

## American College of Radiology ACR Appropriateness Criteria®

**Clinical Condition:** Radiologic Management of Mesenteric Ischemia

**Variant 1:** Elderly patient with recent onset abdominal pain, no peritoneal signs, known atrial fibrillation. CT scan shows filling defect in proximal superior mesenteric artery (SMA) consistent with thrombus.

Treatment/Procedure	Rating	Comments
Systemic anticoagulation	8	
Surgical embolectomy	5	Insufficient evidence. Therapy should be based on local expertise.
Angiography and transcatheter lytic therapy	5	Insufficient evidence. Therapy should be based on local expertise.
Angiography and suction embolectomy	5	Insufficient evidence. Therapy should be based on local expertise.
Supportive measures only (analgesics, nutritional support)	2	
<b>Rating Scale:</b> 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate		

**Variant 2:** Elderly patient with history of abdominal pain after meals for the past few months and weight loss. CT scan of the abdomen shows aortic atherosclerotic disease and suggests SMA origin stenosis with occlusion of celiac origin and an occluded inferior mesenteric artery (IMA).

Treatment/Procedure	Rating	Comments
Angiography with possible angioplasty and stent placement	8	
Surgical bypass or endarterectomy	7	May be helpful if endovascular therapy is unsuccessful at addressing the symptoms.
Systemic anticoagulation	5	
Supportive measures only (analgesics, nutritional support)	3	
<b>Rating Scale:</b> 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate		

**Variant 3:** Middle-aged patient (40-60 years of age) with pain after meals and CT scan showing widely patent origins of SMA and IMA, with possible compression of the celiac origin by the median arcuate ligament.

Treatment/Procedure	Rating	Comments
Mesenteric angiography in lateral projection during both inspiration and expiration	8	CT angiography may be used as well.
Surgery with median arcuate ligament release, with or without bypass	7	
Supportive measures only (analgesics, nutritional support)	7	Median arcuate ligament syndrome is a diagnosis of exclusion. Therefore, a trial of supportive therapy is usually appropriate.
Systemic anticoagulation	2	
Angioplasty with stent placement	1	
<b>Rating Scale:</b> 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate		

**Clinical Condition:****Radiologic Management of Mesenteric Ischemia****Variant 4:**

Hospitalized patient with cardiac disease causing low cardiac output, on Lasix. Now with abdominal pain but without peritoneal signs. CT scan shows patent origins and proximal portions of celiac, SMA, and IMA, with some thickening of small-bowel walls.

Treatment/Procedure	Rating	Comments
Angiography with infusion of vasodilator	8	
Systemic infusion of vasodilator (Prostaglandin E1)	6	
Supportive measures only (analgesics, nutritional support)	5	
Surgery	2	
<b>Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate</b>		

**Variant 5:**

Previously healthy patient with worsening diffuse abdominal pain for 2 weeks. Contrast-enhanced CT shows occlusion of the superior mesenteric vein and its major tributaries. Small bowel appears normal.

Treatment/Procedure	Rating	Comments
Systemic anticoagulation	9	
Transhepatic SMV catheterization and thrombolytic infusion	7	May use either transhepatic or transjugular (TIPS) approach.
SMA angiography followed by thrombolytic infusion	5	
Surgery	3	
Supportive measures only (analgesics, nutritional support)	2	
<b>Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate</b>		

# RADIOLOGIC MANAGEMENT OF MESENTERIC ISCHEMIA

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## **Summary of Literature Review**

### **Diagnosis of Mesenteric Occlusive Disease**

Detection of proximal mesenteric arterial occlusive disease is possible with computed tomography (CT), magnetic resonance angiography (MRA), and ultrasound (US). Ostial lesions are reliably evaluated with all three modalities. Both US and MRA have been directly compared with angiography. Multidetector CT scanners, particularly with sagittal reformatting, are capable of demonstrating the proximal mesenteric vessels very well. CT relies on administration of iodinated contrast but does not entail the risks of angiography [1-5].

In a patient with renal insufficiency or a history of severe reaction to iodinated contrast, noncontrast MRA or US of the mesenteric vessels origins is preferred over CT. Results will vary considerably with operator expertise, patient body habitus, and presence of bowel gas, but accuracy in detecting ostial abnormality has been reported to be greater than 90% [6]. The more peripheral mesenteric vessels are not as well demonstrated with US or CT scanning, and angiography has remained the best method to evaluate these vessels. Therefore, if clinical suspicion of mesenteric ischemia is high, a negative CT or US exam should not preclude selective mesenteric angiography, particularly if distal disease is a consideration.

### **Acute Nonocclusive Mesenteric Ischemia**

In a patient with signs and symptoms of acute mesenteric ischemia, narrowing of peripheral mesenteric vessels or a pattern of alternating dilatation and narrowing suggests nonocclusive mesenteric ischemia. This diagnosis is best made with conventional angiography, which would also enable initiation of catheter-directed vasodilator infusion therapy. Angiography can provide superior anatomic detail not available from CT or US [7]. However, recent data suggest that if a patient is not clinically stable enough to undergo angiography, multidetector contrast-enhanced CT may provide adequate information to make a diagnosis of nonocclusive mesenteric ischemia [8]. Vasoconstriction may lead to bowel ischemia and necrosis with a mortality rate that has been reported to be up to 70%. Early diagnosis and treatment are critically important in acute mesenteric ischemia to avoid bowel infarction. Typically therapy consists of intra-arterial administration of vasodilators, such as nitroglycerin, papaverin, or glucagon [9]. Administration of high-dose intravenous prostaglandin E1 may be equally effective. While an angiogram is the preferable means of diagnosis that also allows for an intra-arterial catheter to be left in-situ for pharmacologic therapy, patients who are critically ill may benefit from rapid diagnosis afforded by the multidetector CT with subsequent institution of systemic intravenous pharmacotherapy [8].

### **Acute Occlusive Mesenteric Ischemia**

Surgery has been the standard of care for acute occlusive mesenteric ischemia over the past decades [10]. Recently, several endovascular techniques have been described in the literature, including aspiration embolectomy and thrombolysis for embolic occlusion of the superior mesenteric artery (SMA), as well as stenting of the underlying atherosclerotic acute occlusions. Literature supporting the use of aspiration embolectomy is limited to case reports and small series [11]. Thrombolysis for treatment of mesenteric thrombosis or embolus has been reported as a sole intervention or as an adjunct to aspiration embolectomy. While it is technically feasible and in many reported cases successful, a recent review article identified published reports of thrombolytic therapy covering only a total of 43 patients. Thrombolysis could be applied in only a minority of patients presenting with acute mesenteric ischemia. Thrombolysis is contraindicated in bowel infarction, and any indication of bowel infarction (peritoneal symptoms, pneumoperitoneum, or intramural air on CT) is an indication for urgent surgery rather than thrombolysis [12]. The inability to confidently exclude bowel infarction in many patients with mesenteric ischemia has limited widespread use of thrombolysis. Due to the presence of vasospasm associated with occlusive mesenteric ischemia, catheter-directed vasodilator infusion may also be of benefit in some patients with occlusive mesenteric ischemia, especially prior to more definitive therapy. Treatment of underlying stenotic or occlusive lesions

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using percutaneous transarterial angioplasty or stenting (PTA/S) can be achieved at the same setting as diagnosis, sometimes after removal of a thrombotic clot by aspiration or thrombolysis [10]. Data from the United States Nationwide Inpatient Sample suggests that in the setting of acute mesenteric ischemia, PTA/S carries a lower risk of overall morbidity and in-hospital mortality than bypass surgery [13]. However, evidence for the use of endovascular therapy in the setting of acute mesenteric ischemia remains limited.

### Chronic Mesenteric Ischemia

Chronic mesenteric ischemia most commonly occurs due to atherosclerotic occlusive disease of the mesenteric arteries (celiac axis, SMA, inferior mesenteric artery). Signs and symptoms of chronic mesenteric ischemia include weight loss, sitophobia (food fear), and abdominal pain after eating. Given the relatively rich collateral supply to bowel, signs and symptoms of ischemia typically occur when at least two arteries (and often all three) are affected. Endovascular therapy, particularly angioplasty and stenting, has supplanted open surgical repair as the preferred therapy for mesenteric origin stenoses in patients without bowel infarction. Mortality and morbidity are believed to be lower for endovascular interventions compared to open repair; however, more patients develop recurrent symptoms and require reintervention following endovascular treatment than after open repair [14].

### Venous Mesenteric Ischemia

Mesenteric venous thrombosis (MVT) accounts for 5%-15% of all cases of mesenteric ischemia. Patients may have evocative signs, such as abdominal pain, nausea, or vomiting. However, clinical diagnosis is often difficult because abdominal symptoms are nonspecific [15-16]. Diagnosis can be established by noninvasive means, such as multidetector CT and MR venography [17]. The mainstay of therapy is systemic anticoagulation with heparin or warfarin. Generally, patients maintained on systemic anticoagulation have higher chances of recanalization of the occluded veins and lower odds of recurrence. Long-term systemic anticoagulation is usually required. Bleeding in the necrotic bowel may result, but this possibility should not delay systemic anticoagulation, and bleeding has to be treated if it occurs [18-19]. Thrombolysis with or without mechanical thrombectomy may re-establish splanchnic venous flow and prevent bowel infarction in the setting of an acute or a subacute venous thrombosis [20-22]. The rate of blood flow restoration by thrombolytic administration into the SMA appears to be lower than that of direct thrombolytic administration into the splanchnic veins [21].

### Median Arcuate Ligament Syndrome

The median arcuate ligament is a fibrous band connecting the right and left hemidiaphragms and is found in up to 20% of the population. The incidence, and even existence, of abdominal symptoms due to compression of the celiac artery by the median arcuate ligament are debatable. The compression has been postulated to limit blood flow to

bowel with resulting ischemic symptoms or to irritate the celiac ganglion, which results in abdominal pain. Compression of the celiac artery may be a normal finding in asymptomatic patients and is well characterized [23].

Patients with imaging evidence of celiac axis compression have been treated with best results in patients who had both celiac decompression (surgical division of the ligament) and some form of celiac artery revascularization. Predictors of successful outcome in one study were “postprandial pain pattern (81% cured), age between 40 and 60 (77% cured), and weight loss of 20 pounds or more (67% cured)” [24]. There is no evidence supporting the use of angioplasty and stenting in this entity, and endovascular dilation may be contraindicated unless ligament release has been performed first [21].

### Summary

- Noninvasive imaging tests such as CTA, MRA, or US should be the initial choice for evaluating chronic mesenteric ischemia. These modalities can reliably diagnose proximal occlusive disease. Conventional angiography is reserved for diagnosis of distal disease or is performed concurrently with endovascular treatment.
- Angioplasty and stent insertion have shown promising results in treating chronic mesenteric ischemia due to proximal mesenteric occlusive disease and are considerably less invasive than open surgical bypass.
- Because rapid diagnosis and treatment are mandatory in acute mesenteric ischemia, if clinical suspicion is high, conventional angiography is the best overall modality for diagnosis, particularly if it can be obtained with minimal delay.
- Thrombolysis for acute occlusive mesenteric ischemia is predicated on an ability to confidently exclude bowel infarction.
- Patients with acute nonocclusive mesenteric ischemia may benefit from catheter-directed intra-arterial vasodilator infusion. Some patients with acute occlusive mesenteric ischemia may also benefit from vasodilator infusion prior to more definitive therapy.
- Patients with symptomatic mesenteric vein thrombosis should be treated with systemic anticoagulation. Thrombolytic therapy administered via a transhepatically or transjugularly placed catheter may re-establish flow and prevent bowel infarction in patients with acute or subacute mesenteric vein thromboses.

### Supporting Document(s)

- [ACR Appropriateness Criteria® Overview](#)
- [Evidence Table](#)

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The ACR Committee on Appropriateness Criteria and its expert panels have developed criteria for determining appropriate imaging examinations for diagnosis and treatment of specified medical condition(s). These criteria are intended to guide radiologists, radiation oncologists and referring physicians in making decisions regarding radiologic imaging and treatment. Generally, the complexity and severity of a patient's clinical condition should dictate the selection of appropriate imaging procedures or treatments. Only those examinations generally used for evaluation of the patient's condition are ranked. Other imaging studies necessary to evaluate other co-existent diseases or other medical consequences of this condition are not considered in this document. The availability of equipment or personnel may influence the selection of appropriate imaging procedures or treatments. Imaging techniques classified as investigational by the FDA have not been considered in developing these criteria; however, study of new equipment and applications should be encouraged. The ultimate decision regarding the appropriateness of any specific radiologic examination or treatment must be made by the referring physician and radiologist in light of all the circumstances presented in an individual examination.