

**Radiologic Management of Mesenteric Ischemia
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
1. Sise MJ. Acute mesenteric ischemia. <i>Surg Clin North Am.</i> 2014;94(1):165-181.	Review/Other-Dx	N/A	To review the pathophysiology, clinical presentation, diagnostic work-up, effective management, and outcome of AMI.	AMI is uncommon and always occurs in the setting of preexisting comorbidities. Mortality rates remain high. The 4 major types of AMI are acute SMA thromboembolic occlusion, mesenteric arterial thrombosis, MVT, and NOMI, including ischemic colitis. Delays in diagnosis are common and associated with high rates of morbidity and mortality. Prompt diagnosis requires attention to history and physical examination, a high index of suspicion, and early contrast CT scanning. Selective use of nonoperative therapy has an important role in NOMI of the small bowel and colon.	4
2. Bobadilla JL. Mesenteric ischemia. <i>Surg Clin North Am.</i> 2013;93(4):925-940, ix.	Review/Other-Dx	N/A	To review the presentation, diagnosis, evaluation, and treatment of the various forms of mesenteric ischemia, including acute and chronic ischemia.	Mesenteric ischemia remains a rare clinical entity, but because of the grave consequences of missed or significantly delayed diagnosis, clinical suspicion must remain high. Abdominal pain, bloating, nausea, vomiting, and pain out of proportion to physical examination findings remain the hallmark of presentation. Catheter-based angiography is still the gold standard of diagnosis, but high-quality CTA is an acceptable alternative.	4
3. Cademartiri F, Raaijmakers RH, Kuiper JW, van Dijk LC, Pattynama PM, Krestin GP. Multi-detector row CT angiography in patients with abdominal angina. <i>Radiographics.</i> 2004;24(4):969-984.	Review/Other-Dx	N/A	Review role of MD-CTA in patients with abdominal angina.	MD-CTA with appropriate post-processing techniques is highly effective for the diagnosis, evaluation, and treatment of suspected abdominal angina. Additional studies will help further evaluate the performance and applications of this modality.	4

**Radiologic Management of Mesenteric Ischemia
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
4. Kirkpatrick ID, Kroeker MA, Greenberg HM. Biphasic CT with mesenteric CT angiography in the evaluation of acute mesenteric ischemia: initial experience. <i>Radiology</i> . 2003;229(1):91-98.	Observational-Dx	62 patients; 2 reviewers	To evaluate the sensitivity and specificity of biphasic CT with mesenteric CT angiography in the diagnosis of acute mesenteric ischemia (AMI).	AMI was diagnosed in 26 patients. The CT angiogram depicted arterial disease in eight patients and altered care in five. A finding of any one of pneumatosis intestinalis, venous gas, superior mesenteric artery occlusion, celiac and inferior mesenteric artery occlusion with distal SMA disease, or arterial embolism was 100% specific but only 73% sensitive. Alternatively, a finding of bowel wall thickening in addition to focal lack of bowel wall enhancement, solid organ infarction, or venous thrombosis was 50% sensitive and 94% specific. By using either of these criteria for the diagnosis, a sensitivity of 96% and a specificity of 94% can be achieved. Biphasic CT with mesenteric CT angiography is effective in the diagnosis of AMI.	2
5. Stueckle CA, Haegele 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. <i>Australas Radiol</i> . 2004;48(2):142-147.	Observational-Dx	52 patients had both multislice CTA and DSA; 2 reviewers	Retrospective study to compare conventional angiography to CTA in the diagnosis of morphological changes in the abdominal aorta and its branches.	All aneurysms, occlusions, stenoses and calcifications were diagnosed correctly by CTA in axial and multiplanar projections (sensitivity 1.0; specificity 1.0). 3D volume-rendered CTA showed a sensitivity of 0.91 for aneurysms, 0.82 for stenoses, 0.75 for occlusions and 0.77 for calcifications. The specificity was 1.0 in all cases. Multislice CTA seems to be similar to conventional DSA for abdominal vessels if multiplanar projections are used.	3
6. Ernst O, Asnar V, Sergent G, et al. Comparing contrast-enhanced breath-hold MR angiography and conventional angiography in the evaluation of mesenteric circulation. <i>AJR Am J Roentgenol</i> . 2000;174(2):433-439.	Observational-Dx	33 patients; 2 reviewers	Prospective study to compare the results of gadolinium-enhanced breath-hold MRA with those of conventional angiography for the study of mesenteric circulation. Standard reference was selective conventional angiography.	Agreement was good or excellent for the hepatic artery (kappa = 0.78), the SMA (kappa = 0.65), the splenic artery (kappa = 0.70), the portal vein (kappa = 1.0), the superior mesenteric vein (kappa = 0.88), and the splenic vein (kappa = 0.75). Agreement was poor, and vessels were better shown by conventional angiography, for the intrahepatic arteries (kappa = 0.006) and the branches of the SMA (kappa = 0.14). MRA and conventional angiography revealed 29 and 27 portosystemic collaterals, respectively. However, conventional angiography is still necessary to evaluate distal arteries.	2

**Radiologic Management of Mesenteric Ischemia
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
7. Menke J. Diagnostic accuracy of multidetector CT in acute mesenteric ischemia: systematic review and meta-analysis. <i>Radiology</i> . 2010;256(1):93-101.	Meta-analysis	142 patients with AMI and 477 without; 2 reviewers	To use meta-analysis to determine the diagnostic accuracy of contrast agent-enhanced MDCT in primary acute mesenteric ischemia. Surgery or clinical outcome used as the reference standard.	Three studies were prospective, and three were retrospective. All studies were of high quality. The CT scanners used in the included studies had between 4 and 40 rows. The between-study heterogeneity was low to moderate. Overall, acute mesenteric ischemia was found in 142/619 studied cases. The meta-analysis showed a pooled sensitivity of 93.3% (95% CI: 82.8%, 97.6%) and a pooled specificity of 95.9% (95% CI: 91.2%, 98.2%). On the basis of a thorough clinical examination, contrast-enhanced MDCT allows the diagnosis of primary AMI with high sensitivity and specificity. Thus, it may be used as the first-line imaging method.	M
8. Yikilmaz A, Karahan OI, Senol S, Tuna IS, Akyildiz HY. Value of multislice computed tomography in the diagnosis of acute mesenteric ischemia. <i>Eur J Radiol</i> . 2011;80(2):297-302.	Observational-Dx	200 patients	To define the value of multislice CT in the diagnosis of AMI.	94 patients (47%) underwent surgery for AMI or for other causes of acute abdominal pain. 106 patients (53%) were followed conservatively according to clinical, radiologic and laboratory findings. Of the 94 patients who underwent surgery, 49 (25%) were found to have AMI. All of these 49 patients with a proven AMI diagnosis were diagnosed with CT. In the other 45 patients who underwent surgery, CT findings were negative for AMI. None of the patients, who were followed conservatively, were eventually diagnosed as having AMI except 1 patient. This patient was unfit for surgery although his clinical and radiologic findings were consistent with AMI and died in 3 days. The sensitivity and specificity values of CT for the detection of AMI were calculated to be 100% for each.	3

**Radiologic Management of Mesenteric Ischemia
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
9. Harward TR, Smith S, Seeger JM. Detection of celiac axis and superior mesenteric artery occlusive disease with use of abdominal duplex scanning. <i>J Vasc Surg.</i> 1993;17(4):738-745.	Observational-Dx	38 patients	Compare mesenteric duplex scanning with lateral aortography to define the accuracy of abdominal duplex scanning for detection of mesenteric arterial insufficiency.	In the SMA a peak systolic frequency of 4.5 kHz was 96% sensitive (24/25), 92% specific (12/13), and 95% accurate (36/38) at predicting stenoses less than 50% or 50% or greater. For arteries with stenoses 50% to 99%, regression analysis demonstrated excellent linear correlation between percent stenosis and peak systolic frequency ($r = 0.89$). In the celiac axis a peak systolic frequency of 4.0 kHz had a sensitivity of 100% (30/30), a specificity of 88% (7/8), and an accuracy of 97% (37/38). Again, for arteries with stenoses 50% to 99%, an excellent linear correlation existed between peak systolic frequency and percent stenosis ($r = 0.86$). All total arterial occlusions (14) were correctly identified. In all, mesenteric arterial duplex scanning was 96% accurate for predicting SMA and celiac axis stenoses/occlusions.	2
10. Kwan SW, Fidelman N, Durack JC, Roberts JP, Kerlan RK, Jr. Rex shunt preoperative imaging: diagnostic capability of imaging modalities. <i>PLoS One.</i> 2011;6(7):e22222.	Observational-Dx	20 patients	To evaluate the diagnostic capability of imaging modalities used for preoperative mesenteric-left portal bypass ("Rex shunt") planning.	2 readers retrospectively reviewed these studies for an ability to confidently determine left portal vein patency, superior mesenteric vein patency, and intrahepatic left and right portal vein contiguity. In this study, CT arterial portography allowed for confident characterization of left portal vein patency, superior mesenteric vein patency and left and right portal vein continuity in 100% of the examinations. Single phase contrast-enhanced CT, multi-phase contrast-enhanced CT, multiphase contrast-enhanced MRI, and transarterial portography answered all key diagnostic questions in 33%, 30%, 0% and 8% of the examinations, respectively.	3
11. Resch TA, Acosta S, Sonesson B. Endovascular techniques in acute arterial mesenteric ischemia. <i>Semin Vasc Surg.</i> 2010;23(1):29-35.	Review/Other-Tx	N/A	Review endovascular techniques in acute arterial mesenteric ischemia.	Access to excellent imaging facilities, preferably angio-equipped operating rooms, as well as appropriate endovascular tools, is important for successfully treating sick patients. Care must be individually tailored. Laparotomy should be performed liberally, but is not mandatory for successful outcomes.	4

**Radiologic Management of Mesenteric Ischemia
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
12. Acosta S, Sonesson B, Resch T. Endovascular therapeutic approaches for acute superior mesenteric artery occlusion. <i>Cardiovasc Intervent Radiol</i> . 2009;32(5):896-905.	Observational-Tx	21 patients	To characterize the outcome of attempted endovascular intervention in patients with acute embolic or thrombotic SMA occlusion.	The records of 21 patients during a 3-year period between 2005 and 2008 were retrieved from the in-hospital registry. The first group included 10 patients (6 women and 4 men; median age 78 years) with acute embolic occlusion of the SMA. The median duration of symptoms from symptom onset to angiography was 30 hours (range 6 to 120). Synchronous emboli (n = 12) occurred in 6 patients. Embolus aspiration was performed in 9 patients, and 7 of these had satisfactory results. Complementary local thrombolysis was successful in 2 of 3 patients. Residual emboli were present at completion angiography in all 7 patients who underwent successful aspiration embolectomy, and bowel resection was necessary in only 1 of these patients. 1 serious complication occurred because of a long SMA dissection. The in-hospital survival rate was 90% (9/10 patients). The second group included 11 patients (10 women and 1 man; median age 68 years) with atherosclerotic acute SMA occlusions. The median time of symptom duration before intervention was 97 hours (range 17 to 384). The brachial, femoral and SMA routes were used in 6, 7, and 5 patients, respectively. SMA stenting was performed through an antegrade (n = 7) or retrograde (n = 3) approach. Bowel resection was necessary in 4 patients. No major complications occurred. The in-hospital survival rate was 82% (9/11 patients).	2
13. Schoots IG, Levi MM, Reekers JA, Lameris JS, van Gulik TM. Thrombolytic therapy for acute superior mesenteric artery occlusion. <i>J Vasc Interv Radiol</i> . 2005;16(3):317-329.	Review/Other-Tx	48 patients	Systematic analysis of literature to evaluate thrombolytic therapy for acute SMA occlusion as an alternative or adjunctive treatment modality to surgical therapy and to provide current knowledge for timely and informed decisions regarding treatment of AMI.	Technically feasible but few reports found. Insufficient data to judge safety and effectiveness. Thrombolytic therapy can be effective relatively quickly, may obviate surgery, and has the potential to resolve the clot completely. In some cases it can be used as an alternative or neo-adjunctive treatment modality to surgery.	4

**Radiologic Management of Mesenteric Ischemia
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
14. Arthurs ZM, Titus J, Bannazadeh M, et al. A comparison of endovascular revascularization with traditional therapy for the treatment of acute mesenteric ischemia. <i>J Vasc Surg.</i> 2011;53(3):698-704; discussion 704-695.	Observational-Tx	70 patients	To evaluate the effect of endovascular therapy on outcomes for the treatment of AMI.	70 consecutive patients were identified with AMI (mean age, 64 +/- 13 years). Etiology of mesenteric ischemia was 65% thrombotic and 35% embolic occlusions. Endovascular revascularization was the preferred treatment (81%) vs operative therapy (19%). Successful endovascular treatment was achieved in 87%. Endovascular therapy required laparotomy in 69% vs traditional therapy in 100% ($P<.05$), with a median 52-cm necrotic bowel resected (interquartile range, 11–140 cm) vs 160 cm (interquartile range, 90–250 cm; $P<.05$), respectively. Acute renal failure and pulmonary failure occurred less frequently with endovascular therapy (27% vs 50%; $P<.05$ and 27% vs 64%; $P<.05$). Successful endovascular treatment resulted in a mortality rate of 36% compared with 50% ($P<.05$) with traditional therapy, whereas the mortality rate for endovascular failures was 50%. Endovascular therapy was associated with improved mortality in thrombotic AMI (odds ratio, 0.10; 95% CI, 0.10-0.76; $P<.05$).	2

**Radiologic Management of Mesenteric Ischemia
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
15. Block TA, Acosta S, Bjorck M. Endovascular and open surgery for acute occlusion of the superior mesenteric artery. <i>J Vasc Surg.</i> 2010;52(4):959-966.	Observational-Tx	161 patients	To analyze time-trends and patient-related and management-related factors for outcome after open and endovascular intestinal revascularization for acute SMA occlusion.	The number of revascularizations of the SMA increased over time with 41 operations in 2006, compared to 10 in 1999. Endovascular approach increased six-fold by 2006 as compared to 1999. The endovascular group had thrombotic occlusion ($P<.001$) and history of abdominal angina ($P=.042$) more often, the open group had atrial fibrillation more frequently ($P=.031$). All the patients in the endovascular group, but only 34% after open surgery, underwent completion control of the vascular reconstruction ($P<.001$). Bowel resection ($P<.001$) and short bowel syndrome ($P=.009$) occurred more frequently in the open group. Short bowel syndrome (hazard ratio, 2.6; 95% CI, 1.3–5.0) and age (hazard ratio, 1.03/year; 95% CI, 1.00–1.06) were independently associated with increased long-term mortality. 30-day and 1-year mortality rates were 42% vs 28% ($P=.03$) and 58% vs 39% ($P=.02$), for open and endovascular surgery, respectively. Long-term survival after endovascular treatment was better than after open surgery (log-rank, $P=.02$).	2
16. Schermerhorn ML, Giles KA, Hamdan AD, Wyers MC, Pomposelli FB. Mesenteric revascularization: management and outcomes in the United States, 1988-2006. <i>J Vasc Surg.</i> 2009;50(2):341-348 e341.	Review/Other-Tx	6,342 PTA/S and 16,071 open surgical repairs	To evaluate trends in management of CMI and AMI using surgery or PTA/S between 1988 and 2006 and used a national hospital administrative database to compare in hospital outcomes in the most recent years.	From 1988 to 2006, there were 6,342 PTA/S and 16,071 open surgical repairs overall. PTA/S increased steadily, surpassing all surgery for CMI in 2002. PTA/S for AMI has also increased and surpassed bypass in 2002 but has not surpassed all surgical procedures for AMI even in 2006. The mortality rate was lower after PTA/S than after bypass for CMI (3.7% vs 13%, $P<.01$) and AMI (16% vs 28%, $P<.01$). Bowel resection was more common after bypass than PTA/S for CMI (7% vs 3%, $P<.01$). This subgroup showed an increased in-hospital mortality rate for both repair types (54% and 25%, respectively).	4

**Radiologic Management of Mesenteric Ischemia
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
17. Trompeter M, Brazda T, Remy CT, Vestring T, Reimer P. Non-occlusive mesenteric ischemia: etiology, diagnosis, and interventional therapy. <i>Eur Radiol.</i> 2002;12(5):1179-1187.	Review/Other-Dx	NA	Discussion of NOMI. Includes, etiology, presentation, diagnosis, therapies.	Imaging modalities like CT, MRI, and US, are able to evaluate the aorta and the origins of splanchnic arteries. Despite the technical evolution of these methods, selective angiography of mesenteric arteries is still the gold standard in diagnosing peripheral splanchnic vessel disease.	4
18. Mitsuyoshi A, Obama K, Shinkura N, Ito T, Zaima M. Survival in nonocclusive mesenteric ischemia: early diagnosis by multidetector row computed tomography and early treatment with continuous intravenous high-dose prostaglandin E(1). <i>Ann Surg.</i> 2007;246(2):229-235.	Review/Other-Tx	13 patients	To establish a procedure for early diagnosis and treatment of NOMI.	9 of the first 13 patients died of multiple organ failure associated with multiple intestinal necrosis. These cases suggested that NOMI may develop when 3 of the following 4 criteria are met after cardiovascular surgery or maintenance dialysis in elderly patients: symptoms of the ileus develop slowly from abdominal symptoms, such as an unpleasant abdominal feeling or pain; a requirement for catecholamine treatment; an episode of hypotension; and slow elevation of the serum transaminase level. In the 9 recent cases, definite diagnosis was made from spasm of the principal arteries in arterial volume rendering and curved planar reformation MDCT images. Early treatment with prostaglandin E(1) prevented acute-stage NOMI in 8 of the 9 cases.	4

**Radiologic Management of Mesenteric Ischemia
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
19. Woodhams R, Nishimaki H, Fujii K, Kakita S, Hayakawa K. Usefulness of multidetector-row CT (MDCT) for the diagnosis of non-occlusive mesenteric ischemia (NOMI): assessment of morphology and diameter of the superior mesenteric artery (SMA) on multi-planar reconstructed (MPR) images. <i>Eur J Radiol.</i> 2010;76(1):96-102.	Observational-Dx	4 patients	To assess the efficacy of MDCT for the diagnosis of NOMI by analyzing morphology and diameter of SMA.	Multi-planar reconstructed (MPR) images of all NOMI cases showed irregular narrowing of the SMA, spasm of the arcades of SMA, and poor demonstration of intramural vessels. MPR images of two patients who had angiography were concordant with their angiograms. The mean diameter of SMA of NOMI patients was 3.4±1.1mm, which was statistically smaller than that of 13 control patients, 6.0±1.5mm (P<0.05, Wilcoxon rank sum tests). Angiography has been recognized essential for the diagnosis of NOMI. Study shows the possibility of MDCT to be an equivalently useful modality compared to angiography for the diagnosis of NOMI by interpreting morphologic appearance and diameter of SMA. Introduction of MDCT in the decision tree of NOMI treatment may bring the benefit of prompt diagnosis and subsequent early and efficient initiation of therapy, which may improve the mortality.	3
20. Bjorck M, Wanhainen A. Nonocclusive mesenteric hypoperfusion syndromes: recognition and treatment. <i>Semin Vasc Surg.</i> 2010;23(1):54-64.	Review/Other-Tx	N/A	To present knowledge on mesenteric nonocclusive hypoperfusion syndromes.	Mesenteric hypoperfusion syndromes represent a group of serious conditions from which the patient's life is almost always at stake. We tend to see different aspects of the NOMI pattern, depending on our medical specialty. 1 of the keys to success in treating these difficult and challenging patients is using a multidisciplinary approach. The cardiologist or intensivist might not consider abdominal compartment syndrome or an arterial stenosis, the radiologist might not consider intravenous therapy, and the vascular surgeon might not consider drug therapy.	4
21. van Petersen AS, Kolkman JJ, Beuk RJ, Huisman AB, Doelman CJ, Geelkerken RH. Open or percutaneous revascularization for chronic splanchnic syndrome. <i>J Vasc Surg.</i> 2010;51(5):1309-1316.	Review/Other-Tx	412 patients open repair; 227 patients endovascular repair	To review the available evidence for endovascular repair or open repair of chronic splanchnic syndrome.	Endovascular repair appears to be preferential in the treatment of elderly patients and in patients with comorbidity, severe cachexia, or hostile abdomen. Long-term results after open repair are excellent. Open repair can still be proposed as the preferred option for relatively young and fit patients.	4

**Radiologic Management of Mesenteric Ischemia
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
<p>22. Aburahma AF, Campbell JE, Stone PA, et al. Perioperative and late clinical outcomes of percutaneous transluminal stentings of the celiac and superior mesenteric arteries over the past decade. <i>J Vasc Surg.</i> 2013;57(4):1052-1061.</p>	<p>Observational-Tx</p>	<p>83 patients</p>	<p>A retrospective analysis of the medical records of patients with symptoms of CMI treated with stenting of the celiac artery and SMA over a 10-year period.</p>	<p>54 SMA and 51 celiac artery stents were analyzed. The initial technical and clinical success rates were 97% and 96%, respectively, with 2% procedure morbidity and 2% mortality. The primary late clinical success rate was 59%, and the late $\geq 70\%$ in-stent stenosis rate was 51% at a mean follow-up of 31 months (range, 1–124). Freedom from late recurrent symptoms at 1, 2, 3, 4, and 5 years was 83%, 77%, 70%, 70%, and 65%, respectively. Survival rates at the same intervals were 88%, 82%, 70%, 64%, and 51%. Primary patency rates for the whole series were 69%, 48%, 39%, 28%, and 19% at 1, 2, 3, 4, and 5 years, respectively. Assisted primary patency rates for the whole series were 80%, 61%, 54%, 43%, and 34% at 1, 2, 3, 4, and 5 years, respectively. Primary patency rates for the SMA at 1, 2, 3, 4, and 5 years were 71%, 47%, 37%, 28%, and 18%, respectively; and assisted primary rates were 82%, 64%, 57%, 45%, and 32%, respectively. Primary patency rates for the celiac artery were 68%, 50%, 40%, 29%, and 21%; and assisted primary rates were 79%, 58%, 52%, 42%, and 36% for 1, 2, 3, 4, and 5 years, respectively. There were no significant differences in either primary or assisted primary patency between the SMA and celiac artery ($P=.7729$ and $.8169$). A secondary intervention was carried out in 30% of the series. Freedom from $\geq 70\%$ in-stent stenosis for the SMA was 82%, 65%, 56%, 42%, and 34%, and that for the celiac artery was 73%, 59%, 48%, 34%, and 25%, at 1, 2, 3, 4, and 5 years, respectively.</p>	<p>2</p>

**Radiologic Management of Mesenteric Ischemia
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
23. Oderich GS, Tallarita T, Gloviczki P, et al. Mesenteric artery complications during angioplasty and stent placement for atherosclerotic chronic mesenteric ischemia. <i>J Vasc Surg.</i> 2012;55(4):1063-1071.	Review/Other-Tx	113 women; 43 men	To describe the incidence, management, and outcomes of mesenteric artery complications during angioplasty and stent placement for CMI.	There were 113 women and 43 men (mean age, 73 +/- 14 years). 11 patients (7%) developed 14 mesenteric artery complications, including distal mesenteric embolization in 6, branch perforation in 3, dissection in 2, stent dislodgement in 2, and stent thrombosis in 1. 5 patients required adjunctive endovascular procedures, including in 2 patients each, catheter-directed thrombolysis or aspiration, retrieval of dislodged stents, and placement of additional stents for dissection. 5 patients (45%) required conversion to open repair: 2 required evacuation of mesenteric hematoma, 2 required mesenteric revascularization, and 1 required bowel resection. There were 4 early deaths (2.5%) due to mesenteric embolization or myocardial infarction in 2 patients each. Patients with mesenteric artery complications had higher rates of mortality (18% vs 1.5%) and morbidity (64% vs 19%; $P<.05$) and a longer hospital length of stay (6.3 +/- 4.2 vs 1.6 +/- 1.2 days) than those without mesenteric artery complications. Periprocedural use of antiplatelet therapy was associated with lower risk of distal embolization or vessel thrombosis (odds ratio, 0.2; 95% CI, 0.06–0.90). Patients treated by a large-profile system had a trend toward more mesenteric artery complications (odds ratio, 1.8; 95% CI, 0.7–26.5; $P=.07$).	4
24. Lee VS, Morgan JN, Tan AG, et al. Celiac artery compression by the median arcuate ligament: a pitfall of end-expiratory MR imaging. <i>Radiology.</i> 2003;228(2):437-442.	Review/Other-Dx	97 patients; 2 blinded reviewers	To measure the prevalence and degree of celiac artery compression during breath-hold imaging at end inspiration and end expiration in patients referred to undergo MRI of the abdomen for reasons unrelated to intestinal ischemia.	Average percentage of stenosis at end expiration (21% +/- 16) was significantly higher than that at end inspiration (11% +/- 11; $P<.001$). Authors recommended end inspiration imaging to minimize false positive celiac compression.	4

**Radiologic Management of Mesenteric Ischemia
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
25. Reilly LM, Ammar AD, Stoney RJ, Ehrenfeld WK. Late results following operative repair for celiac artery compression syndrome. <i>J Vasc Surg.</i> 1985;2(1):79-91.	Review/Other-Tx	44 patients	Retrospective review of outcomes after operative treatment for celiac artery compression.	Celiac revascularization in addition to decompression provided better symptom relief than decompression alone. Authors identified indicators of favorable and unfavorable outcomes. Favorable; postprandial pain, age 40–60, weight loss of ≥ 20 lbs. Unfavorable; atypical pain, history of psychiatric disorder or alcohol abuse, age >60 , weight loss <20 lbs.	4
26. Liu FY, Wang MQ, Fan QS, Duan F, Wang ZJ, Song P. Interventional treatment for symptomatic acute-subacute portal and superior mesenteric vein thrombosis. <i>World J Gastroenterol.</i> 2009;15(40):5028-5034.	Review/Other-Tx	46 patients	To summarize methods and experience with interventional treatment for symptomatic acute-subacute portal vein and superior MVT.	Blood reperfusion of portal vein and superior MVT was achieved completely or partially in 34 patients 3–13 days after thrombolysis. Interventional treatment, including direct or indirect portal vein and superior MVT, is a safe and effective method for patients with symptomatic acute-subacute portal vein and superior MVT.	4
27. Bergqvist D, Svensson PJ. Treatment of mesenteric vein thrombosis. <i>Semin Vasc Surg.</i> 2010;23(1):65-68.	Review/Other-Tx	N/A	To review treatment for MVT.	No results reported in abstract.	4
28. Rhee RY, Gloviczki P. Mesenteric venous thrombosis. <i>Surg Clin North Am.</i> 1997;77(2):327-338.	Review/Other-Tx	N/A	To review MVT.	No results reported in abstract.	4
29. Bradbury MS, Kavanagh PV, Bechtold RE, et al. Mesenteric venous thrombosis: diagnosis and noninvasive imaging. <i>Radiographics.</i> 2002;22(3):527-541.	Review/Other-Dx	N/A	Review the causes, clinical features, radiologic findings, and management of portal or MVT.	Helical CT and CTA, especially when performed with multi-detector row scanners, and MRI, particularly gadolinium-enhanced MRA, enable volumetric acquisitions in a single breath hold, eliminating motion artifact and suppressing respiratory misregistration. Helical CTA and 3D gadolinium-enhanced MRA should be considered the primary diagnostic modalities for patients with a high clinical suspicion of mesenteric ischemia.	4
30. Abu-Daff S, Abu-Daff N, Al-Shahed M. Mesenteric venous thrombosis and factors associated with mortality: a statistical analysis with five-year follow-up. <i>J Gastrointest Surg.</i> 2009;13(7):1245-1250.	Review/Other-Tx	31 cases	To examine the factors associated with mortality in MVT.	30 day mortality for MVT is strongly associated with colonic involvement as well as “short-bowel” syndrome, while anticoagulation may be protective. 5-year survival was found to be strongly associated with “short-bowel” syndrome.	4

**Radiologic Management of Mesenteric Ischemia
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
31. Amitrano L, Guardascione MA, Scaglione M, et al. Prognostic factors in noncirrhotic patients with splanchnic vein thromboses. <i>Am J Gastroenterol.</i> 2007;102(11):2464-2470.	Observational-Tx	121 patients; 104 patients had screening for thrombophilic factors	To examine prognostic factors in noncirrhotic patients with splanchnic vein thromboses.	Anticoagulant therapy was effective to obtain recanalization of acute splanchnic vein thromboses in 45.4% of patients and preserved patients from recurrent thrombosis when given lifelong.	2
32. Di Minno MN, Milone F, Milone M, et al. Endovascular Thrombolysis in Acute Mesenteric Vein Thrombosis: a 3-year follow-up with the rate of short and long-term sequelae in 32 patients. <i>Thromb Res.</i> 2010;126(4):295-298.	Observational-Tx	32 patients	A 3-year follow-up with the rate of short and long-term sequelae in patients with endovascular thrombolysis in acute MVT.	An early endovascular thrombolytic treatment in MVT will improve the patency of the mesenteric-portal system and to protect from the development of short (bowel resection) and long-term (portal hypertension) sequelae in subjects with contraindications to surgery.	2
33. Hollingshead M, Burke CT, Mauro MA, Weeks SM, Dixon RG, Jaques PF. Transcatheter thrombolytic therapy for acute mesenteric and portal vein thrombosis. <i>J Vasc Interv Radiol.</i> 2005;16(5):651-661.	Review/Other-Tx	20 patients	Retrospective study to evaluate the utility of transcatheter thrombolytic therapy in patients with acute or subacute (symptoms <40 days) portal and/or MVT with severe symptoms, deteriorating clinical condition, and/or persistent symptoms despite anticoagulation.	15/20 patients showed some degree of lysis of the thrombus. 3 patients had complete resolution, 12 had partial resolution, and 5 patients had no resolution. 85% of patients (n = 17) had resolution of symptoms. 60% of patients (n = 12) developed a major complication. Transcatheter thrombolysis was beneficial in avoiding patient death, resolving thrombus, improving symptoms, and avoiding bowel resection. However, there was a high complication rate, indicating that this therapy should be reserved for patients with severe disease. Further evaluation of these techniques and outcomes should continue to be pursued.	4

Evidence Table Key

Study Quality Category Definitions

- *Category 1* The study is well-designed and accounts for common biases.
- *Category 2* The study is moderately well-designed and accounts for most common biases.
- *Category 3* There are important study design limitations.
- *Category 4* The study is not useful as primary evidence. The article may not be a clinical study or the study design is invalid, or conclusions are based on expert consensus. For example:
 - a) the study does not meet the criteria for or is not a hypothesis-based clinical study (e.g., a book chapter or case report or case series description);
 - b) the study may synthesize and draw conclusions about several studies such as a literature review article or book chapter but is not primary evidence;
 - c) the study is an expert opinion or consensus document.
- M = Meta-analysis

Dx = Diagnostic

Tx = Treatment

Abbreviations Key

AMI = Acute mesenteric ischemia
CI = Confidence interval
CMI = Chronic mesenteric ischemia
CT = Computed tomography
CTA = Computed tomography angiography
DSA = Digital-subtraction angiography
MDCT = Multidetector computed tomography
MD-CTA= Multidetector computed tomography angiography
MRI = Magnetic resonance imaging
MRA = Magnetic resonance angiography
MVT = Mesenteric vein thrombosis
NOMI = Nonocclusive mesenteric ischemia
PTA/S = Percutaneous transarterial angioplasty or stenting
SMA = Superior mesenteric artery
US = Ultrasound