GI Surgery
(Small Intestine & Appendix)
Small Intestine

- **Obstruction**
  - Historically, nonoperative management ruled
    - Reduction of hernias
    - Laxatives
    - Ingestion of heavy metals
    - Leeches
  - Late 1800s when antisepsis and aseptic surgical technique developed → surgical intervention became safer
Small Intestine - Obstruction

- Understanding the pathophysiology of SBO with the use of the following has greatly reduced mortality of pts with mechanical SBO
  - Isotonic fluid resuscitation
  - Intestinal tube decompression
  - Antibiotics
SBO

■ Etiology
  ■ Obstruction arising from extraluminal causes (adhesions, hernias, carcinomas, and abscesses)
  ■ Obstruction intrinsic to the bowel wall (primary tumors)
  ■ Intraluminal obstruction (gallstones, enteroliths, FB, bezoars)
At turn of 20\textsuperscript{th} century, hernias accounted for >50\% of mechanical SBO.

Now with elective hernia repairs, it is the 3\textsuperscript{rd} most common cause of SBO.

\textbf{ADHESIONS} are by far the MCC of SBO!
Adhesions

Mainly after pelvic operations (gynecologic procedures, appendectomy, and colorectal resection)

More than 60% of all causes of bowel obstruction in the U.S.

Likely due to the increased mobility of the bowel in the pelvis as compared to the more tethered state in the upper abdomen
Malignant tumors

- 20% of cases
- Majority are metastatic lesions secondary to peritoneal implants that have spread from an intra-abdominal primary tumor such as ovarian, pancreatic, gastric, or colonic
- Primary colonic cancers (cecal or ascending colon) may cause extrinsic compression
- Primary SB tumors are extremely rare
SBO

- Hernias
  - 10% of cases (3rd MCC)
  - Ventral or inguinal
  - Internal hernias – usually related to prior abdominal surgery
SBO

- Crohn’s disease
  - 4th MCC (approximately 5%)
  - Obstruction results from acute inflammation and edema that sometimes resolves with conservative management
  - Longstanding Crohn’s disease can lead to strictures that may require resection and reanastomosis versus strictureplasty
Pathophysiology

- Early in an obstruction, intestinal motility and contractile activity increase to propel luminal contents past the obstructing point.
- Early on this increase in peristalsis is present both proximal and distal to the point of obstruction.
- Later in the course, the intestine becomes fatigued and dilates.
- With dilation, water and electrolytes accumulate both intraluminally and within the bowel wall.
**SBO**

- Pathophysiology
  - Massive 3\textsuperscript{rd}-space fluid loss $\rightarrow$ dehydration and hypovolemia
  - Can lead to hypotension, shock, IAP, ↓ venous return, elevation of the diaphragm, ↓ ventilation
  - Proximal obstruction
    - Dehydration + hypochloremia + hypokalemia + metabolic alkalosis + vomiting
  - Distal obstruction
    - Less dramatic electrolyte abnormalities
    - Dehydration + oliguria + azotemia + hemoconcentration
SBO

- **Pathophysiology**
  - As the intraluminal pressure ↑, the mucosal blood flow ↓
  - Concern for bowel perforation and peritonitis
  - In absence of obstruction, jejunum & ileum virtually sterile; however, with obstruction, microflora changes
    - *E. coli, S. faecalis, Klebsiella* (up to $10^9$-$10^{10}$/ml)
SBO – Clinical Manifestations

- Symptoms
  - Colicky abdominal pain
  - Nausea
  - Vomiting
    - Have patient describe bilious, nonbilious, or feculent
  - Failure to pass flatus/feces (obstipation)
    - Develops later
      - Pts may report diarrhea early on due to increased peristalsis
  - Abdominal distention
SBO – Clinical Manifestations

- Physical Exam
  - +/- tachycardia
  - +/- hypotension suggestive of severe dehydration
  - Fever (possible strangulation)
  - Distended abdomen
  - Rushes/tinkles
  - Localized tenderness, rebound, guarding → concern for peritonitis and strangulated bowel
  - ALWAYS check for incarcerated inguinal hernias!!!
  - Rectal exam – perform hemoccult
SBO – Clinical Manifestations

- X-Ray
  - AAS usually confirm H&P
  - 60% accurate
  - Upright → multiple AFL
SBO – Clinical Manifestations

- Complete bowel obstruction secondary to large radiopaque gallstone
SBO – Clinical Manifestations

- CT scan
  - Beneficial when diagnosis uncertain
  - Sensitive for diagnosing complete or HG SBO and for determining location and etiology
  - Less sensitive in PSBO
  - Helpful for extrinsic causes
SBO – Clinical Manifestations
SBO – Clinical Manifestations

- **Barium/Enteroclysis**
  - Enteroclysis – oral insertion of tube into duodenum to instill air and barium directly into small intestine
    - Definitive study in pts in whom diagnosis of LG intermittent SBO is clinically uncertain
  - Disadvantages of enteroclysis
    - NGT
    - Slow transit of contrast in pts with SBO
    - Expertise required

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SBO – Clinical Manifestations

- U/S
  - Pregnant pts
- MRI
  - No better than CT
SBO – Clinical Manifestations

- Lab work
  - Not helpful in diagnosis
  - Essential in assessing degree of dehydration
  - Pts with SBO need serial electrolyte checks to assess effectiveness of resuscitation
  - Follow Hct secondary to resuscitation on hemoconcentration associated with SBO
  - Leukocytosis may be associated with strangulation
Simple vs. Strangulating SBO

- Strangulating SBO usually involves closed-loop obstruction
  - Associated with increased morbidity/mortality
  - “Classic signs”
    - Tachycardia
    - Fever
    - Leukocytosis
    - Constant noncramping abdominal pain
Simple vs. Strangulating SBO

- CT useful only in late stages of irreversible ischemia
- LDH, amylase, alk phos, ammonia levels not beneficial
- Lactate and CPK limited success
- BOTTOMLINE:
  Bowel ischemia and strangulation cannot be reliably diagnosed or excluded preoperatively in all cases by any known clinical parameter.
SBO – Treatment

- Fluid Resuscitation
  - LR – IVF of choice
  - UOP monitoring via foley
  - After potassium and chloride levels normalize and UOP adequate, IVF can be changed to maintenance with KCl replacement
  - Due to often large fluid requirements, central venous assessment may be necessary
SBO – Treatment

- Broad-spectrum antibiotics
  - Prophylactically given due to some reported data on bacterial translocation
  - Also given as prophylaxis for possible resection or inadvertent enterotomy at time of surgery
SBO – Treatment

- NGT
  - Empties stomach
  - No benefit given from longer intestinal tubes
  - PSBO can be managed conservatively (IVF & NGT) in 60-85% of patients
SBO – Operative Management

- Complete bowel obstruction → OR
  - 12-24hr delay of surgery is safe but incidence of strangulation and other complications increases significantly after this period
  - “sun should never set on a SBO”
SBO – Surgical Management

- LOA
- Manual reduction of herniated segment of bowel and defect repair
- Malignancy with metastasis - simple bypass of obstructing lesion appropriate
- Crohn’s – resection or strictureplasty
- IAA – percutaneous drainage
- XRT – if chronic, may require resection versus bypass
- If ? intestinal viability, fluorescein versus second look laparotomy
SBO – Surgical Management

- Laparoscopy – accepted in the following clinical scenarios
  1. Mild abdominal distention allowing adequate visualization
  2. Proximal obstruction
  3. Partial obstruction
  4. Anticipated single-band obstruction
Ileus

- Intestinal distention and slowing or absence of passage of luminal contents without demonstrable mechanical obstruction
- May continue to pass flatus and diarrhea
- Treatment is supportive with NGT, IVF, and correction of electrolytes

### CAUSES OF ILEUS

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<th>Causes</th>
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<td>Intestinal ischemia</td>
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<td>Systemic sepsis</td>
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</table>
Crohn’s Disease – Buzz Words

- Transmural inflammatory disease
- Abdominal pain, diarrhea, weight loss
- Complicated by SBO or localized perforation with fistula formation
- Occurs in SI and colon
- Discontinuous and segmental
- Rectal sparing characteristic in pts with colonic disease
- Perianal involvement – multiple chronic perianal fistulas
Crohn’s Disease – Buzz Words

- “skip areas”
- “fat wrapping”
- Aphthous ulcer
- Cobblestone appearance – linear ulcers that coalesce producing transverse sinuses with islands of normal mucosa in between
Crohn’s Disease – Buzz Words

- Young adult (20-30s)
- MCC symptom = intermittent colicky lower abdominal pain
- Next MCC symptom = diarrhea (85% pts)
- Main intestinal complications = obstruction, fistulas, and perforation
- Cancer risk
  - Relative risk SB 100x greater (ileum)
  - Colorectal risk also great
Crohn’s Disease – Buzz Words

- Extraintestinal Manifestations
  - Skin lesions
    - Erythema nodosum
    - Pyoderma gangrenosum
  - Arthritis
  - Arthralgias
  - Uveitis
  - Iritis
  - Hepatitis
  - Pericholangitis
  - Aphthous stomatitis
Crohn’s Disease
Crohn’s Surgical Treatment

- Medical management for acute exacerbations
- Surgical treatment limited to
  - Intestinal obstruction
  - Intestinal perforation with fistula formation or abscess
  - Free perforation
  - GIB
  - Urologic complications
  - Cancer
  - Perianal disease
- Make no attempt to resect more bowel even though grossly evident disease may be apparent
Strictureplasty

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SB Neoplasms

- Rare despite the fact that SB is 80% of the total length of the GI tract and 90% of mucosal surface area
- 5% of GI neoplasms, 1-2% of malignant tumors
- Possible reasons rate so low
  - Rapid transit of luminal contents
  - High turnover rate of SB epithelial cells minimizing carcinogenic exposure
  - Alkalinity of SI contents
  - High level IgA
  - Low bacterial count
SB Neoplasms

- Highest cancer rates – Maori of New Zealand and native Hawaiians
- Low in India, Romania, and Eastern Europe
- Increasing incidence likely due to spread of AIDS and lymphomas which occur in the immunocompromised host
- Benign – leiomyomas and adenomas; more common in distal SB
- Adenocarcinoma and carcinoid tumors are the most common malignant neoplasm
- Genetic mutations – \( K\text{-ras} \)
Work-up

- Upper GI series w/ SBFT
  - 50-70% accurate diagnosis
- Enteroclysis
  - Diagnostic accuracy 90%
- Flexible endoscopy
  - Duodenal lesions and ileal lesions
- CT A/P
  - Duodenal lesions and ileal lesions
Benign Neoplasms

- Adenomas most common in autopsy series
- GIST most common benign lesion producing symptoms
- Symptoms – vague and nonspecific
  - Most asymptomatic
  - Dyspepsia
  - Anorexia
  - Malaise
  - Dull abdominal pain
- SB tumors are the MCC of intussusception in adults!
Benign Neoplasms

- **Treatment**
  - Surgery – segmental resection and primary anastomosis

- **Pathology**
  - Leiomyomas (GIST) – MC symptomatic benign neoplasm of SB
  - Adenomas – 15%; most asymptomatic (20% duodenum, 30% jejunum, 50% ileum)
    - True
  - Villous – rare, mostly found in duodenum, may be associated with FAP, malignant potential 35-55%,
    - Segmental resection preferred, however, in duodenum polypectomy may be performed if histologically benign
  - Brunner gland – benign hyperplastic lesions from Brunner glands of proximal duodenum
    - Simple excision secondary to no malignant potential
Benign Neoplasms

Pathology

Lipomas (GIST)
- Mostly found in ileum
- Elderly men
- <1/3 symptomatic
- Symptomatic lesions should be excised; no malignant potential

Hamartomas (Peutz-Jeghers syndrome)
- Entire jejunum and ileum; 50% pts have colorectal involvement while 25% have gastric lesions
- Adenomatous changes reported in 3-6% of hamartomas
- Extra colonic cancers (50-90% patients)
  - SI, stomach, pancreas, ovary, lung, uterus, breast
  - SI most frequent site (RR 520)
- Surgical resection – should be limited to segment of bowel producing complications
- Cure not possible and extensive resection contraindicated
Benign Neoplasms

- Pathology
  - Hemangiomas
    - Jejunum most common
    - 3-4% benign SB tumors
    - Multiple in 60% of pts
    - May be part of Rendu-Osler-Weber disease, Turner’s syndrome
  - Most common symptom = GIB
  - Angiography and $^{99m}$Tc-RBC scan most useful
  - Surgical resection of involved segment only
Malignant Neoplasms

- Most common in order of frequency
  - Adenocarcinomas
  - Carcinoid tumors
  - Malignant GISTs
  - Lymphomas
Malignant Neoplasms

- How do they present?
  - Pain
  - Weight loss
  - Obstruction (15-35% pts)
    - Due to infiltration and adhesions as opposed to intussusception caused by SB benign lesions
  - Diarrhea with tenesmus
    - Mucus
  - Palpable mass (10-20% pts)
  - Perforations (10% pts)
    - Lymphomas and sarcomas
Malignant Neoplasms

**Pathology**
- Adenocarcinomas
  - 50% malignant tumors of SB
  - Peak incidence 70s, slight male predominance
  - Duodenum and proximal jejunum
    - Crohn’s pts younger age and in ileum
- GISTs
  - 20% malignant tumors of SB
  - Peak incidence 50-60s, slight male predominance
  - Jejunum and ileum
  - Direct extension and hematogenous spread
    - >5cm at time of diagnosis in 80% pts
    - Arise in muscularis propria and grow extramurally
Malignant Neoplasms

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Malignant Neoplasms

Pathology

- Lymphomas
  - 5% all lymphomas
  - 7-25% malignant tumors of SB (most common intestinal neoplasm in children <10)
- Ileum
- Increased risk in those immunocompromised and with celiac disease
- Usually large
Malignant Neoplasms

**Treatment**

- **GISTs**
  - Segmental bowel resections
  - If invasion into other organ segments present, resection may confer improved survival
- **Adenocarcinomas/Lymphomas**
  - Wide resection + regional LN
  - May require Whipple for duodenal lesions
  - Surgery often not curative
  - Palliative procedures versus bypass are often performed
Malignant Neoplasms

- Prognosis
  - 5-yr survival after surgery only 25%
  - Adenocarcinoma has poorest prognosis, with overall survival rate 15-20%
  - GISTs
    - Overall survival 7-56%
Carcinoid Tumors

- Arise from enterochromaffin cells (Kulchitsky cells) found in the crypts of Lieberkühn (a.k.a. argentaffin cells)
- Lungs, bronchi, GI tract
  - GI tract most common site
- SB carcinoids – 5th decade
- Classified by embryologic site of origin and secretory product
  - Foregut (respiratory tract, thymus)
    - Low levels of serotonin
    - ACTH
  - Midgut (jejunum, ileum, R colon, stomach, and proximal duodenum)
    - serotonin
  - Hindgut (distal colon and rectum)
    - Rarely produce serotonin
    - Somatostatin and peptide YY
Carcinoid Tumors

- Can secrete corticotropin, histamine, dopamine, eurotensin, prostaglandins, kinins, gastrin, somatostatin, pancreatic polypeptide, calcitonin, neuron-specific enolase

- Within GI tract
  - Appendix most common site
  - SI 2\textsuperscript{nd} most common
    - Occur within 2 ft of ileum
Carcinoid Tumors

- Primary importance of carcinoid tumors is malignant potential of tumors themselves

- Carcinoid syndrome
  - Episodic attacks of cutaneous flushing
  - Bronchospasm
  - Diarrhea
  - Vasomotor collapse
Carcinoid Tumors

- 70-80% asymptomatic
- 90% carcinoids = appendix 45%, ileum 28%, rectum 16%
- 3% appendiceal carcinoids metastasize
- 35% ileal carcinoids metastasize
- 75% GI carcinoids <1cm (2% metastasize)
- Tumors 1-2 cm (50% metastasize)
- Tumors >2cm (80-90% metastasize)
Carcinoid Tumors

- Pathology
  - Yellow on cut surface
  - Slow growing
  - 20-30% multicentric
  - Synchronous adenocarcinoma (most commonly large intestine) in 10-20% patients with carcinoid tumors
  - Associated with MEN I in 10% cases
Carcinoid Tumors

- **Diagnosis**
  - Elevated urinary levels of 5-hydroxyindoleacetic acid
  - Plasma chromogranin A elevated in >80% pts with carcinoid tumors
  - Administration of pentagastrin safest and most reliable and most frequently used provocotive test (not usually needed anymore)
Carcinoid Tumors

- **XR**
  - Barium may exhibit filling defects as result of kinking/fibrosis of SB
  - Angiography and U/S can reveal mesenteric and hepatic involvement
  - CT detects hepatic and LN metastasis and extent of bowel wall and mesenteric involvement
  - Somatostatin receptor scintigraphy using $^{111}$In-labeled pentetreotide
    - Scintigraphic localization study shows higher reported sensitivity than conventional imaging techniques in delineating and localizing carcinoid tumors
SB Carcinoid Treatment

- Treatment based on tumor size and site and presence or absence of metastatic disease
- Primary tumors <1cm without evidence of regional LN involvement → segmental intestinal resection
- Primary tumors >1cm, multiple tumors, or + regional LN metastasis → wide excision of bowel and mesentery is required
- Primary tumors of TI → R hemicolecotomy
- Small duodenal tumors → local excision (larger duodenal tumors may require Whipple)
- MUST ALWAYS EXPLORE ABDOMEN FOR MULTICENTRIC LESIONS!
SB Carcinoid Treatment

- **Anesthesia alert**
  - May precipitate carcinoid crisis (hypotension, bronchospasm, flushing, tachycardia)
  - Treatment IV octreotide bolus 50-100 µcg, continued with infusion of 50 µcg/hr
SB Carcinoid Treatment

- Surgery STILL indicated in pts with carcinoid tumors and widespread metastasis
- Definite role of surgical debulking in contrast to metastasis from other tumors
- May involve hepatic resection, hepatic artery ligation, or percutaneous embolization, hepatic artery occlusion with chemotherapy
Carcinoid Prognosis

- Best prognosis of all SB tumors
- Resection of carcinoid tumor localized approaches 100%
- 65% 5-yr survival in patients with regional disease
- 25-35% 5-yr survival in patients with distant metastasis
Metastatic Neoplasms

- Much more common than primary neoplasms
- Cutaneous melanoma is the most common extraabdominal source to involve SB
- Symptoms include anorexia, weight loss, anemia, bleeding, PSBO
True or false

- True – usually congenital and contain all layers of intestinal wall
- False – usually acquired and contain mucosa and submucosa protruding through defect in muscle coat
- Duodenal location most common for acquired diverticula
- Meckel’s diverticulum most common true diverticulum of SB
Duodenal Diverticula

- Duodenum second most common location after colon
- Found twice as often in women
- Rare in pts <40 yo
- $\frac{2}{3} - \frac{3}{4}$ duodenal diverticula found in periampullary region
Duodenal Diverticula

- **Clinical Manifestations**
  - Most asymptomatic
  - <5% require surgery
  - Major complications
    - Obstruction of biliary ducts → cholangitis
    - Obstruction of pancreatic ducts → pancreatitis
    - Hemorrhage
    - Perforation
    - “blind loop” syndrome – stasis of intestinal contents within distended diverticulum
Duodenal Diverticula

- **Treatment**
  - Symptomatic duodenal diverticulum
    - Diverticulectomy via Kocher maneuver exposing duodenum
    - Identification of the ampulla is essential
    - For diverticula embedded deep within the head of the pancreas, duodenotomy performed with invagination of the diverticulum into the lumen followed by excision and closure
  - Perforated diverticulum may require procedures similar to that of trauma to the duodenal wall
Jejunal and Ileal Diverticula

- 0.1-1.4% incidence
- Jejunal more common and larger
- False diverticula
- Older age
- Multiple
- Protrude from mesenteric border (often escapes surgical exploration)
- Cause possibly motor dysfunction of smooth muscle or myenteric plexus
Jejunal and Ileal Diverticula

**Clinical Manifestations**
- Majority asymptomatic
- Acute complications are rare
  - Diverticulitis
  - GIB
  - Obstruction
  - Blind loop syndrome – may lead to deconjugation of bowel salts and uptake of B12 by bacteria leading to steatorrhea and megaloblastic anemia

**Treatment**
- Intestinal resection and end-to-end anastomosis for obstruction, bleeding, and perforation
Jejunal and Ileal Diverticula

Omphalomesenteric remnant persisting as fibrous cord from ileum to umbilicus
Meckel’s Diverticulum

- Most common congenital anomaly of the SI (2% population)
- Antimesenteric border of the ileum 45-60cm proximal to the ileocecal valve
- Due to incomplete closure of the vitelline (omphalomesenteric) duct
- Male=Female
- Cells lining vitelline duct pluripotent; therefore, heterotopic tissue often within Meckel’s (most common is gastric – 50%)
Meckel’s Diverticulum

Clinical Manifestations

- Majority benign and incidentally discovered
- GIB most common clinical presentation
- Usual source of bleeding is chronic acid-induced ulcer in ileum adjacent to Meckel’s that contains gastric mucosa
- Intestinal obstruction is another common presenting symptom (volvulus, intussusception, Littre’s hernia)
Meckel’s Diverticulum

- Clinical Manifestations
  - Intussusception – diverticulum invaginates and then is propelled forward by peristalsis
    - Ileoileal or ileocolic
    - Possible palpable mass
  - Diverticulitis – 10-20% symptomatic presentations
Meckel’s Work-up

- XR, CT, U/S rarely helpful
- Meckel’s scan
  - 85% sensitive, 95% specific, 90% accurate in pediatric population
  - Not reliable for adults secondary to reduced ectopic gastric mucosa within diverticulum
Meckel’s Diverticulum

- **Treatment**
  - Symptomatic → prompt surgical intervention with resection of diverticulum or segment of ileum with diverticulum
  - Segmental intestinal resection required for bleeding because bleeding site usually in ileum adjacent to diverticulum
  - Hand-sewn technique or stapling across base in diagonal or transverse line
  - Laparoscopy safe and feasible option
  - Incidental Meckel’s found in children should be resected; however, in adults treatment controversial
Meckel’s Diverticulum

Common presentation of a Meckel diverticulum projecting from the antimesenteric border of the ileum.
SB Ulcerations

- NSAID use and complications responsible for at least 4% of all SB resections
- Treatment of complications from SB ulcerations is segmental resection with reanastomosis
Foreign Body Ingestion

- Majority treated with observation
- Can follow radiopaque objects with serial XR
- Cathartics contraindicated!
- Development of abdominal pain, tenderness, fever, or leukocytosis → OR for laparotomy
- Also to OR for obstruction
SB Fistulas

- EC fistulas most commonly iatrogenic (surgical mishap)
  - Also secondary to erosion (suction catheters, adjacent abscesses, or trauma)
  - Contributing factors can be prior XRT, intestinal obstruction, IBD, mesenteric vascular disease, intra-abd sepsis
  - < 2% occur spontaneously and if so usually due to Crohn’s disease
EC fistula diagnosis usually obvious

- Typically postop febrile pt with erythematous wound that once wound opened, purulent or bloody discharge found followed by leakage of enteric contents immediately or within 1-2 days

- Classified according to their location and volume which dictate treatment
SB Fistulas

- More proximal the fistula, the more serious the problem with greater fluid & electrolyte loss
  - High output fistulas drain >500cc per 24h

FACTORS PREVENTING SPONTANEOUS FISTULA CLOSURE

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<th>Factor</th>
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<td>High output</td>
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<tr>
<td>Severe disruption of intestinal continuity (&gt;50% bowel circumference)</td>
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<tr>
<td>Active IBD of bowel segment</td>
</tr>
<tr>
<td>Cancer</td>
</tr>
<tr>
<td>Radiation enteritis</td>
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<tr>
<td>Distal Obstruction</td>
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<tr>
<td>Undrained abscess cavity</td>
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<tr>
<td>FB in fistula tract</td>
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<tr>
<td>Fistula tract &lt;2.5cm in length</td>
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<tr>
<td>Epithelialization of fistula tract</td>
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</table>
SB Fistula

Treatment

Successful management dependent on establishing controlled drainage

- Control of fistulous output most easily done by intubation of fistula tract with drain
- Must protect skin around fistulous opening using stomahesive appliances with zinc oxide or similar products
- TPN can be used to replace nutritional losses when necessary
SB Fistulas

**Treatment**

- Long-acting octreotide has been used with successful decrease in volume of output in proximal fistulas
  - whether it improves rate of closure remains in debate
- Some advocate up to 3 months for spontaneous closure (however about 90% SB fistulas close within 1 month)
  - Therefore current recommendations suggest 4-6 weeks conservative management and optimization of nutritional status prior to surgical intervention if fistula fails to close
SB Fistulas

**Surgical Management**

- Most easily accomplished by entering prior abdominal wound
- Preferred approach is fistula tract excision and segmental resection of involved segment of intestine with reanastomosis
- Simple closure of the fistula after removing the tract almost ALWAYS results in recurrence
- If unexpected abscess found and anastomosis unsafe, both ends should be exteriorized
SB Fistulas - BOTTOMLINE

- Most commonly results from previous surgical procedure
- Imaging must be performed to define location, possible abscess (usually by fistulogram)
- Must control sepsis, fluid & electrolytes, skin protection, and malnutrition
- After 6 weeks, if no closure → OR!
Pneumatosis Intestinalis

- Multiple gas-filled cysts of GI tract
- Most common in jejunum
- Males = Females
- In neonates, associated with NEC
- Most promising theories on etiology consist of mechanical, mucosal damage, bacterial, and pulmonary
Pneumatosis Intestinalis

- Cysts are thin-walled and when rupture → pneumoperitoneum
- Represents one of the few cases of sterile pneumoperitoneum
  - Should be considered in pt with free air but no evidence of peritonitis
- Symptoms nonspecific but when present
  - Diarrhea
  - Abdominal pain
  - Abdominal distention
  - N/V
  - Weight loss
  - Mucus in stool
  - Hematochezia
  - Constipation
Pneumatosis Intestinalis

- Pneumatosis intestinalis is benign cause of pneumoperitoneum!
- No treatment necessary unless rare complication intervenes
  - Rectal bleeding
  - Cyst-induced volvulus
  - Tension pneumoperitoneum
- Surgical intervention should be decided based on clinical course of the patient
SMA Syndrome

- Vascular compression of the duodenum or Wilkie’s syndrome
  - Characterized by compression of 3rd portion of duodenum by SMA as it passes over this portion of the duodenum

- Symptoms
  - N/V
  - Abdominal distention
  - Weight loss
  - Post-prandial epigastric pain
SMA Syndrome

- Most common in young athletic women
- Predisposing factors
  - Significant weight loss
  - Supine immobilization
  - Scoliosis
  - Body cast placement
- Association with
  - Peptic ulcer
  - Anorexia nervosa
  - After proctocolectomy and J-pouch anastomosis
  - AVM resection of cervical cord
  - Orthopedic procedures (spinal)
SMA Syndrome

- Diagnosis made by barium UGI
  - Abrupt or near-total cessation of flow of barium from duodenum to jejunum
SMA Syndrome

**Treatment**

- Conservative measures tried initially
- Operative treatment of choice is duodenojejunalostomy
Appendix

- **Diagnosis**
  - Believe it or not should be primarily based on H&P! (CT scan not to be done BEFORE pt seen)
  - Lab and imaging are adjuncts to the H&P!
  - History
    - Onset of generalized abdominal pain followed by anorexia and nausea
    - Pain then intensifies in epigastrum migrating toward umbilicus and finally localized in RLQ
    - Emesis may occur during migration

- **Physical**
  - Diminished bowel sounds
  - Direct tenderness with muscle spasm in RLQ; spasm increases with development of rebound
  - Temperature mildly elevated (higher if perforation)
  - REMEMBER variable location of tip of the appendix from last week!
  - Rovsing’s sign
  - Psoas sign
  - Obturator sign
  - Rectal to indicate presence of a mass

Onset of generalized abdominal pain followed by anorexia and nausea.

Pain then intensifies in epigastrum migrating toward umbilicus and finally localized in RLQ.

Emesis may occur during migration.
Appendix

- Imaging
  - AAS
    - Pneumoperitoneum usually = diagnosis other than appendicitis
    - Findings can include fecalith, localized ileus, loss of peritoneal fat stripe
  - U/S
    - Often used as initial study in pts with equivocal diagnosis
    - Sensitivity >85%, specificity >90%
    - Highly operator dependent
    - Sonographic criteria
      - Noncompressible appendix
      - 7mm or greater AP diameter
      - Presence of appendicolith
      - Interruption of continuity of echogenic submucosa
      - Periappendiceal fluid or mass
Appendix

CT A/P
- Reserved for pts with equivocal H&P and lab findings
- Greatest when effort made to visualize appendix
- PO & IV contrast
Appendix

- Diagnostic CT findings
  - Periappendiceal inflammation
  - Appendix distended or thickened to >5-7mm
  - Wall circumferentially thickened (“halo”)

![Diagnostic CT findings image](image-url)
Appendicitis

Lab work

- WBC 12-18
- Left shift
- CRP nonspecific
- UA – may show mild pyuria with appendicitis due to proximity of ureter to appendix
Diagnosing Appendicitis

- **What conditions will fool you?**
  - School-age children
    - Gastroenteritis (no lab findings, peritonitis)
    - Omental infarction (no pain migration)
  - Adolescent/young males
    - Crohn’s disease/UC
    - Epididymitis (+ epididymis tenderness)
  - Adolescent/young females
    - PID (lower abdominal pain that is bilateral and worse with pelvic exam)
    - Ovarian cysts and torsion (no migration)
    - UTI (UA)
  - Elderly
    - Malignancies of GI and reproductive system
    - Diverticulitis
    - Perforated ulcers
    - cholecystitis
Appendicitis & the Surgeon

- IVF resuscitation prior to surgery
- Acute
  - Urgent appendectomy
  - Prophylactic antibiotics should be administered preop (single dose) – Cefoxitin or cefotetan
  - Negative appy rate historically has been acceptable at 20%, with diagnostic modalities available in 2005 should be lower 😊
Appendicitis & the Surgeon

- Transverse incision (Davis-Rockey)
- Oblique incision (McArthur-McBurney)
- Paramedian incision
Open Appendectomy
Laparoscopic Appendectomy

- Usually done with 3 ports (one umbilical and position of other 2 vary depending on the surgeon)
- Appendix can be removed using endoloops or an endoscopic stapler
- Appendiceal stump is not buried
- Fascia at 10mm port sites closed
- D/C home usually less than 24h postop
Laparoscopic Appendectomy
Perforated Appendicitis

Antibiotic therapy duration controversial (7-10d versus until afebrile with normal WBC)
Many surgeons advocate that the appendix should be removed since the complication rate is quite low in this setting (including authors of Sabiston)
Interval Appendectomy

- Controversial
- Risk of recurrent appendicitis must be balanced against risk of interval appendectomy
- Younger the patient, higher lifetime risk of recurrent appendicitis and lower operative risk
Appendicitis in Pregnancy

- Appendicitis and cholecystitis most common causes of abdominal pain during pregnancy
- After 5\textsuperscript{th} month of gestation, appendiceal position shifted superiorly above iliac crest and appendix tip rotated medially by gravid uterus
Appendicitis in Pregnancy

- WBC usually not helpful as it is commonly elevated in pregnancy
- Symptoms usually not of diagnostic value secondary to pregnancy
- U/S can be helpful
- Suspicion should lead to EARLY surgical intervention in ALL trimesters
- Negative laparotomy results in minimal fetal loss whereas delay in diagnosis and perforation may lead to high incidence of fetal death and relatively high incidence of maternal death
- Laparoscopic approach may be used
MANAGEMENT OF POST-OPERATIVE INFECTIONOUS COMPLICATIONS OF APPENDICITIS

- Symptoms/signs of infectious complications
  - Clinical exam/wound evaluation
    - CT abdomen/pelvis
      - Discrete abscess
        - Percutaneously drain
          - Potentially modify antibiotics according to cultures
      - Multiple loculated, small fluid collections
        - Clinically stable
          - Consider new antibiotics until WBC normal/afebrile
        - Clinically deteriorating
          - Exploratory laparotomy
            - Drain abscesses
  - Wound infection
    - Open/dressing changes
Neoplasms

- Carcinoids most common appendiceal neoplasm
- Appendiceal neoplasms extremely rare
- Adenocarcinomas
  - <0.5% of all GI neoplasms
  - Mucinous (55%)
  - Most common presentation is that of acute appendicitis
  - Survival rate better with R hemicolecotomy versus appendectomy alone
  - Second primary was located in 35% patients
  - R hemicolecotomy indicated for
    - Invasive adenocarcinoma
    - Tumors close to cecum
    - Mucin-producing tumors
    - Invasion of lymphatics, serosa, or mesoappendix
    - Cellular pleomorphism with high mitotic rate
  - Appendectomy indicated in ALL patients with Krukenberg tumors when another primary site cannot be identified at time of surgery