decreases motility, VIP reduces gastric motility and gastric acid production.

When chyme enters duodenum, hypertonicity and proteins stimulate CCK which causes GB contraction. Gastroileal and gastrocolic reflexes stimulate TI emptying into colon, think that CCK augments motility of colon at this time to help move the fluid TI is emptying into it.

Obstruction - Pathophysiology

- Dependent Upon:
 - Degree of Obstruction
 - Duration of Obstruction
 - Presence and Severity of Ischemia
- Results in:
 - Accumulation of fluid and air
 - Bacterial overgrowth
 - Maximal by 24 hrs after obstruction
 - Gut translocation to nodes and portal system
 - Once Distended get:
 - Impaired fluid and nutrient absorption
 - Secretion of isotonic fluid (intravascular → intraluminal) thought secondary to bacterial overgrowth

Obstruction - Pathophysiology

- Systemic symptoms thought secondary to:
 - Hypovolemia
 - Bacterial translocation (typically *E. coli*)
 - Ischemia worsens general inflammatory state, bacterial translocation, and fluid requirements
- Large Bowel Obstruction
 - Ileocecal valve plays prominent role in pathophysiology of LBO
 - If competent valve = closed loop obstruction
 - Cecal ischemia around 10-13 cm

Obstruction

- 2 Varities:
 - Mechanical
 - 90% of Mechanical SBO due to adhesions, hernias, or cancer
 - Colonic obstruction accounts for only 10-15% of all mechanical obstructions
 - Most commonly carcinoma, diverticulitis, or volvulus
 - Non-mechanical (ileus)

Mechanical Obstruction

- Acute vs Chronic
- Partial vs Complete
- Simple *vs* Closed loop
- Gangrenous *vs* Nongangrenous
- Natural history, response to treatment, and associated M&M vary based on type of obstruction



Sleisenger & Fordtran's Gastrointestinal and Liver Disease, 7th ed.

Table 2 Causes of Small Bowel Obstruction in Adults
Extrinsic causes Adhesions* Hernias (external, internal [paraduodenal], incisional)* Metastatic cancer* Volvulus Intra-abdominal abscess Intra-abdominal hematoma Pancreatic pseudocyst Intra-abdominal drains Tight fascial opening at stoma
Intraluminal causes Tumors* Gallstones Foreign body Worms Bezoars Intramural abnormalities Tumors Strictures Hematoma Intussusception Regional enteritis Radiation enteritis

*Approximately 85% of all small bowel obstructions are secondary to adhesions, hernias, or tumors.



Mechanical Obstruction - Presentation

- Distinguished from ileus or pseudo-obstruction by:
 - Location mid-abdomen (others diffuse)
 - Character colicky
 - Proximal periodicity every 3 4 mins
 - Distal SB or Colon every 15-20 minutes
 - Between episodes of nausea, vomiting, cramping
 - <u>Severity</u> of pain generally severe, worsens over time (ileus tends to be constant)

Mechanical Obstruction - History

- Did this ever happen before?
- Change in bowel habits (acute *vs* chronic)
- Progressive *vs* acute abd. distention
- Weight loss
- Flatus?
- Prior Surgeries
- Hx of abdominal CA?
- Hx of Inflammatory Bowel Dz
- Prior abdominal XRT?
- Meds: Anticoagulants, Anticholinergics, Opioids, Antihistamines, Alpha-agonists, Catecholamines

Obstruction - Exam

- Want idea of vitals, hydration status, and cardiopulmonary status
- NGT, Foley, IV placed
- Volume and character of NG aspirate:
 - Clear GOO
 - Bilious Mid to distal SBO
 - Feculent Distal SBO to LBO
- aMI or Pneumonia a possible cause?
 - Why CXR part of acute abdominal series

Mechanical Obstruction - Exam

- Abdominal Exam:
 - Observe
 - Distention More in distal or chronic obstruction
 - Symmetry Assymetric may be mass *vs* volvulus
 - Incisions
 - Visible peristalsis acute obstruction
 - Auscultate
 - High-pitched
 - Rushes
 - Tingles
 - Absent late obstruction
 - Palpate
 - Inguinal, Femoral, Umbilical, Incisional hernias.
 - Pain out of proportion of exam (closed-loop obstruction)
 - Percuss
 - Dull Fluid or mass
 - Tympanic Air (intraluminal or not)
 - Peritoneal irritation
- DRE or Digital Ostomy Exam for mass, impaction, peristomal hernia...etc.

Table 26.2. SYMPTOMS AND SIGNS OF BOWEL OBSTRUCTION

Symptom or sign	Proximal small bowel (open loop)	Distal small bowel (open loop)	Small bowel (closed loop)	Colon and rectum
Pain	Intermittent, intense, colicky; often relieved by vomiting	Intermittent to constant	Progressive, intermittent to constant; rapidly worsens	Continuous
Vomiting	Large volumes, bilious and frequent	Low volume and frequency; progressively feculent with time	May be prominent (reflex)	Intermittent, not prominent; feculent when present
Tenderness	Epigastric or periumbilical; quite mild unless strangulation is present.	Diffuse and progressive	Diffuse, progressive	Diffuse
Distention Obstipation	Absent May not be present	Moderate to marked Present	Often absent May not be present	Marked Present

Adapted from Schuffler MD, Sinanan MN. Intestinal obstruction and pseudo-obstruction. In: Sleisenger MH, Fordtran JS, eds. *Gastrointestinal disease*, 5th ed. Philadelphia: WB Saunders, 1993:898.

The most helpful diagnostic radiographic procedure in suspected SBO is:

- A. CT of Abdomen and Pelvis
- B. UGI gastrograffin contrast study
- C. Supine and Erect plain films of abdomen
- D. U/S of the abdomen

Imaging – Plain Films

- Dilated loops, SB dilation? AFLs?
- Are AFL's and bowel loops in same place on supine and upright films?
- Is there gas throughout the entire colon?
 - Ileus or pSBO
- Paucity of distal colonic gas or abrupt cutoff of colonic gas w/proximal distention and/or AFLs?
 - Suggesting complete or near-complete LBO
- Massive dilation of colon, especially of the cecum or sigmoid?
 - Suggestive of volvulus or pseudoobstruction
- Evidence of strangulation?
 - Thickened SB loops, mucosal thumb printing, pneumatosis cystoides intestinalis, or free air
- Are there biliary or renal calculi? Pneumobilia?
 - GS ileus? Renal stone causing ileus?

Mechanical Obstruction - Labs

- CBC
- Electrolytes
 - Including Mg⁺² and Ca⁺²
- BUN/Cr
- Coags
- U/A (hematuria, UTI)



SBO from adhesions. Note fixed loop of small bowel in right pelvis (arrow) that doesn't change position with different patient position – suggests adhesion.

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Adjunctive Tests

- Sigmoidoscopy
 - When large amounts of air extend down to the rectum
 - Flex or Rigid will exclude rectal or distal sigmoid obstruction
- CT Scan or U/S
 - When normal plain films but history and exam are consistent with obstruction
 - Plain films in SBO will be nondiagnostic approximately 30% of the time

Mortality

- Strangulation obstruction is cause in about 10% of SBO's
 - Mortality of 10-37%
- Simple SBO mortality < 5%
- Classic signs of continuous abd. pain, fever, tachycardia, peritoneal signs, and leukocytosis *NOT* sensitive or specific for strangulation
 - 50% of patients w/strangulation were not recognized preoperatively

Table 4 Guidelines for Operative and Nonoperative Therapy				
Situations necessitating emergent operation Incarcerated, strangulated hernias Peritonitis Pneumatosis cystoides intestinalis Pneumoperitoneum Suspected or proven intestinal strangulation				
Closed-loop obstruction				
Nonsigmoid colonic volvulus Sigmoid volvulus associated with toxicity or peritoneal signs Complete bowel obstruction				
Situations necessitating urgent operation Progressive bowel obstruction at any time after nonoperative measures are started				
Failure to improve with conservative therapy within 24–48 hr				
Early postoperative technical complications				
Situations in which delayed operation is usually safe Immediate postoperative obstruction				
Sigmoid volvulus successfully decompressed by sigmoidoscopy				
Acute exacerbation of Crohn disease, diverticulitis, or radiation enteritis				
Chronic, recurrent partial obstruction				
Paraduodenal hernia				
Gastric outlet obstruction				
Postoperative adhesions				
Resolved partial colonic obstruction				

3 Reasons:

1. Low likelihood of spontaneous resolution of complete obstruction

2. High risk of strangulation of complete SBO (8 - 22%)

3. Difficulty in detecting strangulation clinically until late in course

Nonmechanical Obstruction

Table 1 Causes of Ileus

Intra-abdominal causes Intraperitoneal problems Peritonitis or abscess Inflammatory condition Mechanical: operation, foreign body Chemical: gastric juice, bile, blood Autoimmune: serositis, vasculitis Intestinal ischemia: arterial or venous, sickle-cell disease Retroperitoneal problems Pancreatitis Retroperitoneal hematoma Spine fracture Aortic operation Renal colic Pyelonephritis Metastasis

Extra-abdominal causes Thoracic problems Myocardial infarction Pneumonia Congestive heart failure Rib fractures Metabolic abnormalities Electrolyte imbalance (e.g., hypokalemia) Sepsis Lead poisoning Porphyria Hypothyroidism Hypoparathyroidism Uremia Medicines Opiates Anticholinergics Alpha agonists Antihistamines Catecholamines Spinal cord injury or operations Head, thoracic, or retroperitoneal trauma Chemotherapy, radiation therapy

Gallstone ileus is best treated by:

- A. Prokinetic agents
- B. Initial control of the cholecystoenteric fistula
- C. Ileocecctomy
- D. Removal of the obstructing stone by enterotomy
- E. None of the above

Board Answer: Do *nothing* to the cholecystoenteric fistula!



Sleisenger & Fordtran's Gastrointestinal and Liver Disease, 7th ed.

Volvulus of the Colon

- Sigmoid most commonly involved
 - 75% of all colonic volvulus
 - 10% of all colonic obstructions
 - 180° or > counterclockwise twist
- Cecal volvulus next most common
- Transverse colon volvulus is rare
 - 4% of colonic volvulus
- Splenic flexure volvulus VERY rare

Sigmoid Volvulus – Predisposing Factors

- Long and highly-mobile sigmoid
- Lengthy mesosigmoid
 - Narrow at its base
- Adhesions between proximal sigmoid and rectosigmoid
 - With long loop of colon inbetween
- Chronic constipation and high-fiber diet

Sigmoid Volvulus - Pathogenesis

- Closed-loop type obstruction
- Proximal colon dilates
 - Extent depends on ileocecal valve competence
- Simple or Strangulated
 - Venous then arterial obstruction
 - With simple form takes a few days for vascular compromise to develop
 - In acute fulminating variant much more rapid course seen

Sigmoid Volvulus - Varieties

- Acute Fulminating Type
 - Mortality 37-80%
 - Younger patient, sudden onset, rapid course
 - Early vomiting, severe pain, peritonitis, and gangrene
 - Minimal distension often, hard to diagnose
- Subacute Progressive Type
 - Generally older pt., more gradual onset
 - Hx prior attacks, chronic constipation
 - Abdominal distension often extreme
 - Late vomiting, pain is minimal, no peritonitis

Sigmoid Volvulus - Diagnosis

- Plain films of Abdomen
 - Massively dilated and distended bowel loop
 - Both ends in pelvis, bow of loop cephalad
 - "Bent inner tube" sign
 - Air/fluid level within loop
 - Proximal colon & SB may be dilated
- Barium enema
 - "Birds beak"

Sigmoid Volvulus





Sigmoid Volvulus - Treatment

- Rigid sigmoidoscopic detorsion, decompression, & placement of rectal tube
 - RT inserted past obstruction point
 - Successful 77 90% of time
 - Mortality rate 1.2 5.5%
 - Preferred initial treatment
- Colonoscopic decompression (alternative)
- Surgery if:
 - Decompression not successful
 - Ischemic or necrotic bowel encountered

Sigmoid Volvulus – Surgical Treatment

- Recurrence rate is high (33 60%)
- Some advise elective op after 1st episode
- Elective:
 - Resection of redundant colon
 - Small transverse LLQ incision
- Sigmoid fixation another option
- Emergent: Resection +/- stoma

Cecal Volvulus





Ogilvie's Syndrome (Acute Colonic Pseudo-obstruction)

- Massive dilation of cecum, right, and transverse colon (non-mechanical), to splenic flexure
- Dilated SB loops in > 50%
- Symptoms:
 - Distension
 - Nausea and vomiting (2 out of 3)
 - Abdominal pain in 80%
 - Generally mild to moderate
 - 50% have flatus or diarrhea
 - Peritonitis if perforated only
- Bowel sounds may be normal or increased



Conditions associated with Ogilvie's Syndrome

- Non-operative Trauma
- Non-GI surgery (Gyn, Ortho, Cardiac)
- Pancreatitis, Cholecystitis
- Diabetes, Malignancy
- Narcotics, antidepressants, anticholinergics
- Neurologic or Respiratory disease
- Electrolyte (hypo K+, Ca+2), Acid / Base disorder
- Radiation in past

Ogilvie's Syndrome: DDx and Dx

- Plain abdominal films to diagnose and follow cecal diameter (Q12-24 hrs)
 - Normal is < 9 cm</p>
 - If $\geq 14 \text{ cm} \rightarrow \text{perforation in } 23\%$
- Differential Includes:
 - Fecal impaction
 - Cecal or Sigmoid Volvulus
 - Ischemic Bowel
 - Mechanical Obstruction

Ogilvie's Syndrome: Treatment

- Correct electrolyte problems and underlying condition
- D/C narcotics and anticholinergics
- NPO with NGT, +/- Rectal Tube
- Colonoscopic decompression difficult but often successful
 - May need 2nd decompression
- Long colonic drains can be placed via colonoscope (old)
- Neostygmine is the treatment of choice now
- If signs of perforation then OR





Figure 12 Shown is an algorithm outlining an approach to management of ileus.

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