Acute Care SINS: Surgical Insights for the Non-surgeon

Chapter 6: Colon

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About the Authors

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Summary

“Surgical Insights for the Non-surgeon,” or SINS, is composed of several short chapters intended to cover fundamental surgical knowledge for non-surgeons. The authors focus on surgical pearls, operative insights, and applied anatomy. In Chapter 6 of this series, the authors discuss the colon, covering the areas of anatomy, obstruction, colitis, and surgery.

Résumé

L'ouvrage « Surgical Insights for the Non-surgeon » ou SINS (aperçu de chirurgie pour le non-chirurgien) se compose de plusieurs courts chapitres conçus pour couvrir les connaissances fondamentales en matière de chirurgie chez ceux qui ne sont pas chirurgiens. Les auteurs se concentrent sur des « trésors de sagesse » tirés de leur expérience personnelle en chirurgie, certaines idées en matière d'interventions, et sur l'anatomie appliquée. Le sixième chapitre porte sur le côlon sous les aspects de l'anatomie, de l'occlusion, de la colite et de la chirurgie.

The finger is superior to all instruments. Covered with parts soft and supple, it causes little pain, it can be placed in narrow spaces; flexible, it conforms to various parts; sensitive, it permits the appreciation of the variations in resistance of the parts percussed.

— Henri A. Hartmann, 1860–1952

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Anatomy

The colon, or large intestine, is essentially a tube that is approximately 150 cm long. It is embryologically developed from the midgut (cecum and ascending and proximal transverse colons) and the hindgut (distal transverse, descending, and sigmoid colons). The cecum is the capacious sac-like segment that collects contents from the small bowel through the ileocecal valve. The ascending and descending portions are fixed against the retroperitoneum. There are unique characteristics that identify the colon:

- Taeniae coli – three condensations of the outer longitudinal muscle layer, originating at the base of the appendix and converging at the rectosigmoid junction; these contribute to segmental contractions
- Haustra – pouches along the colon wall, causing a segmented appearance
- Appendices epiploicae – fat appendages along the length of the colon

The colon's blood supply is derived from both the superior mesenteric artery (SMA) and the inferior mesenteric artery (IMA). SMA branches to the colon include the ileocolic, right colic, and middle colic. The IMA branches into the left colic artery and sigmoid artery, and terminates as the superior rectal artery. The marginal artery is a large collateral vessel that connects the SMA and IMA by forming a continuous arcade along the colon's mesenteric border.

Large Bowel Obstruction

Complete large bowel obstruction (LBO) is a medical emergency and needs surgical consultation. Common causes of LBO are cancer, diverticulitis, volvulus, and other conditions such as strictures, hernia, adhesions, and fecal impaction. Pseudo-obstruction (signs/symptoms of intestinal obstruction but with no luminal obstruction) can also occur.

Colon Cancer

- Adenocarcinoma of the colon/rectum is the third most common cancer (lung cancer is first, breast second, prostate fourth)
- Lifetime risk is 6%
- Risk factors – age, race, genetic, polyps, diet, alcohol, smoking, obesity, inflammatory bowel disease

Clinical presentation:

- Asymptomatic screening
- Bleeding – bright red blood per rectum (left-sided lesions),

anemia (right-sided lesions)

- Change in bowel habits
- Obstruction

Diagnosis and workup:

- Colonoscopy is the gold standard for diagnosis (biopsy and exclusion of synchronous cancers)
- Workup includes physical examination, chest radiography, liver function tests, carcinoembryonic antigen (CEA), computed tomography (CT) of the chest/abdomen/pelvis

Treatment:

- For non-metastatic disease, surgical resection to remove the primary cancer (plus margins), regional lymphadenectomy, and restoration of the gastrointestinal (GI) continuity
- Right-sided cancers receive a right hemicolectomy
- Left-sided cancers receive a left hemicolectomy, extended right hemicolectomy, or anterior resection
- Hartmann's procedure may be used for obstructing left-sided cancers
- Refer to section "Colonic Surgery," below, for more details

Diverticular Disease

- An acquired condition due to multiple false diverticula
- Mucosa and submucosa herniate through the circular muscle layer (pulsion diverticula)
- Bleeding
 - From a perforated vasa recta – located at the neck or apex of the diverticulum
 - Can present as massive, bright red blood per rectum, or hemorrhagic shock
 - In the majority, bleeding will stop spontaneously; in 10%, ongoing bleeding requires surgery
 - Localizing the bleeding site can be a challenge (colonoscopy, CT angiography)
- Diverticulitis
 - Results from a micro-perforation of the diverticulum
 - Presents as left lower-quadrant abdominal pain, fever, change in bowel habits, bloating

Diagnosis:

CT is the diagnostic test of choice for diverticulitis (surgeons need to know location, extent, and the presence or absence of complications such as an abscess or fistula).

Treatment:

- Uncomplicated disease can be treated conservatively with bowel rest and antibiotics

- Colonoscopy 6–8 weeks later to confirm the diagnosis and rule out malignancy
- Localized abscess requires drainage (either percutaneous or surgical)
- Presence of shock or generalized peritonitis means emergency surgery (to resect the diseased segment)

Colonic Volvulus

- When a segment of colon twists or folds on itself
- Results in obstruction and impaired colonic blood supply
- Most common in the sigmoid colon (two thirds), followed by the ileocecal location (one third)

Sigmoid Volvulus

- Associated with chronic constipation, older age, institutionalization, and psychotropic medications
 - Presents with LBO, perforation, or ischemia
 - In the non-perforated patient, imaging shows colonic dilation, mesenteric whorl, and “bird’s beak” at the point of obstruction

Treatment:

- Intravenous (IV) fluid resuscitation plus decompression (non-operative decompression via colonoscopy or contrast enema, or surgical decompression)
- Patients with necrosis or perforation require emergency surgical resection

Cecal Volvulus

- Associated with pregnancy, previous surgery, malrotation, and female gender
- Patients present with abdominal pain and distension
- Imaging shows a dilated cecum shifted to the left abdomen

Treatment:

Surgical resection is needed to correct the obstruction and prevent ischemia.

Colonic Pseudo-obstruction

- Also known as Ogilvie’s syndrome
- Massive colonic dilatation *but without* mechanical obstruction

Diagnosis:

Diagnostic tests are abdominal radiography and/or CT scan with rectal contrast, or fluoroscopic enema.

Treatment:

- Usually conservative: nasogastric tube for decompression, IV fluids, correction of electrolyte abnormalities,

minimization of medications that impair motility (i.e., opiates)

- Neostigmine (reversible acetylcholinesterase inhibitor) to stimulate the intestinal parasympathetic nervous system; caution: can cause bradycardia (therefore, needs cardiac monitoring) and contraindicated in mechanical obstruction

Colitis

Colonic inflammation is usually secondary to inflammatory bowel disease, infection, or ischemia. It is sometimes treated medically, but a surgeon should be involved early to advise and in case an escalation of treatment is required.

Ulcerative Colitis

- Inflammatory bowel disease that affects the mucosa of the rectum and colon
- Majority (80%) present with distal disease (urgency, tenesmus, frequency, and bloody/mucoid stools)
- Remainder (20%) present with pancolitis with possible progression to fulminant colitis
- Extra-intestinal manifestations in 25%: pyoderma gangrenosum, erythema nodosum, iritis, uveitis, arthritis, primary sclerosing cholangitis, fatty liver, thromboembolism, etc.
- Surgical treatment indicated in the following situations
 - Fulminant colitis (>6 bowel movements/day, fever, tachycardia, anemia, and marked abdominal pain)
 - Toxic colonic dilatation (be concerned when >10cm)
 - Perforation
 - Hemorrhage
 - Failure of medical management
 - Cancer (risk increases with the duration of disease and extent of inflammation)
- Emergency surgery results in total abdominal colectomy and end ileostomy
- Elective procedures
 - Total proctocolectomy with ileostomy (removal of the colon/rectum, permanent ostomy)
 - Total abdominal colectomy with ileorectal anastomosis (colonic resection and ileorectal anastomosis – requires surveillance of the rectum due to risk of ongoing proctitis)
 - Restorative proctocolectomy (removal of the colon/rectum with formation of an ileal pouch anastomosed to the anus; often requires a temporary ostomy)

Ischemic Colitis

- Occlusion of arterial supply or impaired local microvascular perfusion of the colonic wall

- Presents with bleeding per rectum, abdominal pain, diarrhea
- Can sometimes progress to (or present as) full thickness necrosis or perforation with peritonitis

Treatment:

- Most patients treated conservatively (fluid resuscitation, bowel rest, and antibiotics)
- Surgery if more severe disease (full thickness ischemia or clinical presentation of shock, sepsis, or peritonitis)

Infectious Colitis

Causes:

- Viruses (noroviruses, rotaviruses, adenoviruses)
- Bacteria (*Salmonella*, *Campylobacter*, *Shigella*, enterotoxigenic *Escherichia coli*, *Clostridium difficile*)
- Protozoa (*Cryptosporidium*, *Giardia*, *Entamoeba*)

Diagnosis:

Endoscopy is used to distinguish infectious diarrhea from inflammatory bowel disease or ischemic colitis or to diagnose the presence of *C. difficile* (by looking for pseudomembranes).

Treatment:

- Fluid resuscitation
- Antibiotics
- Treatment includes removing precipitating factors such as broad-spectrum antibiotics, proton pump inhibitors
- Surgery indicated for failures of medical therapy, toxic megacolon, perforation, and sepsis
 - Standard surgery is total abdominal colectomy with end ileostomy
 - **Remember the rectum is left in place with this procedure;** therefore, antibiotics often still required to completely treat colitis
 - For *C. difficile* colitis, a diverting loop ileostomy with colonic lavage has been proposed and is currently being addressed in randomized control trials

Colonic Surgery

Right Hemicolectomy and Extended Right Hemicolectomy

- See Figure 1 for an illustration of a right hemicolectomy and Figure 2 for an extended right hemicolectomy
- Resection of part of the distal ileum, cecum, ascending colon, and proximal transverse colon
- Extended right hemicolectomy means that resection goes beyond the mid-transverse colon (see Figure 2)
- Indications: right-sided or transverse colon cancer, appendiceal cancer, right-sided diverticulitis, ischemia, trauma, and cecal volvulus

Surgical Pearl: Ostomies Are the Window to the Abdomen

Upon examination, if you find

- a pink stoma or a productive (stool or flatus) stoma, this suggests all is well
- that it is purple, pale, or prolapsed (or otherwise falling apart), let the surgeon know

Examine for obstruction:

- Remove the ostomy appliance
- Gently insert a lubricated finger into the ostomy to determine if the cause of obstruction is distal (e.g., intraluminal fecalith obstruction)

Examine for intestinal ischemia:

- Examine the colour and capillary refill of the ostomy
- Examine further by gently inserting the end of a glass test tube into the ostomy

- In the majority, the small bowel is re-anastomosed to distal transverse colon (hand sewn or stapled)
- Complications include anastomotic leak, abscess, wound infection, injury to the right ureter or duodenum

Left Hemicolectomy

- Resection of the transverse colon: left of the middle colic vessels to the upper rectum
- Indications: segmental Crohn's disease, ischemia, trauma, distal colon cancers, diverticular disease
- Complications include anastomotic leak, abscess, wound infection, injury to the left ureter or spleen

Low Anterior Resection

- Also known as a "low anterior" (Figure 3)
- Resection of the sigmoid colon and rectum (named because the resection is below the peritoneum's anterior reflection)
- Includes a primary anastomosis between the descending colon and either the lower rectum or anal sphincter
- May include a diverting proximal loop ileostomy to protect the anastomosis
- Alternatively, a resection combined with creation of a colostomy (a.k.a. Hartmann's procedure)
- Indications: distal sigmoid or high rectal cancers

Abdominal Perineal Resection

- Also known as an "AP resection" or "APR"
- Two parts: (1) incision through the abdomen to dissect the sigmoid colon/rectum (and associated lymph nodes) and (2) a perineal portion to dissect the rectum and anus

Figure 1. Right hemicolectomy. Illustration by Rachel G. Khadaroo and Dawne Colwell.

Figure 2. Extended right hemicolectomy. Illustration by Rachel G. Khadaroo and Dawne Colwell.

Figure 3. Lower anterior resection. Illustration by Rachel G. Khadaroo and Dawne Colwell.

- An end colostomy created with the remaining descending colon

Subtotal, Segmental, or Total Abdominal Colectomy

- Removal of part or entire colon without removal of the rectum
- Requires either an end ileostomy or primary ileocolic/ileorectal anastomosis

Hartmann's Resection

- Two-stage procedure often used in emergency clinical settings where there is peritoneal contamination: (1) resection of the diseased descending colon, end colostomy, and creation of a rectal stump (stapled closed or externalized as a mucous fistula); (2) often followed by colostomy closure months later
- Indications: diverticulitis with obstruction or perforation, obstructing left-sided colon cancers

Mucous Fistula

- Distal colon is brought upward and sutured open to the abdominal wall
- Done to prevent perforation of the distal stapled end (a.k.a. a "stump blowout")
- Indications include toxic megacolon or distal obstruction

Ostomies

- Indicated when restoration of intestinal continuity is contraindicated or not feasible

- Site selection influences post-operative complications; site is selected based upon abdominal wall contour, prior incisions, occupation, clothing style, and physical limitations
- Please refer to "Chapter 2: Tubes, Drains, and Ostomies" (CJGIM Issue 8-1) for more details

End ostomies (small bowel or large bowel):

- End of the bowel is advanced through the abdominal wall and sutured
- Should be no rectal gas or stool, but don't be surprised if rectal mucus is secreted

Loop ostomies:

- Proximal functioning limb and defunctioned distal limb (i.e., double-barrel ostomy)
- Loop ostomy may or may not pass flatus/stool (intended to reduce passage; may not completely eliminate)

Stomal complications:

- Stomal necrosis: typically from venous congestion, excessive tension, or tight fascia
- Stomal retraction: causes leakage and difficulties with pouch adherence, skin irritation
- Mucocutaneous separation (usually early post-operative period): conservative treatment with healing by secondary intention
- Parastomal hernia (late complication): presents with abdominal pain, obstruction, and incarceration; treatment

Surgical Pearl: When to Avoid a Rectal Examination

- The doctor has no fingers.
- The patient has no rectum.
- The patient has no neutrophils. (Never perform a rectal examination on a patient who is immunosuppressed due to the risk of causing sepsis.)

options include stoma relocation, direct repair of the fascial defect, or prosthetic mesh

- Stomal prolapse: leads to edema, swelling, and bowel incarceration

Bibliography

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