Participating in the Webinar

All attendees will be muted and will remain in Listen Only Mode.

Type your questions here so that the moderator can see them. Not all questions will be answered but we will get to as many as possible.

How to Receive CME and MOC Points

LIVE VIRTUAL GRAND ROUNDS WEBINAR

ACG will send a link to a CME & MOC evaluation to all attendees on the live webinar.

ABIM Board Certified physicians need to complete their MOC activities by December 31, 2022 in order for the MOC points to count toward any MOC requirements that are due by the end of the year. No MOC credit may be awarded after March 1, 2023 for this activity.
MOC QUESTION

If you plan to claim MOC Points for this activity, you will be asked to: Please list specific changes you will make in your practice as a result of the information you received from this activity.

Include specific strategies or changes that you plan to implement. THESE ANSWERS WILL BE REVIEWED.

ACG Virtual Grand Rounds

Join us for upcoming Virtual Grand Rounds!

Week 30 – July 28, 2022
Diagnosis and Management of Barrett’s Esophagus: An Updated ACG Guideline
Nicholas J. Shaheen, MD, MPH, MACG
Thursday, July 28, 2022 at Noon Eastern and NEW! 8pm Eastern!

Week 31 – August 4, 2022
Cardiometabolic Syndrome in Patients with IBD: Complications and Implications
Parakkal Deepak, MD, FACP
Thursday, August 4, 2022 at Noon Eastern and NEW! 8pm Eastern!

Visit gi.org/ACGVGR to Register
Disclosures

Paul E. Feuerstadt, MD, FACG
Merck and Company: Consultant
Ferring Pharmaceuticals: Consultant, Advisory Board, Speakers Bureau
Seres Therapeutics: Advisory Board, Speakers Bureau
Davolterra Pharmaceuticals: Consultant
Takeda Pharmaceuticals: Advisory Board, Speakers Bureau

Darrick K. Li, MD, PhD
No relevant relationships indicated

*All of the relevant financial relationships listed for these individuals have been mitigated*
Ischemic Bowel Disorders: 
A Case Based Approach

Paul Feuerstadt, MD, FACG
Gastroenterology Center of Connecticut
Assistant Clinical Professor of Medicine
Yale University School of Medicine
Hamden, CT

Clinical Cases

American College of Gastroenterology
Spectrum of Ischemic Disease

- **Acute Mesenteric Ischemia**
- **Colon Ischemia**
- **Intestinal Ischemia**
- **Mesenteric Venous Thrombosis**
- **Focal Segmental Ischemia**
- **Chronic Mesenteric Ischemia**

Frequency of Ischemic Bowel Disease

<table>
<thead>
<tr>
<th>TYPE</th>
<th>FREQUENCY (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colon ischemia*</td>
<td>75</td>
</tr>
<tr>
<td>Acute mesenteric ischemia*</td>
<td>25</td>
</tr>
<tr>
<td>Focal segmental ischemia*</td>
<td>&lt;5</td>
</tr>
<tr>
<td>Chronic mesenteric ischemia</td>
<td>&lt;5</td>
</tr>
</tbody>
</table>

*Includes mesenteric venous thrombosis. Mesenteric venous thrombosis can manifest as colon ischemia, acute mesenteric ischemia, or focal segmental ischemia.*
Physiology

Ischemic Bowel Disease

Foregut
- Pharynx
- Esophagus
- Stomach
- Proximal duodenum
- Respiratory tract
- Liver
- Gallbladder
- Pancreas

Midgut
- Distal duodenum
- Jejunum
- Ileum
- Cecum
- Appendix
- Ascending colon
- Proximal transverse colon

Hindgut
- Distal transverse colon
- Descending colon
- Sigmoid colon
- Rectum
- Superior anal canal

American College of Gastroenterology
Colon Ischemia

- Limited collateral circulation
- Motor activity of the colon decreases colonic blood flow
- Lowest blood flow of all splanchnic organs
- Autonomic stimulation decreases blood flow to the colon
Vascular Supply of the Colon

Sudek's Point
Griffith's Point

Segmental Nature of Disease

<table>
<thead>
<tr>
<th>Brandt et al.</th>
<th>Montoro et al.</th>
<th>Longstrehth and Yao</th>
<th>Yadav et al.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of patients</td>
<td>313</td>
<td>364</td>
<td>417</td>
</tr>
<tr>
<td>Segment</td>
<td>Number of patients</td>
<td></td>
<td>Number of patients</td>
</tr>
<tr>
<td>Left Colon pattern</td>
<td>32.6%</td>
<td>Sigmoid Colon</td>
<td>69.5%</td>
</tr>
<tr>
<td>Distal Colon pattern</td>
<td>24.6%</td>
<td>Descending Colon</td>
<td>58.0%</td>
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<tr>
<td>Right Colon pattern</td>
<td>25.2%</td>
<td>Transverse Colon</td>
<td>22.9%</td>
</tr>
<tr>
<td>Transverse Colon pattern</td>
<td>10.2%</td>
<td>Rectum</td>
<td>15.0%</td>
</tr>
<tr>
<td>Pancolonic pattern</td>
<td>7.3%</td>
<td>Ascending Colon</td>
<td>10.0%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hepatic Flexure</td>
<td>10.0%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cecum</td>
<td>6.5%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rectum only</td>
<td>&lt; 1.0%</td>
</tr>
</tbody>
</table>

Brandt et al. Am J Gastro. 2010
Montoro et al. Scan. J. Gastro 2011
### Vascular Distribution and Outcomes

<table>
<thead>
<tr>
<th>Demography</th>
<th>SMA Distribution ( % [#] )</th>
<th>IMA Distribution ( % [#] )</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Number</td>
<td>20.8% (65)</td>
<td>79.2% (248)</td>
<td></td>
</tr>
<tr>
<td>Age (years, mean ± SD)</td>
<td>71.6 ± 13.0</td>
<td>72.1 ± 13.0</td>
<td>0.77</td>
</tr>
<tr>
<td>Gender (% female)</td>
<td>63.1% (41)</td>
<td>69.8% (173)</td>
<td>0.30</td>
</tr>
<tr>
<td>Charlson Co-morbidity</td>
<td>2.3 ± 2.1</td>
<td>1.6 ± 1.6</td>
<td>0.01</td>
</tr>
<tr>
<td>Outcome</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Length of Stay (days, median [range])</td>
<td>11 (1-89)</td>
<td>6 (1-115)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Surgical Intervention</td>
<td>52.3% (34)</td>
<td>11.3% (28)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Mortality Rate</td>
<td>24.6% (16)</td>
<td>8.5% (21)</td>
<td>&lt; 0.001</td>
</tr>
</tbody>
</table>

Brandt et al. Am J Gastro. 2010

### Colon Ischemia vs. Acute Mesenteric Ischemia

<table>
<thead>
<tr>
<th>Factor</th>
<th>Colon Ischemia</th>
<th>Acute Mesenteric Ischemia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level of illness</td>
<td>Mild</td>
<td>Severe</td>
</tr>
<tr>
<td>Most common presenting symptoms</td>
<td>Bright red blood per rectum or bloody diarrhea</td>
<td>Abdominal pains</td>
</tr>
<tr>
<td>Best diagnostic study</td>
<td>Colonoscopy</td>
<td>Multi-slice CT scan, Magnetic resonance angiography, Angiography</td>
</tr>
<tr>
<td>Identification of precipitating cause</td>
<td>Unusually identified</td>
<td>Commonly identified</td>
</tr>
<tr>
<td>Intestinal blood flow at presentation</td>
<td>Normal</td>
<td>Reduced</td>
</tr>
<tr>
<td>Prognosis</td>
<td>Excellent</td>
<td>Poor</td>
</tr>
</tbody>
</table>

American College of Gastroenterology
## Epidemiology/Risk Factors

**Colon Ischemia**

### Changing Epidemiology?

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Diverticular</strong></td>
<td>26</td>
<td>8.6%</td>
<td>26</td>
<td>10.4%</td>
</tr>
<tr>
<td><strong>Ischemic Colitis</strong></td>
<td>36</td>
<td>12.0%</td>
<td>11</td>
<td>4.4%</td>
</tr>
<tr>
<td>Angiodysplasia</td>
<td>14</td>
<td>4.7%</td>
<td>21</td>
<td>8.4%</td>
</tr>
<tr>
<td>Malignancy</td>
<td>13</td>
<td>4.3%</td>
<td>12</td>
<td>4.8%</td>
</tr>
<tr>
<td>Small bowel or colonic ulcer</td>
<td>12</td>
<td>4.0%</td>
<td>13</td>
<td>5.2%</td>
</tr>
<tr>
<td>Post-polypectomy bleeding</td>
<td>11</td>
<td>3.7%</td>
<td>11</td>
<td>4.4%</td>
</tr>
<tr>
<td>Hemorrhoid</td>
<td>12</td>
<td>4.0%</td>
<td>3</td>
<td>1.2%</td>
</tr>
<tr>
<td>Inflammatory bowel disease</td>
<td>6</td>
<td>2.0%</td>
<td>8</td>
<td>3.2%</td>
</tr>
<tr>
<td>Other colitis</td>
<td>7</td>
<td>2.3%</td>
<td>4</td>
<td>1.6%</td>
</tr>
<tr>
<td>Others</td>
<td>21</td>
<td>7.0%</td>
<td>16</td>
<td>6.4%</td>
</tr>
</tbody>
</table>

Medications Associated with Colonic Ischemia

Strong Association

<table>
<thead>
<tr>
<th>Class</th>
<th>Example</th>
<th>Class</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constipation-Inducing Medications</td>
<td>Anti-psychotics (e.g., quetiapine, clozapine)</td>
<td>Immunomodulators</td>
<td>Lenalidomide</td>
</tr>
<tr>
<td></td>
<td>Opioid Agonists (e.g., loperamide, oxycodone, hydrocodone, morphine, codeine)</td>
<td></td>
<td>Corticosteroids</td>
</tr>
<tr>
<td></td>
<td>Muscarinic agonists (e.g., diphenhydramine, dicyclomine)</td>
<td></td>
<td>TNF-α inhibitors</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Digoxin</td>
<td></td>
<td>Laxatives</td>
<td>Bisacodyl</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Glycerin enema</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Magnesium citrate</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Polyethylene glycol</td>
</tr>
<tr>
<td>Hormonal Therapies</td>
<td>Oral Contraceptive Pills</td>
<td>Non-steroidal anti-inflammatory drugs</td>
<td>Aspirin</td>
</tr>
<tr>
<td></td>
<td>Vaginal Rings</td>
<td></td>
<td>NSAIDS</td>
</tr>
<tr>
<td>Illicit Drugs</td>
<td>Amphetamines</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cocaine</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Vodusek et al. Alim Pharm Ther 2019
Risk Factors for CI: Young versus Old Age

**Young (18-64)**
- **Medications:**
  - Constipation inducing medications
  - Diuretics
  - NSAIDs
- **Co-morbidities:**
  - COPD
  - Atrial fibrillation

**Older ( > 65 )**
- **Medications:**
  - Antipsychotic medications
- **Co-morbidities:**
  - Hypercoagulable state
  - CKD on hemodialysis


COVID-19 and Colon Ischemia

**Epidemiology**
Men older than 65 who have developed respiratory failure on mechanical ventilation

**Presenting Symptoms**
- Abdominal pain
- Nausea
- Diarrhea
- Hematochezia

**Diagnosis**
- D-dimer levels ~4 fold increased above normal
- Imaging
- Colonoscopy (low yield)

**Mechanism of Disease**
Hypoperfusion secondary to an immunologically mediated cytokine storm rather than a direct interaction of the epithelial cells with virus.

- Small vessel thrombosis secondary to hypercoagulability from virus

Singh et al. Kor J Gastro. 2020; 74(3): 164-166
Westerhoff et al. Arch Path Lab Med. 2021
Risk Factors: Surgical Interventions

- Abdominal surgery *
- Aortic surgery *
- Cardiovascular surgery
- Ileostomy*
- Laparoscopy
- Prior colon carcinoma resection

* Indicates odds ratio of CI being greater than 3

Chang et al. Neurogast. 2008
Twohig et al. Ind J Gastro. 2020
Walker et al. Am J Gastr. 2004

Weather and Colon Ischemia

Diagnosis

Colon Ischemia

Abdominal X-Ray

“Pneumatosis Linearis”
Abdominal X-Ray
“Portal Venous Gas”

CT Scan

http://www.wikiradiography.net/m/page/Portal-Venous-Gas

http://www.merckmanuals.com/
Colonoscopy in CI

Zou et al. Dig Dis Sci 2009
Single Stripe Sign


Timing of Colonoscopy

Impact of early endoscopy on outcomes of ischemic bowel disease

- Mortality
- Length of stay*
- Total hospital cost*
- Shock
- Acute kidney injury
- Dialysis for acute kidney injury
- Acidosis
- Acute respiratory failure
- Mechanical ventilation
- Bowel surgery
- Transfusion
- Total parenteral nutrition
- Pneumonia
- Unfavourable discharge disposition

Adjusted Mean Ratio

Pathologic Diagnosis

Treatment

Colon Ischemia
Overall Treatment of CI

- Correction of precipitating condition
- NPO
- Intravenous fluids
- Correction of cardiovascular abnormalities
- Optimize forward cardiac flow
- Electrolyte repletion

Probably the most important therapy
Antimicrobial Therapy

- **Ciprofloxacin:** 400 mg IV q12h
- **Metronidazole:** 500 mg IV q6h
- **Gentamicin:** Weight-based dosing
- **Ceftriaxone:** 1 gram IV q24h
- **Metronidazole:** 500 mg IV q6h

**Treatment should include an anti-anaerobic agent plus a fluoroquinolone, aminoglycoside or third-generation cephalosporin**

*Clindamycin is an acceptable substitute for metronidazole*

When are antibiotics indicated?

Brandt et al. Am J Gastro. 2015
Mild

Typical symptoms of CI with a segmental colitis not isolated to the right colon and with none of the commonly associated risk factors for poorer-outcome that are seen in moderate disease

Moderate

Any patient with CI and up to three of the following factors:

- Male gender
- Abdominal pain without rectal bleeding
- Hypotension (systolic BP < 90 mm Hg)
- Tachycardia (heart rate > 100 beats/minute)
- White blood cell count > 15 x 10^3/L

- Hemoglobin < 12 g/dL
- Blood urea nitrogen > 20 mg/dL
- Serum sodium < 136 mEq/L
- Lactate dehydrogenase > 350 U/L
- Colonic mucosal ulceration identified colonoscopically
Severe

Any patient with CI and more than three of the criteria for moderate disease or any of the following:

- Peritoneal signs on physical examination
- Pneumatosis or portal venous gas on radiologic imaging
- Gangrene on colonoscopic examination
- Pan-colonic distribution or IRCI on imaging or colonoscopy

Utility of Antimicrobials in CI

<table>
<thead>
<tr>
<th>Parameter</th>
<th>CI severity</th>
<th>ICU requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. (%) of pts</td>
<td>CI+ABX group (n=567)</td>
<td>CI-ABX group (n=271)</td>
</tr>
<tr>
<td>Mild/Moderate CI</td>
<td>256 (45.6%)</td>
<td>155 (57.8%)</td>
</tr>
<tr>
<td>Severe CI</td>
<td>305 (54.4%)</td>
<td>113 (42.2%)</td>
</tr>
<tr>
<td>ICU requirement</td>
<td>145 (26.1%)</td>
<td>53 (19.9%)</td>
</tr>
</tbody>
</table>

Feuerstadt et al. ACG 2020 Oral Presentation
Utility of Antimicrobials in CI?

- Patients with pathologically proven disease via colonoscopy
- WBC and absolute neutrophil count were higher in the antimicrobial cohort
- Albumin and LDH levels were lower in the antimicrobial cohort

ACG classification of severity used to sub-group patients
- Moderate Disease Composite Outcome
  - Antimicrobial 2.5% (2/79)
  - No Antimicrobials 0.0% (0/46) (p=0.73)
- Severe Disease Composite Outcome
  - Antimicrobial 4.3% (1/23)
  - No Antimicrobials 16.7% (2/12) (p=0.55)

Outcome | OR (CI+ABX vs CI-ABX) | 95% C.I. of OR | Adjusted p value* |
--- | --- | --- | --- |
30-day mortality | 0.9 | 0.3-3.0 | 0.93 |
90-day mortality | 0.58 | 0.3-1.4 | 0.21 |
30-day colectomy | 0.63 | 0.33-1.2 | 0.15 |
90-day recurrence | 1.4 | 0.7-3.0 | 0.38 |
90-day readmission | 1.2 | 0.8-1.8 | 0.34 |

Length of stay was 2.9 days (SE=1.7) lower in the ABX group (p=0.09)

*Adjusted for severity of CI, Charlson Comorbidity Index, Small bowel involvement
Case Presentation

58 year old woman

Past Medical History
• Hypertension
• Diabetes

Past Surgical History
• Cholecystectomy

Clinical Presentation
• LLQ pains for 1-2 day’s followed by bloody diarrhea

CT Scan
• Segmental colitis in the sigmoid colon

Mild Disease

Typical symptoms of CI with none of the common risk factors for poor outcome *

CT: abdomen and pelvis

Normal

Abnormal

Consider colonoscopy and biopsy

Consistent with CI

No ulceration

Ulceration

Observation and supportive care
**Moderate Disease**

Any patient suspected of CI with ≤ 3 of the common risk factors for poor outcome*

CT: abdomen and pelvis

- Non-IRCI
  - Consider colonoscopy and biopsy
- IRCI (on CT or colonoscopy)
  - Consider CTA or MRA
- Vascular occlusion
  - Mesenteric angiography
  - Surgical evaluation

Supportive care: vol replacement, correction of cardiovascular abnl, broad spectrum antimicrobials

Oclusion relieved
Oclusion not relieved

**Case Presentation**

54 year old man

**Past Medical History**
- CAD
- COPD

**Past Surgical History**
- CABG

**Clinical Presentation**
- RLQ pains for 1-2 day’s with non-bloody diarrhea

**Serology:**
- WBC: 15,600 cells/mm³
- Hgb: 10.8 g/dL
- LDH: 365 IU/L

**CT Scan**
- Segmental colitis of the ascending colon
Severe Disease

Any patient suspected of CI with >3 of the risk factors for moderate disease* or any of the following: peritoneal signs, pneumatosis or portal venous gas (radiology), gangrene (colonoscopy), pancolonic or IRCI (colonoscopy or CT)

Consider CTA, MRA or mesenteric angiography

Transfer to ICU

Supportive care, vol replacement correction of cardiovascular abnl, broad spectrum antimicrobials

Consider surgical intervention

Emergent surgical consultation

Severe Disease

Acute Mesenteric Ischemia

Ischemic Bowel Disease
AMI: Clinical Presentation

Abdominal pain

• Pain out of proportion to exam
• Rebound tenderness
• Muscle guarding

Unexplained abdominal distension

Gastrointestinal bleeding

COVID-19 and Acute Mesenteric Ischemia

Epidemiology

• 41 cases reported through Jan 2021
• ~2/3 men
• Median age 59 (Youngest: 9 years old)

Co-Morbidities

• Many had none (n=13)
• Hypertension
• Obesity
• Diabetes

Mechanism of Disease

• Hypoperfusion secondary to an immunologically mediated cytokine storm rather than a direct interaction of the epithelial cells with virus.
• Small vessel thrombosis secondary to hypercoagulability from virus

Treatment/Outcome

• Exploratory laparotomy/resection (n=33)
• Anti-coagulation (Unfit for surgical intervention)
• 34% reported deceased/39% alive

Reports published quickly after presentation so some outcomes were not reported

Keranen et al. World J Clin Cases. 2021 Jun 26. 9(18) 4700-4708
**Acute Mesenteric Ischemia**

**Diagnosis**

- Acid-base status
  - Lactic acidosis present when bowel is infarcted
- White blood cell count
  - Left shift likely indicates infarcted bowel
- Infection
- Electrolyte abnormalities

Alhan et al. *In J Surg.* 2012
Goyal et al. *World J Gastro* 2017
https://depositphotos.com/vector-images/blood-test.html
AMI: CT scan

Chapter 118, Sleisenger and Fordtran, 2020

AMI: CT Angiogram

Henes et al. Abdom Radiol. 2017
AMI: Selective Mesenteric Angiography

Etiology and Management

Acute Mesenteric Ischemia
## Etiology of Acute Mesenteric Ischemia

<table>
<thead>
<tr>
<th>CAUSE</th>
<th>FREQUENCY (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mesenteric arterial occlusive disease</td>
<td>25</td>
</tr>
<tr>
<td>SMA embolus</td>
<td>45</td>
</tr>
<tr>
<td>Non-occlusive mesenteric ischemia</td>
<td>20</td>
</tr>
<tr>
<td>Mesenteric venous thrombosis</td>
<td>5-10</td>
</tr>
<tr>
<td>Focal segmental ischemia</td>
<td>5</td>
</tr>
</tbody>
</table>

Chapter 118, Sleisenger and Fordtran, 2020
Clair and Beach. NEJM 2016 374 (10): 959-968

---

**Acute Mesenteric Ischemia**

- **Occlusive**
- **Non-Occlusive**

American College of Gastroenterology
Non-Occlusive Mesenteric Ischemia

Clinical presentation:
- Abdominal pain
- Bloating
- Distension

Precipitating event:
- Myocardial infarction
- Congestive heart failure
- Arrhythmia
- Sepsis/Bacteremia
- Following CABG
- Medications
  - Cocaine
  - Digoxin

Increased peripheral vascular resistance

Chapter 118, Sleisenger and Fordtran, 2020

NOMI: Diagnosis

CT Scan:
1. Lack of wall enhancement
2. Pneumatosis linearis
3. Pneumoperitoneum
4. Portal venous gas

Clinical Absence:
1. Shock
2. Vasopressors
3. Pancreatitis

Angiography:
1. Narrowing of origin of SMA branches
2. Irregularities of intestinal branches
3. Spasm of arcades
4. Impaired filling of intramural vessels

Chapter 118, Sleisenger and Fordtran, 2020
Perez-Garcia et al. Br J Radiol. 2018; 91
Overall Management

**Resuscitation**
- IVF
- Optimize cardiac forward flow
- Optimize electrolytes and acid/base status
- Broad spectrum antimicrobials

**Imaging**
- CT scan
- CT angiogram

**Intervention**
- Selective Mesenteric Angiography
- Surgery

**NOMI: Management**

**No Peritonitis**

- Vasodilator (PGE1 or Papaverine)
- Observe
- Repeat Angiogram

Chapter 118, Sleisenger and Fordtran, 2020
NOMI: Management

Peritonitis

- Vasodilator (PGE1 or Papaverine)
- Laparotomy/Laparoscopy ± Resection
- Continuous Vasodilator
- Repeat Angiogram /Second Look

Chapter 118, Sleisenger and Fordtran, 2020

Acute Mesenteric Ischemia

- Occlusive
- Non-Occlusive
SMA Embolus

Clinical presentation with sudden onset:
- Abdominal pains
- Nausea
- Vomiting
- Diarrhea

Most commonly lodges just distal to the takeoff of the SMA
- **Major Emboli**: Proximal to origin of ileocolic
- **Minor Emboli**: Distal to origin of ileocolic

Most commonly from left atrial or ventricular mural thrombus

Chapter 118, Sleisenger and Fordtran, 2020

Mesenteric Arterial Occlusive Disease

- Formerly SMAT or acute thrombosis of SMA
- Acute thrombosis or calcified occlusions with or without acute thrombosis
- Super-imposed on CMI in 20-50% of patients

Atherosclerosis

Critical atherosclerosis or thrombosis

Overall Management

Resuscitation
- IVF
- Optimize cardiac forward flow
- Optimize electrolytes and acid/base status
- Broad spectrum antimicrobials

Imaging
- CT scan
- CT angiogram

Intervention
- Selective Mesenteric Angiography
- Surgery

Occlusive or Embolic Disease

Surgeon

Angiography

**Endovascular Intervention**

### Interventions
- Direct acting vasodilation
- Aspiration embolectomy
- SMA thrombolysis
- Stenting of atherosclerotic lesions

### Complications
- Prolonged vasodilation  
  - Acute tubular necrosis
- Local hematoma (e.g., arterial puncture site)
- Catheter dislodgement
- Dissection
- Fibrin clots of the arterial catheter

---

**Endovascular Approach**

Evolution of Management of AMI

<table>
<thead>
<tr>
<th>Presentation and Management</th>
<th>Year &lt; 2004 (n=159)</th>
<th>Year &gt; 2004 (n=144)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cause</td>
<td></td>
<td></td>
<td>0.15</td>
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<tr>
<td>Embolus</td>
<td>52%</td>
<td>46%</td>
<td></td>
</tr>
<tr>
<td>Thrombus</td>
<td>24%</td>
<td>34%</td>
<td></td>
</tr>
<tr>
<td>NOMI</td>
<td>24%</td>
<td>20%</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Operative Management</th>
<th></th>
<th></th>
<th>0.004</th>
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<table>
<thead>
<tr>
<th>Characteristics of patients undergoing operative management</th>
<th>Year &lt; 2004 (n=137)</th>
<th>Year &gt; 2004 (n=105)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surgical Approach</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Endovascular</td>
<td>2%</td>
<td>10%</td>
<td></td>
</tr>
<tr>
<td>Open</td>
<td>98%</td>
<td>85%</td>
<td></td>
</tr>
<tr>
<td>Hybrid</td>
<td>0%</td>
<td>5%</td>
<td></td>
</tr>
</tbody>
</table>


Surgical Intervention Outcomes

**Overall Survival s/p Surgery**

**Survival Stratified by Age > or < 70**

Duran et al. World J Em Surg. 2015
Case Presentation

60 year old man

Past Medical History
- Hypertension
- Diabetes mellitus

Past Surgical History
- Appendectomy

Clinical Presentation
- Severe, 8/10, diffuse abdominal pains with no vomiting or change in bowel habits

Physical Exam:
- Diffuse abdominal distension and tenderness with mild guarding

Serology:
- WBC: 12.3 cells/mm³
- Hgb: 11.3 g/dL
- Lactate: 2.2 mg/dL

Angiography

Initial, Day 0

Day 4
Case Presentation

46 year old woman

Past Medical History
• Migraines
• Asthma
• Anxiety

Past Surgical History
• CCY

Clinical Presentation
• Severe, 6/10, abdominal pains that are diffuse and cramping associated with non-bloody recurrent emesis

Physical Exam:
• Diffusely tender abdomen with no rebound or guarding

Serology:
• WBC: 20,600 cells/mm³
• Hgb: 12.8 g/dL
• Lactate: 5.8 mg/dL

CT Scan
• Focal enteritis of the mid-jejunum

Angiography

http://vas.sagepub.com/content/19/1/47/F1.large.jpg
Diagnosis before intestinal infarction occurs is the most important factor in improving survival of patients with AMI.
Focal Segmental Ischemia

- Presents with broad spectrum of clinical features
- Diagnosis made via imaging
- **Differential diagnosis:**
  - Acute enteritis
    - Infectious enteritis
  - Chronic enteritis
    - Crohn’s disease
  - Stricture
    - Intestinal obstruction

Chronic Mesenteric Ischemia

**Clinical Presentation**
- Abdominal pains
- Weight loss
- Sitophobia
- Negative previous evaluation

**Diagnosis**
- Angiogram/CTA reveals occlusion of 2 of 3 of celiac, SMA and/or IMA

https://www.cdc.gov
Chronic Mesenteric Ischemia

Diagnosis by Clinical Criteria
Exclusion of Other Diseases

Screening tests
MRA, CTA

Normal
Abnormal

Observe
Treat

Poor-risk pt
Good-risk pt

Splanchnic Angiography

Abnormal
Normal

Observe
Treat

Angioplasty w/ or w/o Stent
Surgical Revascularization

Mesenteric Venous Thrombosis

Clinical Presentation:

Acute:
- Abdominal pain
- Nausea
- Vomiting
- Lower GI bleeding

Subacute:
- Non-specific abdominal pains

Chronic:
- Asymptomatic
- Variceal bleeding
Mesenteric Venous Thrombosis

Pathophysiology
- Hypercoagulability
- Venous stasis
- Endothelial damage

Vessel Involvement
- Portal Vein
- Splenic Vein
- Inferior mesenteric vein

Bowel Involvement
- Ileum (64-83%)
- Jejunum (50-81%)
- Duodenum (4-8%)

MVT: Management

Asymptomatic
- 3-6 months A/C

Symptomatic
- Peritoneal Signs
  - Laparotomy and resection of infarcted bowel
  - Heparinization s/p OR for 7-10 days
  - Questionable infarction → Vasodilator/Thrombectomy
  - Second look laparotomy

Symptomatic
- No peritoneal signs
  - Immediate Heparinization
  - 3-6 months A/C
  - If no improvement, endovascular intervention

Russell et al. Circulation. 2015
Harnik et al. Vasc Med. 2010
Spectrum of Ischemic Disease

Colon Ischemia

- Acute Mesenteric Ischemia
- Intestinal Ischemia
- Focal Segmental Ischemia
- Chronic Mesenteric Ischemia
- Mesenteric Venous Thrombosis

Conclusions

Colon ischemia
- Common and usually benign
- IRCI is associated with worsened outcomes
- Antimicrobial usage should be dictated by disease severity

Acute Mesenteric Ischemia
- Consider both occlusive and non-occlusive types
- Diagnosis prior to infarction is essential
- Understand the tools and skill sets at your institution

Mesenteric Venous Thrombosis
- Recognition in the sub-acute and chronic states is challenging
- Anticoagulation is the treatment of choice
Questions and Answers

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Darrick K. Li, MD, PhD