Mesenteric Ischemia

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Definition

- Bowel ischemia is a complex disease caused by a drastic reduction in blood supply to the mesentery, that can be due to lack of arterial blood flow, venous occlusion or low cardiac output.

- Overall incidence is ~1% of all patients hospitalized for an acute abdomen.
History

• Described by Beniviene in 1509.

• Cokkinis stated in 1921 that “occlusion of the mesenteric vessels is regarded as one of those conditions of which the diagnosis is impossible, the prognosis hopeless, and the treatment almost useless”.

• Overall mortality has not improved much despite more aggressive diagnostic and therapeutic measures.
Pathophysiology

• Acute ischemia can cause:
  • diffuse abdominal pain, and often fail to note abdominal distention.
  • vasospasm, which causes gut emptying or profuse vomiting and diarrhea.
  • mucosal sloughing occurs and concomitant GI bleeding.

• Normal patients exhibit postprandial hyperemia on angiography. Some patients with mesenteric ischemia lose this hyperemia, but returns following restoration of blood flow.
Etiology / Subtypes

Acute

Chronic Mesenteric Ischemia

Extravascular Causes

Non-Occlusive Disease

Arterial Thrombosis

Venous Thrombosis

Extravascular Causes

Non-Occlusive Disease

Arterial Thrombosis

Venous Thrombosis
Causes of Mesenteric Ischemia

• Arterial Occlusion (~50% of cases)
  • Emboli to SMA due to atrial fibrillation or mural thrombi due to cardiac hypokinesia
  • Thrombotic occlusion due to pre-existing atherosclerotic vessel disease or acute obstruction with underlying chronic mesenteric ischemia
  • Cardiac valvular lesions/vegetations
  • Atheroemboli
  • Dissecting aortic aneurysm
  • Fibromuscular dyplasia
  • Trauma
  • Endotoxin induced shock

Source: jaml وهو BMJ 2003;326:1372-1376
Causes of Mesenteric Ischemia

- Non-occlusive mesenteric ischemia (~20-30% of cases)
  - Systemic hypotension
  - Cardiac failure
  - Septic shock
  - Mesenteric vasoconstriction (owing to sympathetic response)

Source: Bhandari KB. BMJ 2002;326:1373-1376
Causes of Mesenteric Ischemia

• Venous occlusion (~5-15% of cases)
  • Primary vein thrombosis
    • Deficiency of protein C and S, antithrombin III, factor V Leiden
    • Antiphospholipid syndrome
    • Paroxysmal nocturnal hemaglobinuria
  • Secondary vein thrombosis
    • Paraneoplastic
    • Pancreatitis
    • Inflammatory bowel disease
    • Cirrhosis and portal hypertension
    • Previous sclerotherapy of varices
    • Splenomegaly/Splenectomy
    • Trauma
    • Oral / Transdermal contraceptives

Sinnamon J BMJ 2003;326:1372-1376
Causes of Mesenteric Ischemia

• Extravascular sources ischemia (~20-30% of cases)
  • Incarcerated hernia
  • Volvulus
  • Intussusception
  • Adhesive bands
Clinical Presentation

• A difficult diagnosis to make, as most patients present with non-specific symptoms.

• Classically, pain is disproportionally exaggerated relative to unremarkable physical findings and may persist beyond two to three hours.

• Fever, diarrhea, nausea and anorexia are commonly reported.

• Melena or hematochezia seen in 15%; guaiac + in >50%.
Diagnosis

• High index of suspicion is required to limit or prevent patients from developing generalized peritonitis which may represent intestinal infarction.

• Especially should be considered in patients with a history of atrial fibrillation in patients older than 60 years of age, or patients with postprandial abdominal pain and weight loss.

• Survival ~ 50% when diagnosed with 24 hours of onset of symptoms, but decreases to less than 30% when delayed.
• May have a profound leukocytosis of 25-40k.

• May have a metabolic acidosis.

• Often demonstrate hemoconcentration on the CBC.

• May also see a widened anion gap and lactic acid levels. Amylase, AST, LDH, CPK may also be elevated but is fairly non-specific.

• **Plain films:** Usually non-specific in early stages. Later they may reveal bowel distension, air fluid levels and sometimes pneumatosis along with gas in the portal vein.
Ultrasound:

- Using duplex scanning, U/S offers a noninvasive, and inexpensive guide in assessing portomesenteric flow especially in cases of mesenteric venous thrombosis.

- Limitations include presence of bowel gas which may obscure, operator skill dependent.

- U/S can also be used to identify other differential causes including cholecystitis, or pancreatitis.
• **CT scans:**
  
  • Multi-detector row CT allows for 92% specificity and 64% sensitivity in determining the presence of mesenteric ischemia.

  • Offers the ability to perform 3D reconstructions.
Fig. 1. Contrast enhanced CT (MIP reconstructions)—normal anatomy of superior mesenteric artery. (a) Sagittal image, (b) axial image and (c) coronal image.
Fig. 5. Bowel Inflammation. (a,b) Contrast enhanced CT—enlarged aspect of ischemic loops (arrowheads) compared to normal bowel (arrows). (c) Jejunal arteries are normal (arrow). Poor representation of ileal arteries (arrowheads).
• **MRI/MRA**: Can be used to identify stenotic lesions, especially in patients with chronic ischemia.
Radiology

• Angiogram:
  • “Gold standard” for diagnosis
  • Offers not only a diagnostic but therapeutic option (ex. thrombolytics or use of papaverine as a vasodilator)
  • Disadvantage includes invasive measure, and cost.
Mainstay of treatment is surgical exploration, especially if patients exhibit peritoneal signs.

Goal of surgery includes:

1. Determining any vascular compromise amenable to embolectomy, or if a vascular reconstruction using a saphenous vein graft for aortomesenteric bypass.

2. Resecting compromised bowel.

3. Consider a second look laparotomy.
Role of Second Look Laparotomy

• Defined as a planned reoperation

• First devised in 1965.

  • Resect all necrotic bowel at the first operation and take the patient back to the OR within 24 hours despite the clinical course of the patient.

• One study examined any benefit in a second look laparotomy and failed to demonstrate any benefit.

Laparoscopy following recent laparotomy?

• Some authors have suggested a possible role for laparoscopy following a recent laparotomy.
• Rosin and performed a case report (n=14) for various indications following a recent laparotomy (one was for an abdominal abscess following a case of mesenteric ischemia), others included SBO following laparotomy for trauma or other indications.
• Used a lateral approach away from the incision via a Hasson canula.
• Found laparoscopy to be a safe adjunct to treat recent laparotomies.
Diagnostic Bedside Laparoscopy

- May be useful in septic patients in the ICU to rule out abdominal causes of sepsis (e.g., abscess, mesenteric ischemia).
- Ideal for patients too unstable for transport for diagnostic or therapeutic measures (CT scan or angiography suite).
- Gagné and colleagues examined n=19 (1 patient had 2 procedures, for a total n=20).
  - Procedure time: 9-68 min (mean: 21 min)
  - Three had extensive mesenteric ischemia (no laparotomy)
  - One had questionable bowel viability, and a subsequent formal negative lap
  - One patient had a necrotic GB and another had a small ischemic segment of bowel and both were treated open.
  - The remaining 14 examinations were normal, and helped to avoid a nontherapeutic laparotomy in 19 of 20 patients.

Gagné, D. et al. Surgery 2002;131:491-6
 Survival varies depending on type of ischemia. 

All better prognosis for patients with arterial emboli (AE) versus venous thrombosis (VT) vs. inferior thrombosis (AT) and NOMI.

Metaanalysis of 45 studies and over 3600 patients.

<table>
<thead>
<tr>
<th>Type</th>
<th>Mortality (Surgical Rx)</th>
<th>Mortality (No Surgical)</th>
</tr>
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<tbody>
<tr>
<td>AE</td>
<td>54%</td>
<td>96%</td>
</tr>
<tr>
<td>AT</td>
<td>77%</td>
<td>99%</td>
</tr>
<tr>
<td>VT</td>
<td>32%</td>
<td>87%</td>
</tr>
<tr>
<td>NOMI</td>
<td>56%</td>
<td>96%</td>
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Short Bowel Syndrome

- Global malabsorption syndrome due to lack of absorptive capacity or due to disturbed GI regulation as a result of extensive small bowel resection.
  - May occur following resection of > 50% of total length
  - Obligatory after resecting 70% of small bowel length or if < 100 cm of small bowel remains.
  - Overall incidence of severe cases are estimated to be 1-2 cases per 100,000

Keller J et al. Best Practice & Research: Clinical Gastroenterology
Phases of Short Bowel Syndrome

• **Acute Phase:**
  - Starts after resection
  - Lasts less than 4 weeks.

• **Adaptation Phase:**
  - Lasts 1-2 years
  - Maximal stimulation of intestinal adaptation is achieved by gradually increasing intestinal nutrient exposure via increasing mucosal surface area, decreasing intestinal motility.

- Important neurohormonal mediators include glucagon-like peptide 1 and 2 (GLP-1 and 2), peptide YY (PYY) and neurotensin.
Phases of Short Bowel Syndrome

• Maintenance Phase:
  • Permanent dietetic treatments must be individualized
  • Patients with Crohn’s in particular should receive effective therapy to limit or prevent acute exacerbation.
SBS Induced Malnutrition

- Fat soluble nutrients and vitamins (A, D, E, K) are poorly absorbed.

- Water soluble vitamin deficiencies (ex. B1, B2, B6 and C) are rare.

- Hyperoxaluria is commonly seen and causes nephrolithiasis of oxalate stones in up to 60% of patients. Similarly due to the loss of terminal ileum, patients develop a vitamin B12 deficiency.

- Calcium, magnesium, iron and folic acid deficiencies are commonly seen in extensive proximal small bowel resections.
TPN during acute phase only
- isotonic salt-glucose-solutions
- control and compensation of electrolyte and water deficiencies
- H2-blocker / PPI for the first 6 months
- Antidiarrheal drugs
- Adequate nutrient supply
- MCT
- Avoidance of oxalate in diet
- 800-1200 mg calcium p.o.

Reduction and termination of parenteral nutrition (if possible)

Tolerated
- Continuation of oral nutrition and above mentioned measures
- Control and substitution of vitamin and trace element deficiencies
- Annual measurements of bone density

Not tolerated
- Continuation of (partial) parenteral nutrition and above mentioned measures
- Control and substitution of vitamin and trace element deficiencies
- Annual measurements of bone density

In case of complications:
- Hepatobiliary system: cholestasis, steatosis, liver failure → oral nutrition, reduce dextrose and fat content of TPN; cholelithiasis → cholecystectomy
- Bones: check calcium and vitamin D, if necessary substitute bisphosphonate i.v.
- Infections: improve handling of catheter
- Catheter occlusion: try to flush, adaptation of TPN solution, anticoagulation

Improvement
- Yes
- No improvement / deterioration
Summary

• The diagnosis of mesenteric ischemia requires a high index of suspicion.

• Requires prompt treatment to prevent bowel infarction.

• Bedside laparoscopy is a viable option to evaluate the small bowel in unstable patients.

• Consider a second look laparotomy if bowel viability is in question.