Ischemic Colitis

Medical Differential, Radiologic Findings, and Avoiding Surgical Intervention!
Ischemic Colitis

Ischemic colitis is a subset of the broad entity of Acute Bowel Ischemia, a continuum that includes a wide range of clinical and pathological manifestations with a mortality rate of 50-90% depending on the cause of the event and the degree and extent of ischemic bowel wall damage.

Acute bowel ischemia can
- involve the small or large bowel
- be segmental or diffuse
- be only partial mural (involving only the mucosa and submucosa, with or without parts of the muscularis)
- or be transmural (continuous necrosis of all bowel wall layers, i.e. infarction)
Where does Ischemic Colitis fall in the continuum?

- *partial mural* and superficial ischemia (involving only the mucosa and submucosa, with or without parts of the muscularis), of the *large bowel* with subsequent inflammatory response
- it is the most common type of colitis in patients older than 50 years, most commonly affecting those in the 6th to 8th decade of life with an equal male/female distribution.
- accounts for about 1 per 2000 hospitalizations
- it is often self-limiting with approx 50% resolution in 2-4 weeks without recurrence
- contrast this to acute bowel infarction (i.e. *transmural* necrosis) which has a higher annual mortality rate than colon cancer!
**Ischemic colitis** itself comprises a spectrum of disorders, including:

- reversible colopathy (submucosal or intramural hemorrhage)
- transient colitis
- chronic colitis
- stricture
- gangrene
- fulminant, universal colitis
Types and Approximate Incidences of Ischemic Colitis

<table>
<thead>
<tr>
<th>Type</th>
<th>Incidence (%)</th>
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<tbody>
<tr>
<td>Reversible colopathy</td>
<td>30–40</td>
</tr>
<tr>
<td>Transient colitis</td>
<td>15–20</td>
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<tr>
<td>Chronic ulcerating colitis</td>
<td>20–25</td>
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<tr>
<td>Stricture</td>
<td>10–15</td>
</tr>
<tr>
<td>Gangrene</td>
<td>15–20</td>
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<tr>
<td>Fulminant universal colitis</td>
<td>&lt;5</td>
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* take home point: while gangrene and fulminant colitis are emergent and life-threatening conditions, reversible and transient colitis are more common

Feldman: Sleisenger & Fordtran
Pathogenesis

• The causes of ischemic colitis can be divided into:
  
  ‣ (1) **occlusive disease**; arterial occlusion, small vessel disease, or venous occlusion
  
  ‣ (2) **non-occlusive disease**; inflammation, low flow states
  
  ‣ (3) **mechanical**; obstruction
What’s on the Differential Diagnosis?

(1) Occlusive Disease:

Arterial Occlusion
- Thrombosis (SMA, IMA)
- Arterial embolus; MI, rheumatic heart disease, A. Fib.
- Atherosclerosis, dissection
- Cholesterol embolization
- Iatrogenic causes; aortic surgery, stent placement, catheter arteriography
- Therapeutic embolization for GI hemorrhage
- Fibromuscular dysplasia (rare)
- Vasculitides; Takayasu’s, giant cell arteritis, etc
- Hypercoagulopathies and microangiopathies; Sickle cell, Polycythemia vera, PNH,
  Protein C and S deficiency, ATIII deficiency, APC resistance, Prothombin mutation

Small Vessel Disease
- Vasculitis; Systemic lupus erythematosus, Polyarteritis nodosa, Rheumatoid vasculitis,
  Buerger’s disease, Behcet’s, Kawasaki’s disease, etc
- Diabetic vasculopathy
- Amyloidosis

Venous Obstruction
- Venous thrombosis (primary and secondary)
What’s on the Differential Diagnosis?

(2) Non-occlusive Disease; inflammation, low flow, or vasospasm
- Cardiac failure or arrhythmias
- Hemorrhagic, cardiogenic, septic shock
- Dehydration, stress (high endurance athletes)
- Chronic renal failure requiring hemodialysis
- Inflammation; pancreatitis, appendicitis, diverticulitis, peritonitis, etc
- Medications and drugs; Digitalis, Vasopressin, Pseudoephedrine, Phenylephrine, Sumatriptan, Methamphetamine, Nonsteroidal anti-inflammatory drugs, Oral saline laxatives, GoLYTELY, Glycerin enema, Interferon Alpha, Flutamide, Penicillin, Immunosuppressive agents, Cocaine
- Pheochromocytoma
- Familial dysautonomia (rare)

(3) Obstruction
- Pronounced overdistention (prestenotic, distention colitis); compromise of mucosal microcirculation by the elevated intraluminal pressure
- Volvulus, strangulated hernia, peritoneal band or adhesion; compression or strangulation of mesenteric veins
- Adjacent to intestinal tumors (focal)
What’s on the Differential Diagnosis?

The most common cause is:

• atherosclerosis with thrombosis of the IMA or colonic branches of the SMA.

But remember, regardless of the cause of the ischemic insult, the end results are similar—a spectrum of bowel injury that ranges from transient alteration of bowel function to transmural gangrene.
Anatomy

Celiac Artery
• supplies the GI tract from the distal esophagus to the descending duodenum

Superior Mesenteric Artery
• supplies the ascending and proximal transverse colon
• arises from the aorta at L1

Inferior Mesenteric Artery
• supplies the distal transverse colon and descending colon
• arises from the aorta at L3
Selective SMA angiogram: note the ileocolic artery separating the jejunal and ileal branches from the left side of the trunk.

(A) Selective IMA angiogram that demonstrates conventional arterial anatomy. There is retrograde filling of the middle colic artery that supplies the distal transverse colon. (B) Venous phase of inferior mesenteric artery angiogram.
Anatomy; Watershed Area

- The colon is particularly susceptible to ischemia, perhaps owing to its relatively low blood flow (20% of resting cardiac output), its unique decrease in blood flow during periods of functional activity, and its sensitivity to autonomic stimulation (can drop to 10% in critical “fight or flight” situations).
- The transverse and left-sided colon, and more specifically the splenic flexure, whose blood supply is a watershed area between the SMA and IMA (called Griffith’s point), are particularly vulnerable.
Presentation

- The clinical presentation varies with the underlying cause, extent of vascular obstruction, rapidity of ischemic insult, and degree of collateral circulation.

- **History:** there may have been previous similar episodes, background of arteriosclerosis, hypertension, diabetes, or cardiovascular or collagen vascular disease.

- **Symptoms:** about 75% have abdominal pain, typically abrupt in onset, crampy, mild, and localized to the left lower quadrant.

- Other common symptoms include lower GI bleeding, abdominal distention, diarrhea, and N/V. The bleeding is typically mild.

- **Signs** include mild tenderness over the involved intestinal segment, abdominal distention, low-grade pyrexia, tachycardia, and fecal occult blood.

- Severe ischemia manifests with leukocytosis, neutrophilia, and a shift to immature leukocyte forms on the leukocyte differential.
Patient Presentation

- T.D. is a 76 year old woman with PMH of htn and cholecystectomy in ‘88, who presented to the ED with 3 days profuse diarrhea, N/V, very limited PO intake, and diffuse crampy left-sided abdominal pain.
- On exam, she was afebrile, orthostatic with BP 78/47 supine, abdomen was distended and diffusely tender but no peritoneal signs. FOBT +.
- Labs came back with a WBC of 15.3, and 4% bands, anion gap of 17, and creatinine 1.8
- The differential was exhaustive, including infectious, inflammatory and infarcted bowel, so what did they do next in the ED?

Start aggressive fluid rehydration and get this woman a CT of the abdomen!
Radiologic Findings

CT - T.D.

- Before oral contrast reached the colon

Thickening of wall to 15.69mm
CT - T.D.

- With rectal contrast and progression of oral contrast to descending colon.

Thickening of bowel wall at splenic flexure to 11.38mm.
• The differential for the radiologic finding of bowel wall thickening includes:
  – IBD
  – infectious colitis; C. Diff., gastroenteritis
  – ischemic colitis

• Therefore, more specific radiologic or additional clinical findings would be helpful.

• Clinical: T.D.’s labs came back with a high anion gap, negative cultures for E. Coli, Salmonella, Shigella, etc., and negative x3 for C. Diff. Toxin. Patient has no personal or family history of IBD

• Radiologic: check out the next slides...
CT - T.D.

- Hint: look at the wall of the transverse colon

* pneumatosis and portal or venous air indicate necrotic bowel!

CT images from another patient with portomesenteric gas
CT, review of radiologic findings

- Wall Thickening; normal ranges from 3-5mm depending on distention. thickening due to mural edema, hemorrhage, and/or spastic contractions seen 94% of the time - most common finding but also the least specific.
- Dilatation; quite common in cases of infarction (56-91%), less common in reversible ischemia (40%)
- Stranding and Ascites; 61% and 37% of cases
- Bowel Wall Attenuation; hypoattenuation (61%) homogeneous and caused by bowel wall edema, hyperattenuation (18%) due to hyperperfusion or mesenteric venous occlusion and subsequent venous outflow obstruction
- Pneumatosis and Portomesenteric Gas; less common but more specific (present 6-28% and 3-14% of cases respectively with a specificity approaching 100%)

Wiesner W, CT of acute bowel ischemia.
CT, review of radiologic findings

• Conclusion: with an overall sensitivity of 82% for the diagnosis of acute bowel ischemia, CT has almost reached the sensitivity of angiography, and in contrast to angio, CT is able to demonstrate not only vascular occlusions but also bowel wall changes and confirmation or exclusion of other abdominal conditions, CT has become the key imaging modality for the diagnosis of acute bowel ischemia.
Multidetector row CT

- Multidetector row CT, combines multiple rows of detectors and faster gantry rotation with narrow collimation
- This CT technique can provide more detailed information about the mesenteric vessels and the intestine by various 3D reformatting techniques, because both 3D volume rendering and maximum intensity projection imaging can display vessels similarly to conventional angiography.
- Multidetector row CT may be able to eliminate the need for additional imaging studies, such as Doppler ultrasonography or angiography.
Infarcted segment of ascending colon (asterisks) is poorly visible indicating absent or no flow to ascending colon. Note normal appearance of other parts of the small (S) and large (L) intestine.

No bowel wall enhancement of affected bowel loop (arrows) and extensive superior mesenteric vein thrombosis (arrowheads).
Plain film KUB

- nonspecific findings, such as bowel dilation, air-filled bowel loops, mural thickening, and ahaustral bowel, but is valuable to exclude other abdominal disorders.
- specific findings occur in about 20% of cases.
- the most characteristic finding is thumbprinting.
- pneumoperitoneum, pneumatosis coli, and portal vein pneumatosis indicate impending colonic infarction.
Barium Enema

- the sensitivity of barium enema approaches 80%
- findings include bowel dilatation, thumbprinting, thickened folds, effacement of the mucosal pattern, ulceration, and stasis of barium
- BE should not be performed in cases of suspected acute occlusive ischemia because barium interferes with angiography
- colonoscopy has replaced barium enema as the most common diagnostic tool with higher sensitivity and specificity, and allows direct visualization of the mucosa, ability to subsequently perform angiography

Colonoscopic equivalent of a “thumbprint”; caused by submucosal hemorrhage and edema

Feldman: Sleisenger & Fordtran
Colonoscopy

- T.D. had a colonoscopy which showed:
- **Findings/ Impression:**
  Pseudomembrane in the splenic flexure, descending colon, sigmoid colon and rectum compatible with ischemic colitis. This pseudomembrane can be washed off, revealing erythematous, congested tissue beneath.

**Given the distribution of T.D.’s findings, what would be the next appropriate step?**
Angiography

- Mesenteric angiography usually is not indicated in the evaluation of ischemic colitis, because by the time of presentation, colon blood flow has returned to normal.
- Angiography may be indicated when patient has more severe abdominal pain or more severe physical findings than are usual for ischemic colitis and/or acute occlusive ischemia is a consideration.
- Angiography still remains the most reliable method for diagnosing acute arterial occlusion. It allows not only diagnosis but also immediate therapy with selective infusion of vasodilative drugs or in isolated cases even fibrinolytic agents.
Angiography

The diagnostic sensitivity of angiography is very high (90%) in assessing arterial occlusion. Abrupt cutoff of a vessel with no evidence of collaterals is diagnostic of an acute thromboembolic event.

Acute intestinal infarction in a patient with a history of atrial fibrillation. (A) Selective superior mesenteric artery (SMA) angiogram demonstrates abrupt cutoff of the SMA (arrowhead), indicating occlusion of the SMA by an embolus, and poor perfusion of the affected small bowel loop (arrows). (B) Small embolus in the SMA (thick arrow) is easily detected on arterial phase of contrast-enhanced CT scan. Note poor perception of affected bowel wall (thin arrows) suggesting bowel necrosis.
Angiography

- **However**, although angiography is considered the gold standard for diagnosing thromboembolism, it is an invasive, time-consuming, potentially nephrotoxic, and costly procedure. Angiography may also cause morbidity in those in whom intestinal ischemia is most commonly seen (ie, elderly patients with atherosclerotic disease).

- Hence, angiography is performed only occasionally when acute mesenteric ischemia and infarction are suspected or when clinically suspected mesenteric thromboemboli cannot be established using noninvasive modalities.
Angio - T.D.
Superior Mesenteric Artery:
  • widely patent SMA and its branches

Compare to the patient with obvious SMA cutoff
AGA technical review on intestinal ischemia
Angio - T.D.

Inferior Mesenteric Artery:

• widely patent IMA and its branches
After 2 days of aggressive rehydration and pressors, T.D. began to deteriorate clinically with continued crampy abdominal pain and increasing white count. She was taken for a repeat CT which showed...
Mild improvement!

- CTA showed continued mural thickening of the colon from the splenic flexure continuing distally to the rectum, but improved in comparison to prior CT.
Case Closed

- T.D. was maintained NPO and on empiric antibiotic therapy. Blood cultures, stool cultures, and C.Diff. toxins x3 were all negative. Her abdominal exam continued to improve throughout her hospitalization. She remained afebrile, her blood pressure improved, and she was able to take good POs by day of discharge.

- T.D. was discharged to home with the diagnosis of ischemic colitis, with f/u with PCP and repeat colonoscopy in 6-8 weeks.
Quiz case

- J.S. is an 85 year old man s/p cardiac catheterization and CABGx3, now presenting with diffuse abdominal pain and fecal occult blood
- Look at the following CT images and try to construct his case
Quiz case

Look at his
(1) Aorta
(2) Spleen
(3) + Celiac Artery
(4) Liver
(5) Kidney
(6) Small Intestine
(7) Large Intestine
• Radiologic findings; 50% plaque in aorta, splenic infarct, liver infarct, renal infarcts, question of a thrombus in the celiac, thickened SI wall and surrounding fat stranding, and question of pneumatosis intestinalis

• Based on the constellation of radiologic findings in combination with clinical symptoms, ischemia of the small and/or large intestine was first on the differential and the patient was taken immediately to the O.R.

• In the O.R., J.S.’s small intestine was found to be grossly gangrenous at the ileum and resected, and his colon was found to be grossly normal despite radiologic findings.

• Diagnosis: acute transmural ischemic infarction
Treatment

- **Mild, transient** ischemic colitis is treated by maintaining *hemodynamic stability*. This can be done with pressors and aggressive parenteral fluid administration to avoid dehydration. Broad-spectrum antibiotics are sometimes used. Most patients rapidly improve with medical therapy.
- **Chronic** ischemic colitis leading to stricture formation is treated by *surgical removal of the stricture*.
- **Severe** ischemic colitis leading to gangrene or fulminant colitis is treated with replacement of blood volume, antibiotics, and *surgical removal of the necrotic bowel area*. 
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References

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