

**American College of Radiology  
ACR Appropriateness Criteria®**

**Clinical Condition:** 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
Anticoagulation	9	
Surgery	8	
Angiography and transcatheter lytic therapy	4	Contraindicated for bowel infarction.
Supportive measures only	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 possible severe stenosis versus occlusion of celiac origin, plus an occluded inferior mesenteric artery (IMA).

Treatment/Procedure	Rating	Comments
Angiography with possible angioplasty and stent placement	8	Less durable but better risk profile. Failure does not preclude surgery.
Surgery with bypass or endarterectomy	7	Appropriate in select patients. No longer the standard of care.
Anticoagulation	3	
Supportive measures only	2	Some patients may be poor candidates for revascularization procedures.
<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	Gold standard, but would try CTA or MRA first and reserve angiography for select patients.
Surgery with median arcuate ligament release, with or without bypass	8	Has been reported to improve symptoms, but other possible causes of abdominal pain should be ruled out first.
Supportive measures only	5	Controversial entity. Need to rule out other possible causes of abdominal pain.
Anticoagulation	1	
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:****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.

<b>Treatment/Procedure</b>	<b>Rating</b>	<b>Comments</b>
Angiography with infusion of vasodilator	8	Early initiation of vasodilator therapy is best.
Anticoagulation	5	Theoretically useful, but no data.
Supportive measures only	3	Appropriate when used in conjunction with other therapy.
Surgery	2	Appropriate for resection of infarcted bowel.
<b><u>Rating Scale:</u> 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate</b>		

# MESENTERIC ISCHEMIA

Expert Panel on Interventional Radiology:  
John M. Gemery, MD<sup>1</sup>; Brian S. Funaki, MD<sup>2</sup>;  
Charles E. Ray, Jr, MD<sup>3</sup>; Daniel B. Brown, MD<sup>4</sup>;  
Thomas B. Kinney, MD<sup>5</sup>; Jon K. Kostelic, MD<sup>6</sup>;  
Jonathan M. Lorenz, MD<sup>7</sup>; Steven F. Millward, MD<sup>8</sup>;  
Albert A. Nemcek Jr, MD<sup>9</sup>; Charles A. Owens, MD<sup>10</sup>;  
Robert D. Reinhart, MD<sup>11</sup>; James E. Silberzweig, MD<sup>12</sup>;  
Gary P. Siskin, MD<sup>13</sup>; George Vatakencherry, MD<sup>14</sup>;  
Gregory L. Moneta, MD.<sup>15</sup>

## **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 [1-4].

In a patient with renal insufficiency or a history of severe reaction to iodinated contrast, 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% [5]. 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 diagnostic information not available from CT or US [6]. Vasoconstriction may lead to bowel ischemia and necrosis with a mortality rate that has been reported to be 50%. Because early diagnosis and treatment are critically important in acute mesenteric ischemia to avoid bowel infarction, if an angiogram can be obtained rapidly it may be preferable to any delay associated with obtaining noninvasive imaging.

### **Acute Occlusive Mesenteric Ischemia**

Thrombolysis for treatment of mesenteric thrombosis or embolus has been reported. 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 [7]. 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.

### **Chronic Mesenteric Ischemia**

Chronic mesenteric ischemia most commonly occurs due to atherosclerotic occlusive disease of the mesenteric arteries (celiac axis, superior mesenteric artery, 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 [8,9].

### **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 is debatable. The

<sup>1</sup>Principal Author, Dartmouth-Hitchcock Medical Center, Lebanon, New Hampshire.

<sup>2</sup>Panel Chair, The University of Chicago, Chicago, Illinois.

<sup>3</sup>Panel Vice-chair, University of Colorado Denver and Health Sciences Center, Aurora, Colorado.

<sup>4</sup>Mallinckrodt Institute of Radiology, Saint Louis, Missouri.

<sup>5</sup>University of California San Diego Medical Center, San Diego, California.

<sup>6</sup>Central Kentucky Radiology, Lexington, Kentucky.

<sup>7</sup>University of Chicago Hospital, Chicago, Illinois.

<sup>8</sup>University of Western Ontario, London, Ontario Canada.

<sup>9</sup>Northwestern Memorial Hospital, Chicago, Illinois.

<sup>10</sup>University of Illinois College of Medicine, Chicago, Ill.

<sup>11</sup>St. Luke's Hospital, Bethlehem, Pennsylvania.

<sup>12</sup>St. Luke's Roosevelt Hospital Center, New York, New York.

<sup>13</sup>Albany Medical College, Albany, New York.

<sup>14</sup>Kaiser Permanente, Los Angeles Medical Center, Los Angeles, California.

<sup>15</sup>Oregon Health Science University, Portland, Oregon, Society for Vascular Surgery.

The American College of Radiology seeks and encourages collaboration with other organizations on the development of the ACR Appropriateness Criteria through society representation on expert panels. Participation by representatives from collaborating societies on the expert panel does not necessarily imply society endorsement of the final document.

Reprint requests to: Department of Quality & Safety, American College of Radiology, 1891 Preston White Drive, Reston, VA 20191-4397.

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 [10].

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 for successful outcome were “postprandial pain pattern (81% cured), age between 40 and 60 (77% cured), and weight loss of 20 pounds or more (67% cured)” [11]. There is no current evidence that supports use of angioplasty and stenting in this entity, and endovascular dilation may be contraindicated unless ligament release has been performed first [9].

### Summary

- Noninvasive tests such as CTA, MRA, or US should be the initial diagnostic imaging tests of choice for evaluating chronic mesenteric ischemia. These modalities can reliably diagnose proximal occlusive disease. Conventional angiography is reserved for diagnosis of distal disease or 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.

### Supporting Document(s)

- [ACR Appropriateness Criteria® Overview](#)
- Evidence table under review

### References

1. Cademartiri F, Raaijmakers RH, Kuiper JW, van Dijk LC, Pattynama PM, Krestin GP. Multi-detector row CT angiography in patients with abdominal angina. *Radiographics* 2004; 24(4):969-984.
2. Kirkpatrick ID, Kroeker MA, Greenberg HM. Biphasic CT with mesenteric CT angiography in the evaluation of acute mesenteric ischemia: initial experience. *Radiology* 2003; 229(1):91-98.
3. Stueckle CA, Haegeler KF, Jendreck M, et al. Multislice computed tomography angiography of the abdominal arteries: comparison between computed tomography angiography and digital subtraction angiography findings in 52 cases. *Australas Radiol* 2004; 48(2):142-147.
4. Ernst O, Asnar V, Sergent G, et al. Comparing contrast-enhanced breath-hold MR angiography and conventional angiography in the evaluation of mesenteric circulation. *AJR Am J Roentgenol* 2000; 174(2):433-439.
5. Harward TR, Smith S, Seeger JM. Detection of celiac axis and superior mesenteric artery occlusive disease with use of abdominal duplex scanning. *J Vasc Surg* 1993; 17(4):738-745.
6. Trompeter M, Brazda T, Remy CT, Vestring T, Reimer P. Non-occlusive mesenteric ischemia: etiology, diagnosis, and interventional therapy. *Eur Radiol* 2002; 12(5):1179-1187.
7. Schoots IG, Levi MM, Reekers JA, Lameris JS, van Gulik TM. Thrombolytic therapy for acute superior mesenteric artery occlusion. *J Vasc Interv Radiol* 2005; 16(3):317-329.
8. Brown DJ, Schermerhorn ML, Powell RJ, et al. Mesenteric stenting for chronic mesenteric ischemia. *J Vasc Surg* 2005; 42(2):268-274.
9. Matsumoto AH, Angle JF, Spinosa DJ, et al. Percutaneous transluminal angioplasty and stenting in the treatment of chronic mesenteric ischemia: results and longterm followup. *J Am Coll Surg* 2002; 194(1 Suppl):S22-31.
10. Lee VS, Morgan JN, Tan AG, et al. Celiac artery compression by the median arcuate ligament: a pitfall of end-expiratory MR imaging. *Radiology* 2003; 228(2):437-442.
11. Reilly LM, Ammar AD, Stoney RJ, Ehrenfeld WK. Late results following operative repair for celiac artery compression syndrome. *J Vasc Surg* 1985; 2(1):79-91.

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.