Mesenteric Ischemia

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Classification of Intestinal ischemia

• Affect the small or large intestine, can be caused by any process that reduces intestinal blood flow, such as arterial occlusion, venous occlusion, or arterial vasospasm.
Features of acute small bowel versus acute colonic ischemia

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<th>Acute small bowel ischemia</th>
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<tr>
<td>Age varies with etiology of ischemia</td>
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<td>Acute precipitating cause is typical</td>
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<td>Patients appear severely ill</td>
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<td>Pain is usually severe, tenderness is not prominent early</td>
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<td>Bleeding uncommon until very late</td>
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<td>MRA or MDCT angiography may be considered as the initial diagnostic test; angiography is recommended if there is strong clinical suspicion</td>
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<td>Acute colonic ischemia</td>
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<td>90 percent of patients over age 60 years</td>
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<tr>
<td>Acute precipitating cause is rare</td>
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<td>Patients do not appear severely ill</td>
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<td>Mild abdominal pain, tenderness present</td>
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<td>Rectal bleeding, bloody diarrhea typical</td>
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<td>Colonoscopy is procedure of choice</td>
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• to the time course of onset and quality of symptoms, the degree to which blood flow is compromised, and the segment of bowel that is affected. Ischemia affecting the small intestine is generally referred to as mesenteric ischemia, while ischemia affecting the large intestine is referred to as colonic ischemia. A broader term, splanchnic (visceral) ischemia, encompasses ischemia affecting the intestine, as well as other abdominal organs such as the liver, spleen, or kidneys.
• Chronic mesenteric ischemia usually develops in patients with mesenteric atherosclerosis causing episodic intestinal hypoperfusion related to eating.
INTESTINAL VASCULAR ANATOMY

• The arterial supply to the intestines consists primarily of the superior mesenteric artery (SMA) and inferior mesenteric artery (IMA). The venous drainage parallels the arterial circulation and drains into the portal venous system.
• The SMA supplies the entire small intestine except for the proximal duodenum.
• The SMA and IMA both supply the colon.
Collateral circulation

- Prolonged reduction in splanchnic blood flow leads to vasoconstriction in the affected vascular bed, and eventually reduces collateral blood flow
• The celiac axis and the SMA communicate principally through the junction of the superior and inferior pancreaticoduodenal arteries.

• Because of the rich collaterals around the stomach, gastric ischemia is rare.
• The SMA and IMA communicate via the marginal artery of Drummond and the meandering mesenteric artery.
• The right, middle, and left colic arteries
• Referred to as the Arc of Riolan
Areas prone to ischemia

• The watershed areas between the major vessels that supply the colon are at risk for ischemia. Narrow terminal branches of the SMA supply the splenic flexure, and narrow terminal branches of the IMA supply the rectosigmoid junction.
• The marginal artery of Drummond is often very small
PHYSIOLOGY AND MECHANISMS OF ISCHEMIA

• The splanchnic circulation receives between 10 to 35 percent of cardiac output, depending upon whether it is in the fed or fasted state.

• Although the capillary density within the intestinal vasculature is high compared with other vascular beds, intestinal oxygen extraction is relatively low, thereby permitting sufficient oxygen to be delivered to the liver via the portal vein. As a result, intestinal blood flow must be reduced by at least 50 percent from the normal fasting level before oxygen delivery to the intestine becomes compromised.
• Numerous control mechanisms contribute to the regulation of mesenteric vascular tone and are responsive to varying conditions such as the postprandial state or systemic hypotension.

• Intrinsic autoregulation of blood flow is an adaptation that helps redirect blood from the gut to the brain during periods of systemic hypotension.
Response to Ischemia

- Reperfusion injury occurs following restoration of blood flow after a period of ischemia. It is a complex response characterized by release of free oxygen radicals, toxic byproducts of ischemic injury, and neutrophil activation which can lead to multisystem organ failure.
• Vasoconstriction may persist even after blood flow has been restored. Persistent ischemia can lead to full-thickness necrosis of the bowel wall and subsequent perforation.
The colonic circulation is vulnerable to hypoperfusion since it receives relatively less blood flow compared with the rest of the gastrointestinal tract.
Colonic ischemia

- A specific occlusive vascular lesion cannot be identified on angiography. Approximately 85 percent of these patients develop nongangrenous ischemia, which is usually transient and resolves without surgery or further complications
Etiologies of ischemia

• The major etiologies of mesenteric ischemia are mesenteric arterial embolism (50 percent), mesenteric arterial thrombosis (15 to 25 percent), mesenteric venous thrombosis (5 percent), and nonocclusive mesenteric ischemia due to intestinal hypoperfusion (20 to 30 percent)
Nonocclusive mesenteric ischemia

- Nonocclusive mesenteric ischemia (NOMI) is thought to occur as a result of splanchnic hypoperfusion and vasoconstriction. Nonocclusive colonic ischemia or ischemic colitis most commonly affect the "watershed" areas of the colon that have limited collateralization, such as the splenic flexure and rectosigmoid junction.
EPIDEMIOLOGY AND RISK FACTORS

• Acute insufficiency of mesenteric arterial blood flow accounts for 60 to 70 percent of cases of mesenteric ischemia. The remainder is related to chronic mesenteric and colonic ischemia.
Risk Factors

• Hemodialysis – Low flow to the intestinal circulation can lead to nonocclusive intestinal ischemia or intestinal infarction
• Extreme exercise (as occurs in marathon running)
• History — A careful review of the patient's personal and family history is important.
• Aortic surgery or instrumentation
• Peripheral artery disease
Risk Factors 2

- Vasoconstrictive medications
- Acquired and hereditary thrombotic conditions
- Inflammation/infection
- Hypovolemia
- Segmental ischemia from bowel strangulation can be due to external or internal hernias, bowel volvulus, or overdistention of the bowel.
Abdominal Pain

• The severity and location of the abdominal pain that accompanies nonocclusive mesenteric ischemia (NOMI) is usually more variable than the classic severe pain of acute occlusive mesenteric ischemia.

• Symptoms may be overshadowed by precipitating disorders including hypotension, heart failure, hypovolemia, and cardiac arrhythmias. Thus, a high index of suspicion in elderly patients with risk factors for NOMI is imperative for making a prompt diagnosis.
Clinical Findings

• Patients with chronic mesenteric ischemia complain of recurrent abdominal pain after eating, which is due to an inability to increase blood flow to meet the demand of the intestine postprandially.

• Consequently, these patients develop food fear and can lose a considerable amount of weight.
Clinical Findings

• As bowel ischemia progresses and transmural bowel infarction develops, the abdomen becomes grossly distended, bowel sounds become absent, and peritoneal signs develop. A *feculent odor* to the breath may also be appreciated.

• Signs consistent with dehydration and shock indicate a deteriorating clinical course.
Lab Findings

• Findings may include a marked leukocytosis with a predominance of immature white blood cells
• Elevated hematocrit consistent with hemoconcentration
• Metabolic acidosis
• A useful clinical guideline is that any patient with acute abdominal pain and metabolic acidosis has intestinal ischemia until proven otherwise.
• **Occult blood** may be present in the stool.
Imaging

• For patients in whom the index of suspicion for intestinal ischemia is high, multidetector CT angiography and magnetic resonance (MR) angiography have improved the ability to diagnose acute mesenteric ischemia.
Imaging

• CT is preferred over MR because of its lower costs, speed, and wide availability.
• MR angiography may be more sensitive for the diagnosis of mesenteric venous thrombosis and may be necessary for those with an allergy to iodinated contrast.
• CT can demonstrate findings consistent with acute ischemia, such as focal or segmental bowel wall thickening, intestinal pneumatosis with portal vein gas, bowel dilation, mesenteric stranding, portomesenteric thrombosis, or solid organ infarction, in addition to ruling out other causes of acute abdominal pain. It is important to note that the bowel wall changes of acute mesenteric ischemia, while sensitive, are not specific. The presence of pneumatosis intestinalis
<table>
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<tr>
<th>Etiology (Predisposing factors)</th>
<th>Equivalent</th>
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<td>Arterial Embolus</td>
<td>CVA from A Fib</td>
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<td>Atrial Fibrillation</td>
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<td>Valvular heart disease</td>
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<td>Arterial Thrombosis</td>
<td>MI</td>
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<td>Artherosclerotic disease</td>
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<td>Venous thrombosis</td>
<td>DVT</td>
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<td>Hypercoagulable state</td>
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<td>(History of thromboembolic events)</td>
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<tr>
<td>Non-occlusive</td>
<td>Shock</td>
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<tr>
<td>Shock / Volume Depletion</td>
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<td>(Vasopressors, Heart failure, Diuretics)</td>
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TREATMENT OF SPECIFIC ETIOLOGIES

• Arterial occlusion or thrombosis
• Mesenteric venous thrombosis
• Nonocclusive mesenteric ischemia
Mesenteric arterial occlusion

- Arterial embolism is early surgical laparotomy with embolectomy
  - A solitary, proximal superior mesenteric embolus
  - Inspection of the bowel
Mesenteric venous thrombosis

• Anticoagulation may be all that is needed in the treatment of patients with mesenteric venous thrombosis.
• Venous thrombolysis has been reported in small case series.
• If symptoms progress, abdominal exploration may be needed to evaluate for nonviable bowel.
Nonocclusive mesenteric ischemia

- The treatment of nonocclusive mesenteric ischemia focuses on removing inciting factors (vasoconstrictive medications), treating underlying causes (heart failure, sepsis), hemodynamic support and monitoring, and intraarterial infusion of vasodilators, if necessary.
OUTCOMES

• An acute ischemic event is worse for patients with an arterial etiology compared with a venous etiology. For acute mesenteric ischemia, mortality rates exceed 60 percent. In one systematic review, the pooled operative mortality rate for acute mesenteric ischemia was 47 percent.
Symptoms

• Patients with chronic mesenteric ischemia complain of recurrent abdominal pain after eating.

• Specific features of the pain and its presentation may provide clues to the etiology of the ischemia and for distinguishing small intestinal from colonic ischemia.
Diagnosis

• Early signs and symptoms of acute mesenteric ischemia are nonspecific, and definitive diagnosis often requires invasive testing.
• Computed tomographic (CT) angiography without oral contrast as an initial test for patients suspected of having mesenteric ischemia. CT angiography has a high degree of accuracy for diagnosing mesenteric ischemia and is useful in excluding other causes of acute abdominal pain.
• Arteriography may still be necessary if the diagnosis of mesenteric ischemia remains in question.
• Colonoscopy or sigmoidoscopy is used to establish the diagnosis of colonic ischemia.
Management of specific etiologies

- **Acute** or **chronic** intestinal ischemia depends on the specific etiology (ie, arterial occlusion or thrombosis, mesenteric venous thrombosis, and nonocclusive mesenteric ischemia). **Treatment options** include arterial embolectomy, arterial bypass, arterial stenting, arterial or venous thrombolysis, and intraarterial vasodilator infusion.
Studies – Results

- Plain abdominal films
  - Diffuse dilation of small bowel w/ air fluid levels on upright view. Some air in Left colon and Rectum. NO free air
Mesenteric Angiogram

Note complete lack of contrast in mesenteric vessels in AP view (left). The occluded origins of the celiac axis and superior mesenteric artery are demonstrated in the Lateral view (right).
Note complete occlusion and lack of IV contrast filling the superior mesenteric artery from its origin from the aorta (Arrows).
Other studies

CT angiogram / MR angiogram

- sensitivity 75%, specificity 100% for emboli
- additionally can detect thickened, distended bowel loops
- more sensitive for Mesenteric Venous Thrombosis
Management

- Pre-operative preparation
  - Assure adequate resuscitation
  - Monitoring
  - Foley Catheter

- Urgent exploration
  - Surgical embolectomy
  - Assess bowel viability
Management

- Pre-operative preparation
  - Assure adequate resuscitation
  - Monitoring
    - Non-invasive: EKG, BP, Pulse Oximetry, foley catheter
    - Consider invasive monitoring: Central venous catheter, PA Catheter? Arterial line?

- Operative Technique/ Urgent exploration
  - Midline Laparotomy
  - Relevant Anatomy
  - Surgical Embolectomy
  - Assess bowel viability
Discussion

The four processes:

1) **Acute arterial embolus** - usually from cardiogenic embolus in pts w/ Afib or valvular disorders. SMA is the common vessel affected as it has a less acute take off from aorta.

2) **Acute arterial thrombosis** - chronic atherosclerotic plaque at origin of vessel acutely thromboses.

3) **Chronic mesenteric ischemia** - atherosclerosis of visceral vessels results in abdominal pain (intestinal angina) during times of increased blood demand (digestion).

4) **Acute venous occlusion** - venous thrombosis causes cessation of venous outflow from intestines.

*Non-occlusive mesenteric ischemia can also be seen in low-flow states.*
**Discussion**

**Diagnosis** - requires high degree of suspicion. Classically presents as "pain out of proportion to physical exam" or severe pain w/o peritoneal signs. The history of Cardiac disease, valvular disease, or Afib should alert one to an embolic disease. Gold standard for diagnosis is mesenteric angiogram, but CT angiogram is more and more being used.

**Treatment** - requires aggressive resuscitation and hemodynamic monitoring as patients become critically ill very quickly. Urgent surgery w/ visceral revascularization (embolectomy, thrombectomy, endarterectomy, or bypass) is required. After this, evaluation of viability of bowel segments should be performed with resection of any necrotic portions.
Non Occlusive mesenteric ischemia

- 20% of all cases of acute mesenteric ischemia
- Occurs with patent mesenteric arteries
- Splanchnic vasoconstriction - pathophysiologic process
  - Precipitated by hypoperfusion from medications, depressed cardiac output, or renal or hepatic disease
- Blood pressure in the bowel falls below a critical pressure of 40 mm Hg, ischemia develops and eventually leads to infarction and bowel necrosis.
Diagnosis

- Classical - *Abdominal pain out of proportion to the findings on physical examination and persisting beyond 2 to 3 hours*
- Diarrhoea
- Nausea
- Vomiting
- Anorexia
- Abdominal distention
- *Melena / hematochezia / occult fecal blood – 15%*

**Full thickness bowel involvement**

- *Acute abdomen*
- *Distention, guarding, rigidity, hypotension – peritonitis – septic consequences*
Diagnosis

- Plain x rays - Non diagnostic
- Ultrasonography - Limited utility in acute mesenteric ischemia
- CT scan
- Magnetic resonance angiography - Not a choice in acute state
- Arteriography - Method of definitive diagnosis
Plain x-ray

- Supine / erect
- Chest – AP view

- Suspicious findings
  - Non specific ileus
  - Dilated bowel loops
  - Thumb printing
  - Separation of bowel loops
  - Intramural gas
  - Free air

*Majority of the cases plain films are non diagnostic*
CT scan

- Indirect findings of arterial bowel ischemia and may show the arterial occlusion or mesenteric venous thrombus.
- Dilation of the bowel lumen,
- Bowel wall thickening
- Abnormal bowel wall enhancement,
- Arterial occlusion,
- Venous thrombosis
- Intramural or portal venous gas
CT scan

- Symmetrical bowel wall thickening greater than 3 mm in a distended segment of bowel suggests ischemia.

- Greater degrees of bowel wall thickening should raise suspicion of mesenteric venous thrombosis (MVT).

- Intravenous contrast is useful in demonstrating the heterogeneity of the ischemic bowel wall (lack of bowel wall enhancement) and may show occlusion of mesenteric arteries if given by rapid bolus administration.
<table>
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<th>Pathologic Damage</th>
<th>CT Findings</th>
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<td>Vasoconstriction</td>
<td>Wall hyper density</td>
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<td></td>
<td>Absence of wall enhancement</td>
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<tr>
<td>Increased capillary permeability</td>
<td>Wall thickening</td>
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<td>Bowel dilation</td>
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<tr>
<td>Mucosal cellular necrosis</td>
<td>Pneumatosis</td>
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<td></td>
<td>Gas in mesenteric vein branches</td>
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<td>Gas in portal vein branches</td>
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<tr>
<td>Transmural bowel necrosis</td>
<td>Pneumoperitoneum</td>
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<td>Retropneumoperitoneum</td>
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<td>Ascites</td>
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CT scan

- Sensitivity - 64%
- Specificity - 92%
- CT is the diagnostic technique of choice for acute MVT
  - sensitivity exceeding 90%.
- 3D recon of the aorta and its branches show additional detail
  - sensitivity and specificity to 94% to 96%
- The limitations and risks of CT angiography
  - renal insufficiency or contrast allergies
  - limitations of contrast volume, and metal artefacts obscuring the area of interest
Arteriography

- Definitive diagnosis - acute and chronic mesenteric ischemia.
- Arteriograms
  - Establish the diagnosis
  - Assist in differentiating between acute embolic, thrombotic, or nonocclusive mesenteric ischemia
  - Allow proper planning of the revascularization procedure.
- AP and lateral views of the aorta and the mesenteric branches are required for proper arteriographic evaluation.
- The lateral view is particularly important to examine the proximal celiac artery and SMA, which overlap the aortic contrast column on AP views.
Arteriography

- Acute embolic occlusion of the SMA is abrupt occlusion of the artery, usually at a branch point where the vessel tends to narrow.

- If imaged acutely, a meniscus sign (crescent) is often observed.

- If secondary thrombosis occurs proximal to the embolus, the classic meniscus sign of embolic occlusion will be obscured.
Management

- Effective management
  - Early diagnosis
  - Aggressive resuscitation
  - Early revascularization
  - On going supportive care

- Medical treatment
- Surgical treatment
- Endovascular Treatment
Chronic Mesenteric ischemia

- Commonly the result of advanced atherosclerotic disease of multiple mesenteric arteries.

- Good collateral circulatory - symptomatic chronic mesenteric ischemia is rare.

- Risk factors
  - a positive family history,
  - smoking,
  - hypertension,
  - hypercholesterolemia.

- More common in females
Clinical features

- Classic picture
  - Postprandial abdominal pain
  - Weight loss.

- Pain - intestinal angina / intestinal claudication
  - Diffuse - Midabdominal, midepigastric, and crampy in nature.
  - Develops within 15 to 45 minutes after eating,
  - Severity - size of the meal ingested.
  - Early-onset pain with foregut (celiac artery distribution) ischemia,
  - Later-onset pain - diffuse ischemic disease.
Diagnosis

- Non invasive mesenteric duplex scan
  - Fasted state
  - Sensitivity – 75%, Specificity – 92%
- Aortography
- CT angiogram
- Magnetic resonance angiography
Chronic mesenteric ischemia

- Also called intestinal angina, refers to episodic or constant hypoperfusion of the small intestine that can occur, typically in patients with multivessel mesenteric stenosis or occlusion.
ETIOLOGY AND ASSOCIATIONS

• The majority of cases of chronic mesenteric ischemia are caused by atherosclerotic narrowing of the origins of the celiac or superior mesenteric arteries.

• Atherosclerosis of the mesenteric vessels is fairly common; however, clinical manifestations as a consequence of mesenteric arterial disease are rare.

• Up to 18 percent of individuals over 65 in the general population have significant stenosis of the celiac or superior mesenteric artery without any known prior symptoms. In one autopsy series, 29 of 120 individuals showed atherosclerotic disease within 2 cm of the origins of the celiac or mesenteric arteries, and 18 of 120 had at least two stenotic vessels; only one patient had evidence of bowel necrosis. The occurrence of disease was strongly associated with aging and correlated with atherosclerotic disease of cerebral arteries at the skull base.
ETIOLOGY AND ASSOCIATIONS

• In one autopsy series, 29 of 120 individuals showed atherosclerotic disease within 2 cm of the origins of the celiac or mesenteric arteries, and 18 of 120 had at least two stenotic vessels; only one patient had evidence of bowel necrosis. The occurrence of disease was strongly associated with aging and correlated with atherosclerotic disease of cerebral arteries at the skull base.
Rare causes

• Chronic mesenteric ischemia include median arcuate ligament syndrome (compression of the celiac artery from the median arcuate ligament of the diaphragm), fibromuscular dysplasia, aortic or mesenteric artery dissection, vasculitis (polyarteritis nodosum, Takayasu’s disease), and retroperitoneal fibrosis
CLINICAL FEATURES

• Most patients with atherosclerotic mesenteric vascular disease do not exhibit symptoms, because a large collateral network can form to compensate for reduced flow.

• In one review of 270 patients with occlusive disease of one or more splanchnic vessels, 61 (60 percent) had no symptoms. In a study of 82 patients identified on arteriography to have a 50 percent stenosis in at least one mesenteric artery, 4 of 15 patients with significant three-vessel disease developed mesenteric ischemia during follow-up. One of these had no abdominal complaints prior to an acute presentation resulting in necrosis of the entire gut. The others developed typical symptoms of chronic mesenteric ischemia at 7, 24, and 24 months.
• The diagnosis of chronic mesenteric ischemia is supported by the demonstration of high-grade stenoses usually in multiple mesenteric vessels, in patients with unexplained chronic abdominal pain, weight loss, and food aversion. A high clinical index of suspicion is crucial to making the diagnosis.
For patients diagnosed with chronic mesenteric ischemia, the indication for revascularization is the presence of symptoms, including abdominal pain and weight loss. The aim of intervention is to prevent future bowel infarction. Therapeutic options include open surgical and endovascular revascularization. Provided an endovascular approach is technically feasible, we attempt angioplasty with or without stenting as the initial treatment, rather than using an open surgical approach. Although percutaneous revascularization is associated with a higher rate of restenosis, recurrent symptoms from restenosis can often be successfully managed with repeat angioplasty/stenting.
• Patients who manifest symptoms of chronic mesenteric ischemia are typically over the age of 60, and are three times more likely to be female rather than male. The typical patient has a history of smoking (58 percent in one study) and approximately half of patients have a history of coronary heart disease, cerebrovascular disease, or lower extremity peripheral artery disease.
Symptoms

- Symptoms of chronic mesenteric ischemia manifest as recurrent episodes of acute **abdominal pain after eating**, which has also been referred to as "**intestinal angina.**" Patients classically complain of dull, crampy, postprandial epigastric pain, usually within the first hour after eating. The pain usually subsides over the course of the next two hours.
The pain can be variable in intensity and location, and may occasionally radiate to the back. The severity of the pain is greater following larger meals with high fat content. The association of abdominal pain with eating leads the patient to avoid eating (food fear) and they typically lose weight. A survey of 270 patients identified four clinical factors associated with chronic mesenteric ischemia (weight loss, postprandial pain, adapted eating pattern, diarrhea); Approximately one-third of patients have less typical symptoms including nausea, vomiting, early satiety, or even lower gastrointestinal bleeding, which is likely a consequence of foregut ischemia (ischemic gastropathy) from celiac artery insufficiency.
A survey of 270 patients identified four clinical factors associated with chronic mesenteric ischemia (weight loss, postprandial pain, adapted eating pattern, diarrhea); Approximately one-third of patients have less typical symptoms including nausea, vomiting, early satiety, or even lower gastrointestinal bleeding, which is likely a consequence of foregut ischemia (ischemic gastropathy) from celiac artery insufficiency
Symptoms can be progressive and may lead to acute mesenteric ischemia (acute-on-chronic mesenteric ischemia) from thrombus formation. Such patients have a much higher morbidity and mortality compared with patients with only chronic symptoms.
Physical examination

• Physical findings are usually nonspecific except that findings consistent with weight loss are present in about 80 percent of patients, which is attributed to the development of a food aversion due to the anticipation of postprandial pain. Abdominal examination reveals a bruit in approximately 50 percent of patients.
A high index of clinical suspicion is important for making a timely diagnosis of chronic mesenteric ischemia, which is often delayed as patients are often first evaluated for other etiologies (especially malignancy) as an explanation for weight loss. The average delay from the beginning of symptoms to diagnosis or treatment was 10.7 months in one review and 15 months in another.
• The failure to identify a specific etiology in patients with otherwise unexplained chronic abdominal pain, weight loss, and food aversion should suggest chronic mesenteric ischemia.

• The diagnosis is supported by the imaging that demonstrates high-grade stenosis or occlusion of two or more mesenteric vessels.

• Patients with stenosis in only one of the three mesenteric arteries do not typically exhibit symptoms; however, a complete occlusion of a single artery may be the cause of intestinal angina in approximately 5 percent of patients, particularly in association with prior gastrointestinal surgery that has disrupted the collateral circulation.
Vascular imaging

• Demonstration of stenosis of the major mesenteric vessels is a requirement for a diagnosis of chronic mesenteric ischemia. Calcification of mesenteric vessels seen on plain abdominal films (often obtained in an initial evaluation) may be a clue to the diagnosis of mesenteric atherosclerosis, but is not specific. For patients with suggestive symptoms,
we agree with the American College of Radiology consensus opinion that recommends computed tomography (CT) of the abdomen as the initial imaging study, since it reliably identifies or excludes the presence of atherosclerotic vascular disease as the most likely etiology, and simultaneously rules out other abdominal pathologies as the source of symptoms. Conventional arteriography is indicated for diagnostic confirmation when the results of noninvasive testing are equivocal, and for therapeutic intervention when clinically appropriate.
Computed tomographic (CT) angiography

- has sensitivities and specificities exceeding 90 percent for the diagnosis of chronic mesenteric ischemia due to atherosclerosis. High-grade mesenteric vascular stenoses in at least two major vessels (celiac, superior mesenteric, or inferior mesenteric) must be established. Evidence for collateral formation to compensate for the reduced main arterial flow is typically present. Contrast-enhanced magnetic resonance (MR) angiography is also highly sensitive for detecting arterial stenoses at the origins of the celiac or mesenteric arteries; however, the technique is much less reliable for detecting more distal lesions. Quantification of postprandial flow on MR angiography may prove useful as a diagnostic modality.
Duplex ultrasonography

• of the mesenteric vessels has also been advocated as a reasonably accurate screening modality for the detection of high-grade celiac and superior mesenteric artery stenosis.

• For patients who are initially seen in an office setting, a duplex ultrasound is a reasonable first study.

• Sensitivity exceeding 90 percent has been reported in patients with more than a 50 percent stenosis of the superior mesenteric or celiac arteries.
Because the negative predictive value of duplex ultrasonography approaches 99 percent, it is justifiable to pursue other etiologies of abdominal pain after a negative study. However, the number of patients who have been studied using this technique is limited, and technical considerations, including the expertise of the examiner, large body habitus, intraintestinal gas, and prior abdominal surgery, should be considered in assessing the results. Duplex ultrasound can also be used to diagnose the median arcuate ligament syndrome. With inspiration, the celiac artery moves inferiorly and becomes more vertical. This leads to decompression of the celiac artery from the median arcuate ligament of the diaphragm, which is manifested by increased flow velocities.
Functional studies

• A possible role for tonometry, spectroscopic oximetry, magnetic resonance (MR) flow for the diagnosis of chronic mesenteric ischemia has been suggested, but the clinical usefulness of these studies, which are still under investigation, has not been adequately established.
DIFFERENTIAL DIAGNOSIS

• There are many causes of chronic abdominal pain and of weight loss in adults. The constellation of progressive abdominal pain and weight loss, particularly in older adult patients, frequently prompts an evaluation to rule out other conditions such as malignancy, chronic cholecystitis, chronic pancreatitis, or peptic ulcer disease. If a patient presents with symptoms suggestive of chronic mesenteric ischemia but has not had significant weight loss, an alternative diagnosis (eg, functional bowel disorder) is more.

• Food aversion and weight loss may also be a sign of an eating disorder.
MANAGEMENT

• Conservative care — In general, patients with an incidental diagnosis of mesenteric occlusive disease who do not have overt clinical manifestations are managed with smoking cessation and secondary prevention measures to limit the progression of atherosclerotic disease. Interestingly, compared with patients with a typical risk profile for peripheral artery disease, 376 patients with chronic mesenteric ischemia were more likely be female, have lower incidences of hypertension and hypercholesterolemia, and a lower than expected incidence of obesity and diabetes. Reduced caloric intake, related to the postprandial pain, likely explains the observed differences
• Secondary prevention in patients with atherosclerotic disease typically includes antiplatelet therapy, which also has a role in the treatment of patients with spontaneous mesenteric artery dissection.
• Systemic anticoagulation is indicated in the setting of acute thrombus (ie, acute-on-chronic mesenteric ischemia).
In the absence of symptoms, there is little role for prophylactic intervention. An exception may be in patients with atherosclerotic occlusive disease of the mesenteric vessels who require aortic reconstruction for other indications (aneurysm, aortoiliac occlusive disease) or extensive foregut surgery (eg, pancreaticoduodenectomy), but such a decision depends on other factors as well.
Nutritional assessment and support

• Due to the often delayed diagnosis, patients may exhibit malnutrition (eg, BMI <20, albumin <3.0). Thus, nutritional status should be evaluated in all patients. The severity of nutritional deficiency has a bearing on the approach to treatment.
Revascularization

• The indication for revascularization (open or endovascular) is the presence of symptoms, including abdominal pain and weight loss, in the setting of documented severe splanchnic artery stenoses. The aim of intervention is to prevent future bowel infarction. For patients with acute symptoms (ie, acute-on-chronic mesenteric ischemia), revascularization options in the acute setting are discussed separately.
Options for revascularization include open surgical reconstruction and percutaneous transluminal angioplasty (PTA) with or without placement of a stent (bare or covered). Traditionally, open surgical revascularization, which is durable, was the standard and only available treatment. As catheter-based techniques improved, percutaneous angioplasty, with or without stenting, was offered initially to those...
Open surgery

• Open surgical techniques for mesenteric revascularization include aortomesenteric and/or celiac bypass grafting, endarterectomy, and mesenteric reimplantation. For patients deemed to be candidates for open surgery, the choice of procedure depends primarily upon the presenting anatomy.
Angioplasty and stenting

- Mesenteric angioplasty and stenting has become a first-line therapy for patients with chronic mesenteric ischemia. Stenting the superior mesenteric or celiac artery has high technical and early clinical success rates.
Open versus endovascular

• we suggest an attempt at endovascular treatment as the first-line therapy, provided it is technically feasible. This is based primarily on the lower risk of periprocedural morbidity and mortality. Although open reconstruction has superior primary and secondary patency and a lower rate of symptomatic recurrence, long-term assisted patency rates and overall survival appear similar.
MORBIDITY AND MORTALITY

• Perioperative mortality among patients with chronic mesenteric ischemia ranges from 0 to 16 percent, but can be as high as 50 percent for those patients who develop acute symptoms
SUMMARY AND RECOMMENDATIONS

• Chronic mesenteric ischemia (also called intestinal angina) refers to episodic or constant intestinal hypoperfusion, and is usually due to mesenteric atherosclerotic disease.
Patients classically complain of dull, crampy, postprandial epigastric pain, usually within the first hour after eating. The pain can be of variable intensity and location, and may occasionally radiate to the back. The severity of the pain is increased after larger meals with high fat content. The pain usually subsides over the course of the next two hours. Symptoms are often progressive and may culminate in acute mesenteric ischemia (acute-on-chronic mesenteric ischemia) from thrombus formation.