Ischemic Bowel Disease

John K. Bini, MD, FACS

Editors: Joseph M Galante, MD
Clay Cothern Burlew, MD

Injury/Disease Demographics

- Ischemic bowel disease consists primarily of three distinct entities with unique characteristics that impact diagnosis, management and prognosis.
- Ischemic Colitis, Acute Mesenteric Ischemia and Chronic Mesenteric Ischemia are the three major causes of mesenteric bowel disease and each has different etiology although significant similarities and over lap occur among these distinct disease entities.
- The incidence of Ischemic Colitis is 16 per 100,000 with 6% occurring after hospitalization for another reason. Recurrence rates range from 6.8% to 16%.
- Acute Mesenteric Ischemia is an uncommon cause of abdominal pain and may be due to arterial embolism, arterial thrombosis or venous thrombosis. Overall it accounts for between 0.09% and 0.2% of admissions for abdominal pain.
- Chronic Mesenteric Ischemia is rare and no good estimates of true incidence exist. The incidence does increase with age older than 60; asymptomatic mesenteric stenosis may exist in 6-25% of patients over 60.

Ischemic Colitis

Clinical Presentation

- Sudden cramping
- Mild left lower quadrant abdominal pain
- Urgent desire to defecate
- Bright red blood or maroon stools per rectum within 24 hours or bloody diarrhea.
- Vomiting, dizziness, syncope are less common.
- Left colon is more frequently affected however may involve only right colon or the entire colon.
- Right sided disease is more common in patients with A-Fib, CAD and chronic renal disease.

Risk Factors

- Cardiovascular disease and diabetes
- History of irritable bowel syndrome (IBS)
- Chronic kidney disease and COPD are associated with increased mortality
- H/O surgical procedures where the IMA has been sacrificed such as AAA repair or Aorto-femoral bypass

History of constipation inducing meds, use of immunomodulators or history of illicit drug use

Evaluation/Diagnostics/Imaging

- CT with IV and oral contrast
  - Bowel wall thickening
  - Edema
  - Thumb printing
- CT findings suggestive of colonic infarct
  - Portal venous gas
  - Colonic pneumatosis
  - The presence of pneumatosis plus porto-mesenteric venous gas
    - Specificity (83%) but low sensitivity (17%) for transmural bowel infarction.
    - Positive and negative predictive values: 60% and 17%.
- CTA in patients with suspected isolated right colon ischemia or in whom acute mesenteric ischemia can't be ruled out
- Traditional mesenteric angiography in patients with ischemic colitis is thought to be secondary acute mesenteric
- Early colonoscopy (within 48 hours) – careful with minimal insufflation. Biopsy of mucosa if diagnosis (ischemic vs. infectious) is in question, except if gangrene present
- Colonoscopy should not be done in patients with acute peritonitis or with evidence of irreversible ischemic damage such as pneumatosis.

Management and Associated Considerations

- Management depends on severity of disease
  - Mild
    - Typical symptoms not isolated to right colon
    - Observation and supportive care
  - Moderate
    - Patient with ischemic colitis and up to 3 additional risk factors
      - Male
      - Hypotension (<90 systolic)
      - Tachycardia (>100 BPM)
      - Abdominal pain without rectal bleeding
      - BUN > 20 mg/dl
      - Serum Na < 136 mEq/l
      - WBC > 15
      - Colonic ulceration identified endoscopically
    - Correction of cardiovascular abnormalities (volume resuscitation

        - Broad spectrum antibiotics
        - Early surgical intervention
    - Severe
        - Patient with Ischemic Colitis and more than 3 additional risk factors for moderate disease or any of following
            - Peritoneal signs on physical exam
            - Pneumatosis or portal venous gas
            - Gangrene found during colonoscopy
            - Pan-colonic disease or Isolated right colon ischemia
        - Emergent surgical intervention
        - Resuscitation in ICU and may need to be done in OR concurrent with surgical source control.
        - Correction of cardiovascular abnormalities (volume resuscitation)
        - Broad spectrum antibiotics

Indications for Operative Intervention

- Acute
    - Peritoneal signs
    - Massive bleeding
    - Fulminant colitis with or without toxic mega colon
    - Clinical deterioration despite supportive care
- Subacute
    - Failure of acute segmental disease to respond to therapy in 2-3 weeks
- Chronic
    - Colonic stricture
    - Persistent symptomatic segmental ischemic colitis

Pre-operative Preparation

- CT or CTA of abdomen as indicated
- Colonoscopy as indicated
- Laboratory evaluation
- Fluid resuscitation and correction of hemodynamic abnormalities.
- Resuscitation in ICU with appropriate line and monitor placement.
- In severe physiologic derangement, resuscitation and surgical management should be done concurrently in the OR.

Operative Techniques/ Intraoperative Considerations

- Patient in supine position, consider low lithotomy
- Limited role for laparoscopy especially in patient who is hemodynamically unstable.

- Ongoing intra-operative resuscitation and communication with anesthesia team.
- Damage control with temporary closure and open abdomen management should be considered early especially in patients with significant comorbidities or severe cardiovascular derangement secondary to shock.
- Surgical Options
    - Right colectomy with isolated right colonic ischemia
    - Sigmoid/left colectomy
    - Other segmental colectomy
    - Subtotal colectomy
- Strong consideration for proximal diversion if colo-colo anastomosis performed.
- End colostomy strongly considered especially in patients with significant comorbidities or vascular disease
- When in doubt – damage control with segment resection and planned second look laparotomy

Postoperative Management/ Complications

- Fluid resuscitation and monitoring in the ICU
- Return to OR if failure to resuscitate as expected
- In patients with an open abdomen, return to OR occurs after correction of acidosis and coagulopathy and electrolyte abnormalities.
- Early enteral support vs. consideration parental nutrition
    - If anticipation that GI will not be available for full enteral support within 5-7 days then consider early TPN
- If de-compensation or persistent fever in setting of anastomosis, gastrograffen enema or CT with rectal contrast must be performed to rule out leak.
- Wound infection
- Organ space infection/abscess may be managed with CT guided drainage and antibiotics
- In severe cases requiring surgery, antibiotics should be continued at least 4 days after surgical source control.

Acute Mesenteric Ischemia

Clinical Presentation

- Severe abdominal pain out of proportion to examination (should be considered acute mesenteric ischemia until proven otherwise).

- Acute onset of abdominal pain (less abrupt onset if source is venous thrombosis).
- Nausea
- Vomiting
- Diarrhea
- Blood per rectum
- Fever
- Hemocult-positive stools
- Extremis with septic shock
- Peritonitis – if present, likely irreversible intestinal ischemia

Risk Factors

- Pre-existing chronic atherosclerotic disease
- History of chronic mesenteric ischemia
- Cardiovascular disease and diabetes
- Atrial fibrillation
- Recent myocardial infarction
- Vasculitis
- Low cardiac output
- Venous thrombosis
    - Slower onset of pain
    - History of DVT
    - Chronic liver disease
    - Portal vein thrombosis
    - History of cancer
    - Recent abdominal surgery
    - Inflammatory bowel disease
    - Pre-existing coagulopathy

Evaluation/Diagnostics/Imaging

- Laboratory values
    - Electrolyte and fluid assessment consistent with dehydration
    - Lactic acidosis
    - Leukocytosis with left shift (may be ominous indicating full thickness necrosis of bowel with bacterial translocation)
- CT with IV contrast/ CT angiography (CTA)
    - Lack of enhancement of bowel
    - Bowel wall thickening
    - Mesenteric stranding
    - Pneumatosis
    - Pneumoperitoneum
    - Portal venous gas
    - Evidence of no arterial flow

        - Embolic disease may be seen with occlusion 3-10 cm after origin of SMA thus sparing of proximal jejunum and colon
        - Thrombotic disease with evidence of chronic atherosclerotic disease and is seen at origin of mesenteric vessels
    - Venous phase of scan to evaluate for venous thrombosis as cause
- Magnetic resonance Angiography (MRA)
    - May overestimate degree of stenosis
    - Takes longer to obtain
    - Lower resolution than CTA
    - Benefits of CTA outweigh the risks of contrast and radiation especially in the acute setting even in patients with chronic renal disease or acute kidney injury therefore CTA should be used versus MRA.
- Endoscopy
    - Although useful if suspected ischemic colitis, is not of benefit in diagnosis of acute mesenteric ischemia
- Angiography
    - May be confirmatory prior to open abdominal exploration but not required
    - Is now frequently used as a component of the treatment once diagnosis obtained

Management and Associated Considerations

- Fluid and electrolyte management and resuscitation
    - Isotonic fluids
    - Blood component therapy as indicated
    - Serial monitoring of acid base disturbances and electrolytes because of potential severe metabolic acidosis and hyperkalemia which may cause rapid and severe systemic de-compensation
    - Invasive hemodynamic monitoring including central venous access and atrial line placement
- Medical therapy
    - Heparin anticoagulation ASAP barring contra-indications such as active bleeding
    - Broad spectrum antibiotics
    - NPO
- Endovascular therapy
    - May be first line treatment in relatively stable patient who do not have evidence of acute peritonitis
    - May be used to treat both thrombotic and embolic disease
    - Can be used as an option to re-establish vascular flow after open surgical removal of obvious dead bowel.
        - One large study suggests that in-hospital mortality may be lower in patients undergoing endovascular vs open revascularization (25 vs. 40%)

            - More patients in open group underwent bowel resection.
        - Thrombolysis – only in patient without peritonitis
        - Angioplasty +/- stent placement are therapeutic options
    - Hybrid OR may be advantageous in these cases.
    - Although endovascular therapy does not allow direct visualization of bowel, some studies show that about 1/3 of patients may actually be spared a laparotomy.
- AMI secondary to venous thrombosis is usually managed non-operatively except in setting of obvious bowel necrosis or peritonitis.
    - Anticoagulation
    - Fluid resuscitation
    - Close monitoring in ICU

Indications for Operative Intervention

- The goal of open surgery is to immediately asses the bowel, control contamination and re-establish perfusion
- Peritoneal signs
- Fulminant sepsis/shock
- Imaging evidence consistent with full thickness bowel necrosis
- Clinical deterioration despite supportive care

Pre-operative Preparation

- CTA of abdomen
- Laboratory evaluation
- Rapid and aggressive resuscitation with fluid and blood components as indicated
- Establish indwelling means to assess volume and cardiac status
    - Central venous catheter
    - Arterial line
- Do not delay imaging secondary to renal failure
- Rapid transfer to operating room or endovascular suite

Operative Techniques/ Intraoperative Considerations

- Immediate resection of perforated bowel to control contamination
- Open vascular options
    - Surgical embolectomy
    - Arterial bypass (if open embolectomy fails)
        - Autologous graft of vessel distal to occlusion

        - If distal perfusion still of concern
            - May consider local instillation of thrombolytic agent
- After revascularization bowel and abdominal organs can be reassessed
- Resect all necrotic bowel
- Ischemic but questionable areas may be left to reassess at second operation
- Damage control operation with planned second look in all cases where bowel was resected because of necrosis or there are questionable areas of ischemia.
    - 57% of patients will require further resection on second look
    - Bowel resection at second look portends a higher mortality as do:
        - Renal insufficiency
        - Longer duration of symptoms
        - Older age
        - Persistent metabolic acidosis
- Initial laparotomy for intra abdominal catastrophe does not preclude subsequent endovascular techniques to establish perfusion

Postoperative Management/ Complications

- Fluid resuscitation and monitoring in the ICU
- Return to OR if failure to resuscitate as expected
- Return to OR after correction of acidosis and coagulopathy and electrolyte abnormalities
- Early enteral support vs. consideration parental nutrition
- Wound infection
- Organ space infection may be managed with CT guided drainage and antibiotics
- Antibiotics should be continued at least 4 days after surgical source control.

Chronic Mesenteric Ischemia

Clinical Presentation

- Postprandial abdominal pain usually starting 30-60 minutes after eating
- Food fear
- Early satiety
- Significant weight loss
- Nausea
- Vomiting
- Diarrhea or constipation or both
- Extensive GI work-up may be negative and abdominal exam may be unremarkable

Risk Factors

- Pre-existing chronic systemic atherosclerotic disease
- Smoking
- Female sex
    - Female over 60 with weight loss, dietary changes and systemic atherosclerosis need to strongly consider diagnosis of chronic mesenteric ischemia
- Cardiovascular disease and diabetes
- Vasculitis

Evaluation/Diagnostics/Imaging

- Laboratory values
    - Electrolyte and fluid assessment consistent with dehydration secondary to poor PO intake
    - Lactic acidosis late and is associated with bowel necrosis and these patient fall into the acute management paradigm
    - Laboratory indices of protein calorie malnutrition
        - Albumin
        - Transthyretin
        - Transferrin
        - C-reactive protein
- CT angiography (CTA)
    - Chronic disease usually appears as stenosis at origin of vessels
- Endoscopy
    - Usually done as part of extensive GI work-up but is usually unremarkable
- Angiography
    - Technically the gold standard for diagnosis
    - Added benefit of potentially treating at time of definitive diagnosis
        - Angioplasty
        - Angioplasty and stent placement

Management and Associated Considerations

- The goal is elective revascularization to prevent progression to acute mesenteric ischemia
- Endovascular therapy
    - Is now considered first line treatment

Indications for Operative Intervention

- Elective open revascularization in patients who have failed endovascular therapy
- Patients who progress to acute mesenteric ischemia

Pre-operative Preparation

- CTA or angiogram of abdomen
- Laboratory evaluation
- Patient is fluid resuscitated
- Nutritional optimization, may consider TPN
- Imaging should be customized to account for renal failure

Operative Techniques/ Intraoperative Considerations

- Open vascular options
    - Surgical endarterectomy
    - Patch angioplasty
    - Open vascular bypass
    - embolectomy

Postoperative Management/ Complications

- Fluid resuscitation and monitoring in the ICU
- Anticoagulation
- Consider antiplatelet therapy
- Routine peri-operative antibiotic prophylaxis, stop within 24 hrs.
- Early nutritional support
    - Enteral
    - Parental

Suggested Readings

1. Brandt LJ, Feuerstadt P, Longstreth GF, Boley SJ. ACG Clinical Guideline: Epidemiology, Risk Factors, Patterns of Presentation, Diagnosis and Management of Colon Ischemia (CI). Am j Gastroenterology 2015; 110:18-44.
2. Balla M, Kashuk J, Moore EE, et al. Acute Mesenteric ischemia: guidelines of World Society of Emergency Surgery. World Journal of Emergency Surgery 2017; 12:38.

3. Clair DG, Beach JM. Mesenteric Ischemia. New England Journal of Medicine 2016; 374:959-68.