Acute-on-Chronic Mesenteric Ischemia

Recanalization of an occluded SMA using a steerable, deflectable guiding catheter.

BY JACK WEI CHIEH TAN, MBBS, AND JOHN R. LAIRD, JR, MD

A 77-year-old woman presented to an outside institution with acute onset of severe abdominal pain and diarrhea for a few days. Her history was significant for obstructive sleep apnea, type 2 diabetes mellitus, hypertension, and nondebilitating stroke with right carotid endarterectomy 20 years ago. She had a history of persistent postprandial abdominal pain and a 70-lb weight loss during the previous year. She had been prescribed narcotics for this pain, which were minimally helpful. Multiple upper endoscopies performed through the course of the year showed signs of peptic ulcer disease for which she was treated with a course of antibiotics and a proton pump inhibitor. During the last few weeks, her abdominal pain worsened before the acute exacerbation.

On physical examination, her abdomen was minimally distended and had no peritoneal signs. Radiographic examination of the abdomen showed multiple dilated small-bowel loops consistent with an ileus pattern. The CT scan was notable for severe stenosis and calcification at the celiac trunk and poor opacification of the superior mesenteric artery (SMA). Initial laboratory evaluations, including arterial blood gas, complete blood cell counts, amylase, lipase, and liver function tests, were unremarkable except for a leukocytosis of 20,400 cells/mm^3 and thrombocytosis of 767,000 cells/mm^3. The clinical diagnosis was acute mesenteric ischemia (AMI), and the patient was transferred directly to our angiographic suite for urgent angiographic study. Aspirin (325 mg) was administered, but clopidogrel was withheld because there was a low threshold for explorative laparatomy if her condition worsened. Intravenous vancomycin and metronidazole were administered before the procedure. The patient was allergic to penicillin. Anticoagulation was achieved with unfractionated heparin titrated to an activated clotting time of 250 to 300 seconds. A 5-F pigtail catheter was advanced into the abdominal aorta at the level of the celiac trunk, and abdominal aortography was performed. The angiogram demonstrated severe disease of the celiac trunk and flush occlusion of the SMA (Figure 1).

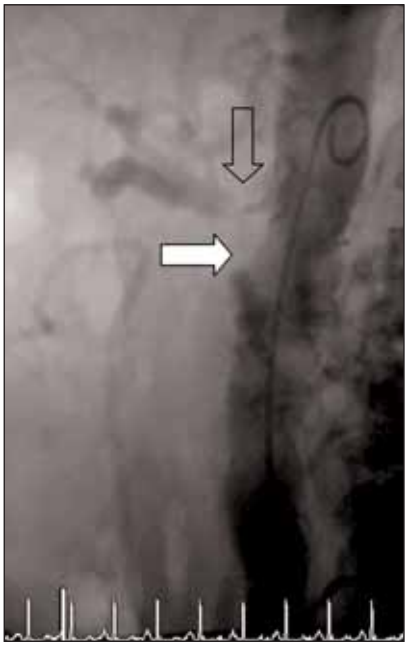

Figure 1. Aortogram, lateral projection. Severe stenosis of the celiac trunk with a filling defect (arrow) and flush occlusion of the SMA (white arrow).

The 5-F sheath was exchanged for a 7-F, 35-cm-long BriteTip sheath (Cordis Corporation, Warren, NJ). A 5-F IMA diagnostic catheter was then telescoped through a 7-F IMA guiding catheter (Cordis Corporation). The celiac trunk was intubated with the diagnostic catheter. A .014-inch BMW guidewire (Boston Scientific Corporation, Natick, MA) was advanced across the stenosis to the more distal celiac trunk. The guiding catheter was then telescoped over the diagnostic catheter to the ostium of the celiac trunk. The celiac trunk stenosis was predilated with a 5-mm X 2-cm Aviator RX balloon (Cordis Corporation) and then stented with a 6-mm X 12-mm Palmaz Genesis biliary stent (Cordis Corporation), deployed covering the lesion and back to the ostium at 14 atm. Angiography after stenting showed an excellent result with brisk flow into the celiac

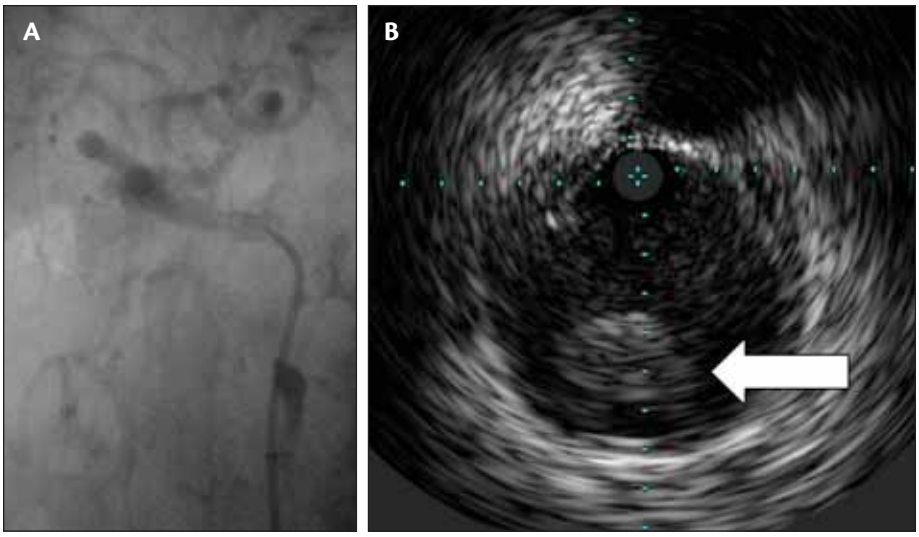

Figure 2. Poststenting of the celiac trunk (A). IVUS image of thrombus within the celiac trunk stent (arrow) (B).

trunk and no apparent significant residual narrowing (Figure 2A). Her abdominal discomfort was dramatically relieved upon stenting of the celiac trunk. However, during guiding catheter engagement of the stent, significant damping of pressure was noted. Intravascular ultrasound (IVUS) was then performed with a Volcano Eagle Eye IVUS catheter (Volcano Corporation, Rancho Cordova, CA) and demonstrated a large thrombus within the stent in the proximal celiac trunk (Figure 2B).

An additional 6-mm X 12-mm-long Palmaz Blue biliary stent (Cordis Corporation) was then deployed within the stent to trap the thrombus and provide better stent expansion. Repeat IVUS confirmed that there was still residual thrombus within the stented lumen of the celiac trunk. Thromboaspiration was attempted with a 7-F Export XT catheter (Medtronic CardioVascular, Santa Rosa, CA) without success, and 5 mg of intra-arterial tissue plasminogen activator was then administered via the guiding catheter. Completion angiography demonstrated brisk flow in the celiac trunk without change in the pressure damping. The 7-F IMA guiding catheter was then withdrawn to the estimated occlusion site of the SMA and probed with a .014-inch PT Graphics guidewire (Boston Scientific Corporation) followed by an Asahi Confianza Pro guidewire (Abbott Vascular, Santa Clara, CA). The 7-F IMA guide was then exchanged for a 6-F steerable Morph guiding catheter (BioCardia, Inc., South San Francisco, CA). Using the Morph catheter, the stump of the SMA was intubated. The total occlusion in the SMA was ultimately crossed using the Confianza Pro guidewire with a Transit catheter (Cordis Corporation) for back-up support. Balloon dilatation in the SMA was performed with a 2.5-mm X 25-mm Maverick balloon (Boston Scientific Corporation) followed by a 4-mm X 4-cm Sterling balloon (Boston Scientific Corporation). IVUS confirmed the suboptimal angiographic result with significant plaque burden and residual narrowing. The 6-F Morph guide was changed out for the 7-F IMA guide catheter. Two 5-mm X 19-mm Express stents (Boston Scientific Corporation) were then deployed from the more distal aspect of the SMA occlusion back to the ostium of the SMA. Postdilation was performed with a 6-mm diameter balloon after IVUS examination demonstrated incomplete stent expansion and apposition.

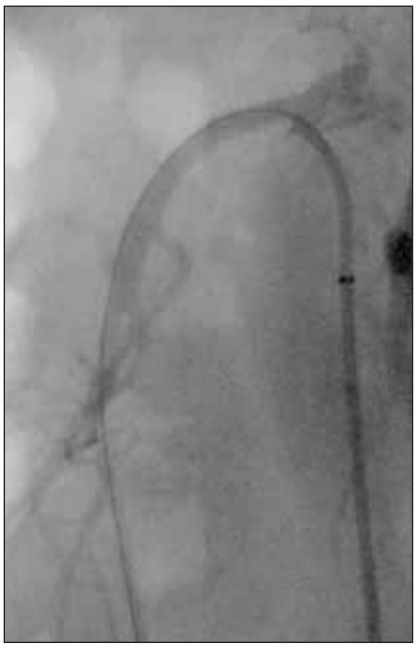

Figure 3. SMA final result. A 7-F guide catheter intubating ostium of the SMA.

Completion angiography demonstrated an excellent result (Figure 3). The sheath was removed, and hemostasis was achieved with an 8-F AngioSeal device (St. Jude Medical, Inc., St. Paul, MN). Anticoagulation was continued with unfractionated heparin, maintaining an activated partial thromboplastin time of 50 to 70 seconds. The patient had her nasogastric tube removed on day 2 after the procedure, was taken off antibiotics on day 3, and her total parental nutrition was discontinued on day 13 when she met her nutritional needs through enteral feeds. She was then discharged. A CT scan performed on day 5 for persistent diarrhea and abdominal distension showed patent stents with bowel edema but no infarction (Figure 4). Clopidogrel was started on day 6 and continued for 1 month. The patient continued to do

Figure 4. Patent celiac trunk and SMA stents on CT scan (arrows).

well on follow-up, and duplex studies showed stent patency at 2 months after the procedure (Figure 5).

DISCUSSION

Acute thrombosis of the mesenteric circulation usually occurs as a superimposed phenomenon in patients with a history of chronic mesenteric ischemia (CMI) from progressive atherosclerotic disease.[1,2] Thrombosis of the SMA or celiac axis usually occurs at the origin of the vessel, which renders the cases more amenable to endovascular therapy. Patients with CMI commonly have stenosis or occlusion of at least two or more mesenteric arteries and have a low threshold before onset of catastrophic AMI.[3] This patient has classic CMI symptoms with chronic occlusion of her SMA, a heavily diseased celiac trunk, and an occluded inferior mesenteric artery. The acute exacerbation was likely precipitated by thrombosis of the diseased celiac trunk. Left unrecognized, these patients often worsen and progress to frank bowel infarction.[4] Although endovascular therapy has gained tremendous ground in the treatment of CMI for selected patients,[5,6] the principal management for patients presenting with AMI from mesenteric artery thrombosis remains surgical.[7] Complication rates for surgical management in this group of patients remains high with a perioperative mortality rate of up to 52%. In survivors, long-term freedom from recurrence is a respectable 79% at 5 years and 59% at 10 years. Primary endovascular management for patients presenting early with AMI and without evidence of frank bowel infarction has been reported.[8-10] The utility of this approach has been historically low because most cases of AMI are diagnosed or present late, and technical expertise has often not been available.

We approached this patient by treating the celiac stenosis with primary stenting after predilatation. Balloon angioplasty alone in this setting provides inadequate results due to elastic recoil and dissection.[6-11] Balloon-expandable stents over a .014-inch platform are preferred for precise placement in the setting of ostial atherosclerotic lesions. The .014-inch–compatible devices are often more maneuverable through the challenging take-off angle of the celiac trunk and SMA from the aorta.[12] Although successful angioplasty of one mesenteric vessel is usually sufficient for initial symptom relief, we prefer complete revascularization when possible, especially of the SMA. For patients with AMI, complete revascularization would provide better flow for the acutely ischemic bowel. In addition, SMA patency is essential for long-term freedom from symptoms, as shown in surgical series.[7] We advocate the telescoping technique for intubation of the mesenteric vessels with a small diagnostic catheter before advancing the guide or sheath to avoid atheroembolism in these often severely diseased aortas. The steerable, deflectable Morph guiding catheter is a boon, as demonstrated in this case from the femoral approach for a severely angulated and occluded SMA. This device has a reinforced kink-resistant lumen with an adjustable-angle tip that maintains its shape, creating directionality for intubation and support. IVUS is also useful in sizing and stent optimization. Clopidogrel can not be administered until surgical intervention is ruled out, and initial stent apposition and expansion need to be perfect while the patient is on a single antiplatelet agent.[13] Intra-arterial thrombolytic infusion has been successful in case reports for treatment of SMA embolism.[14,15] The regimen for infusion and best agent are not well established. Postprocedure monitoring for evidence

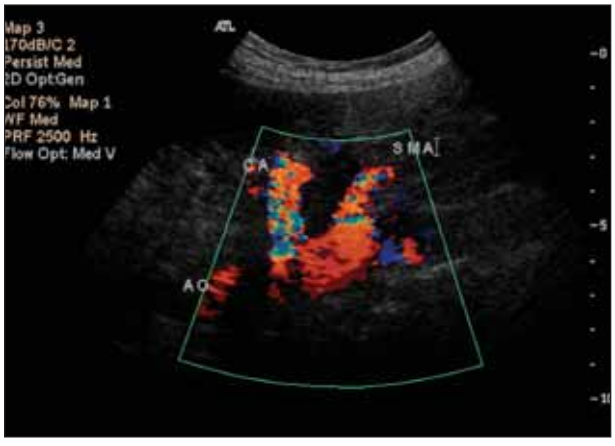

Figure 5. Patent celiac trunk (CA) and SMA on surveillance duplex ultrasound.

of bowel ischemia is crucial, and there should be a low threshold for surgical exploration.

CONCLUSION

Endovascular techniques with the current range of equipment can be the first-line therapy for early AMI patients. When in doubt, laparoscopic examination for bowel viability[16] can be combined with endovascular revascularization in place of surgery. ■

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