Recanalization of an Occluded Celiac Artery

PTFE-covered stenting in the mesenteric arteries after previous failed endovascular and open mesenteric revascularizations.

BY LARRY HORESH, MD

Chronic mesenteric ischemia (CMI) is a morbid disease that is occurring with increasing frequency, which is likely primarily due to an aging population combined with decreased mortality rates from cardiac causes. The number of occluded vessels that are responsible for symptoms vary; however, mesenteric ischemia is believed to occur when two of the three visceral vessels are affected with severe stenosis or occlusion. Generally, the disease presents in patients over 60 years of age, and the incidence is three times higher in women.

Clinical manifestations of mesenteric vascular stenosis are uncommon because of extensive collateral development in the mesenteric arteries. At a certain level of vascular insufficiency, intestinal blood flow is unable to supply the physiological gastrointestinal demands, and mesenteric ischemia will occur. Classic symptoms include "food fear," postprandial abdominal pain, and weight loss. Open surgical management has had substantially better long-term graft patency and lack of patient symptom recurrence than endovascular revascularization but with significantly greater perioperative mortality and morbidity rates in widespread practice. Treating symptomatic CMI is necessary to prevent progression to acute mesenteric ischemia, which may lead to bowel infarction and death. Classic surgical management primarily involves aortomesenteric bypass but may include endarterectomy and reimplantation.

The first successful percutaneous angioplasty of the superior mesenteric artery (SMA) was reported in 1980 by Andreas Grüntzig,[1] and in the same year, the first angioplasty of the celiac artery (CA) was reported by Saddekni et al.[2] Since then, multiple studies have presented the results of angioplasty and/or stenting in treating CMI. These series report binary restenosis and recurrent symptoms occurring at a greater frequency than with open revascularization but with lower mortality and morbidity rates on average.

CASE REPORT

The patient was a 62-year-old man with a history of tobacco use (one pack per day for 45 years), coronary artery disease with myocardial infarction and a coronary bypass in 2003, symptomatic peripheral vascular disease, and CMI, who initially underwent SMA and CA stenting with monorail 5- X 19-mm Express SD stents (Boston Scientific Corporation, Natick, MA) in November 2005. The patient had rapid recurrent symptoms by January 2006. He underwent repeat angiography in March 2006 that showed an occluded CA stent and SMA in-stent restenosis (Figure 1). He underwent temporizing repeat stenting of the SMA with two overlapping 6- X 14-mm Express SD stents (Figure 2).

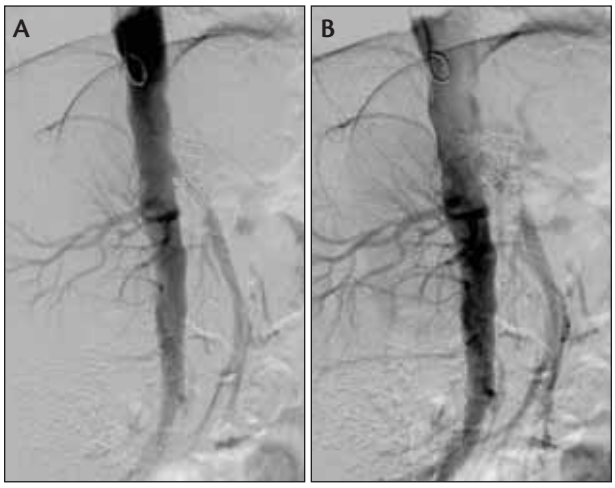

Figure 1. Angiogram 5 months after initial CA and SMA stent placement shows CA occlusion and severe SMA in-stent restenosis (A). Delayed image shows collaterals from the pancreaticoduodenal arteries reconstituting the CA (B).

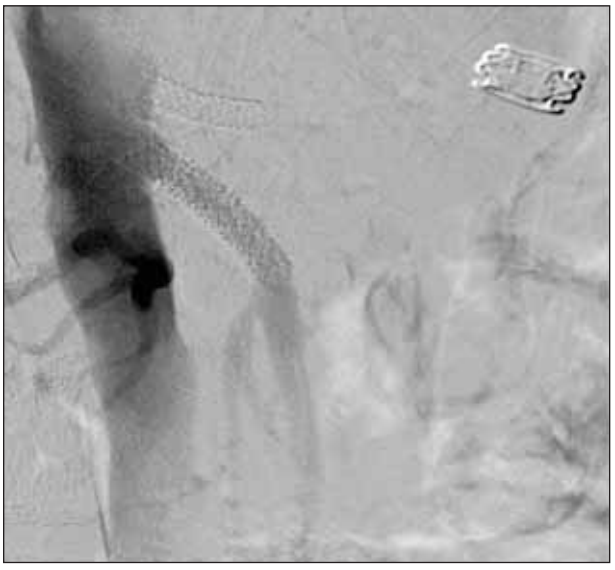

Figure 2. Temporizing stenting of the SMA before polytetrafluoroethylene (PTFE) bypass.

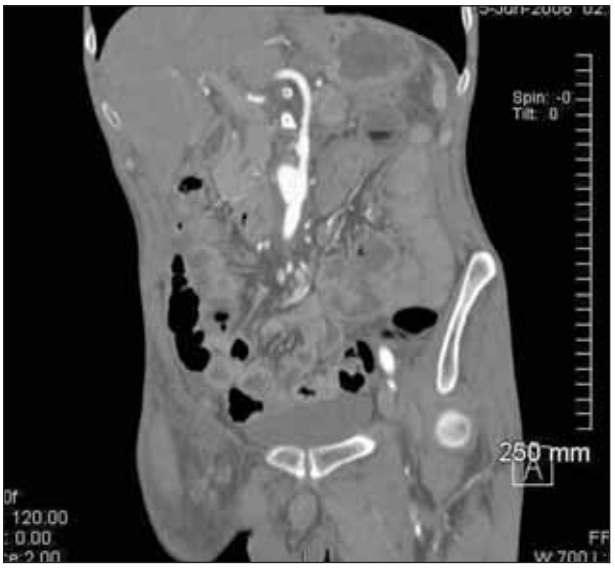

Figure 3. Patent retrograde bypass extending from aortobifemoral bypass sequentially to the SMA and common hepatic artery in June 2006. Note the occluded SMA and CA stents.

We further performed aortobifemoral bypass and retrograde synthetic sequential mesenteric bypass to the SMA and common hepatic artery in June 2006 (Figure 3). At the time of surgery, it was noted that there was solid, hard intimal hyperplasia in the SMA stent, which was crimped and occluded with a clip. In February 2007, the patient presented with an acute abdomen and was found to have an occlusion in his mesenteric bypass (Figure 4). The bypass was treated with endovascular thrombolysis, and the patient underwent exploratory laparotomy, with all bowel noted to be viable. Four days later, the patient underwent antegrade vein bypass to the SMA, with the belief that this may provide better patency in this special case.

The patient did well for 1 year but returned in March 2008 with an acute abdomen. On this admission, he underwent recanalization of the occluded CA via a left arm approach using the back end of a 0.014-inch Choice PT wire (Boston Scientific Corporation), which was supported by a 6.5-F H1 catheter and a 6-F Shuttle sheath (Cook Medical, Bloomington, IN) (Figure 5). The back end of the wire was curved, allowing for directional punctures within the solid intimal hyperplasia. When a "hole" into the patent lumen was identified, the hydrophilic front end of the Choice PT wire was advanced into the CA to allow for serial dilation. The CA was eventually revised using an iCast stent with a PTFE coating (Atrium Medical Corporation, Hudson, NH) over a TAD II wire (Covidien, Mansfield, MA) that was dilated to 7 mm with a 7- X 20-mm Dorado high-pressure balloon (Bard Peripheral Vascular, Inc., Tempe, AZ).

The patient has resumed tobacco use but has undergone routine follow-up until his last visit in March 2010, with the CA stent widely patent and without any stenosis (Figure 6).

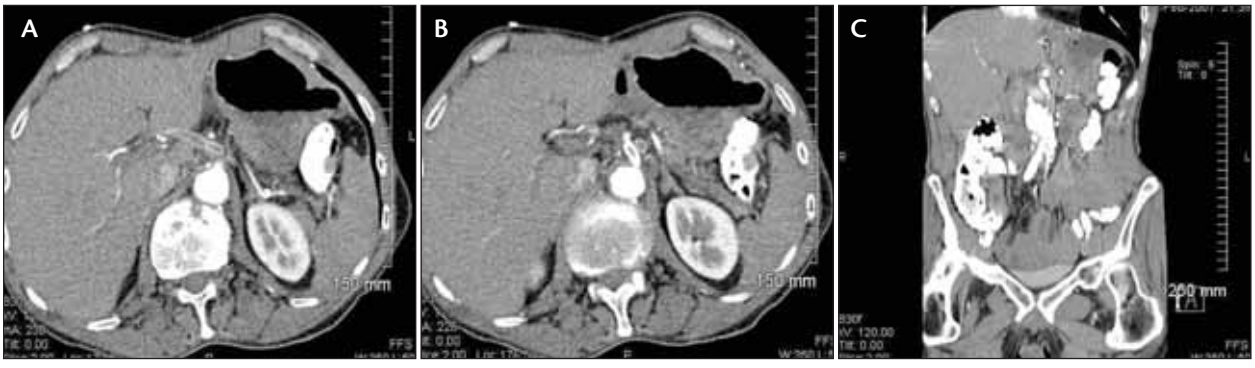

Figure 4. Occluded retrograde bypass in February 2007.

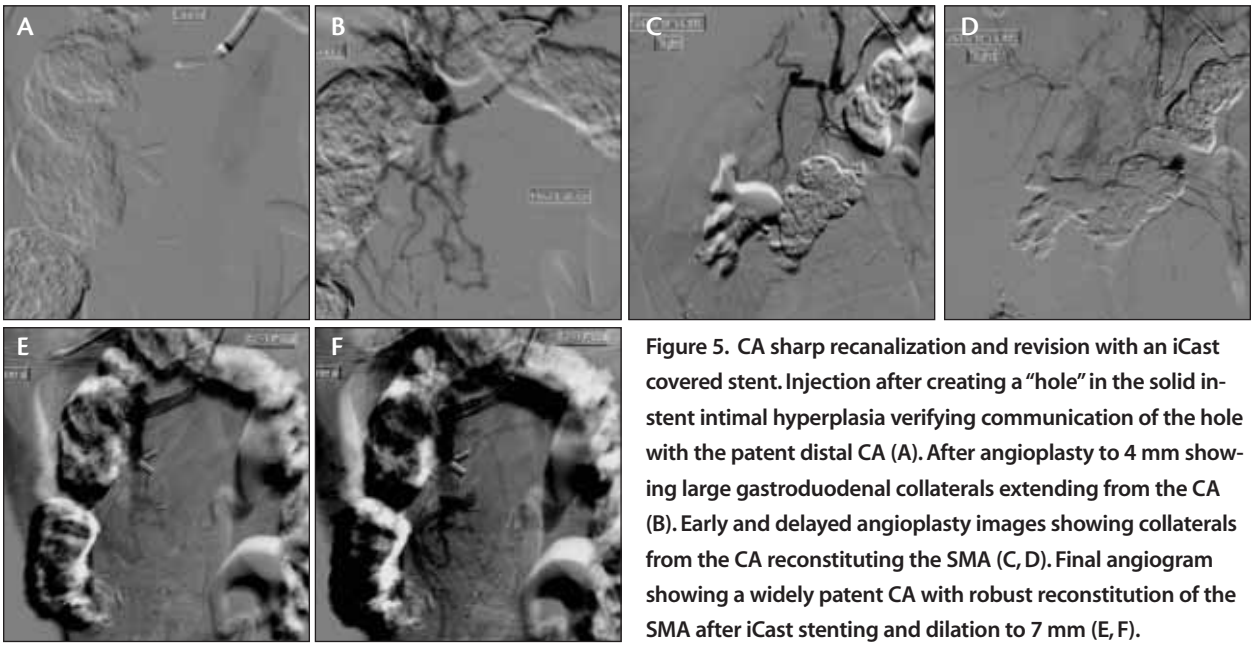

Figure 5. CA sharp recanalization and revision with an iCast covered stent. Injection after creating a "hole" in the solid in-stent intimal hyperplasia verifying communication of the hole with the patent distal CA (A). After angioplasty to 4 mm showing large gastroduodenal collaterals extending from the CA (B). Early and delayed angioplasty images showing collaterals from the CA reconstituting the SMA (C, D). Final angiogram showing a widely patent CA with robust reconstitution of the SMA after iCast stenting and dilation to 7 mm (E, F).

DISCUSSION

The feasibility and reasonable durability of percutaneous endovascular mesenteric intervention were established by Matsumoto et al along with other groups in the mid-1990s.[3,4] There was an initial surge in excitement during the era of stenting, and as the frequency of CMI increased and thresholds for treating CMI decreased, large reports from surgical groups mounted, and a significant recurrence rate was encountered.

An overview of 83 patients by Oderich et al showed a life-table analysis primary patency rate of approximately 50% for mesenteric stents, with a 5-year patency rate of open revascularization of 88%.[5] In 2009, Peck et al reported on 49 patients and found a life-table 3-year primary patency rate of 60% but with restenosis in 65% of patients who had radiographic follow-up within 8.5 months.[6] Sarac et al in 2008 showed a 69% 1-year primary patency rate.[7] Earlier data from Brown et al showed that 53% of patients required reintervention within 13 months.[8]

In mesenteric intervention, long-term relief from significant stenosis is crucial because loss of patency may result in occlusion and lethal consequences. Additionally, abdominal symptoms are varied and may not be the best indicator of impending stent occlusion. Complicating the clinical picture is the fact that despite binary restenosis, adequate perfusion of the bowel may remain, rendering the patient asymptomatic. However, progression of stenosis is common in both de novo and stented lesions. A retrospective review by Oderich et al of more than 100 patients treated with mesenteric stenting concluded that approximately half of the stents had recurrent stenosis, and half of these recurrences rendered patients symptomatic during the course of 3 years.[9]

In another series that advocates endovascular intervention first, two out of 51 patients (4%) were lost to follow-up and died from acute mesenteric ischemia. An additional 14% required open bypass. However, the 2-year primary clinical success rate was 56%.[10] A natural history study of "asymptomatic" multiple mesenteric stenoses showed that during a course of 6 years, 86% of patients with significant stenoses progressed to acute mesenteric ischemia.[11]

Long-term primary patency of mesenteric grafts has been demonstrated in the past, with a 50% patency rate at 10 years based on a 37-year experience by Cho et al.[12] The durability of antegrade synthetic mesenteric bypass has been established, with a 5-year primary patency rate of 69%.[13] Additionally, complete open surgical mesenteric revascularization resulted in better long-term patient outcomes compared to incomplete revascularization.[14] More recent surgical series' results of open revascularization are exemplified by Kruger's group of 39 patients treated with open revascularization.[15] This series, which is similar to a large, modern institution series, showed a 5-year graft patency rate of 92% and a perioperative mortality rate of 2.5%. In this study, synthetic bypass was used approximately half the time, and multivessel grafting was used whenever feasible.

Most recently, Dahl et al reviewed their mesenteric stent series of 140 patients, making it the largest series of

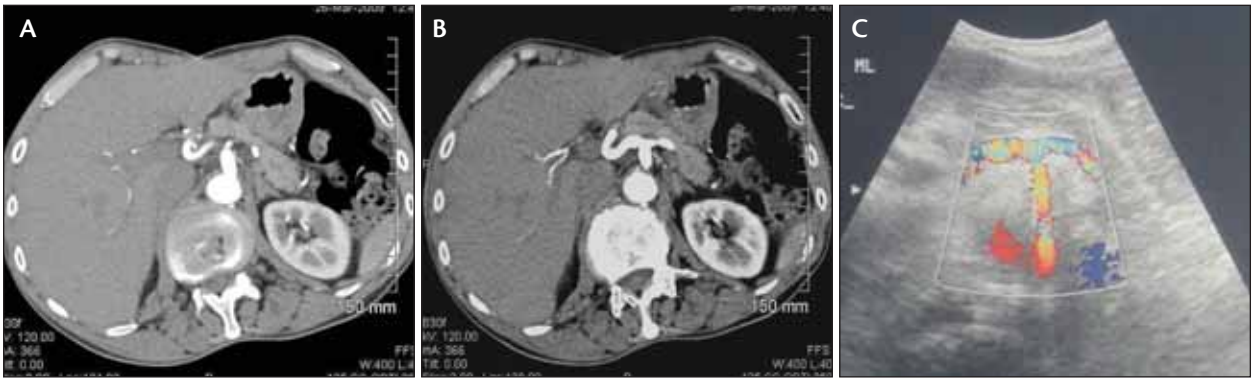

Figure 6. The recanalized CA with an iCast stent 1 year after the procedure (A, B). Duplex ultrasound 2 years after the procedure showing wide patency and stable velocities of 160 cm/s in the stent (stable velocities are also present in the hepatic artery, splenic artery, and SMA) (C).

mesenteric stents to date.[16] They showed a 55% 1-year patency rate for SMA stenting and a 17% primary patency rate for celiac stenting based on duplex scanning criteria. These statistics match our experience at the Savannah Vascular Institute. Theoretically, covered stenting mimics an antegrade synthetic bypass. One advantage of covered stenting is a shorter endovascular bypass; a disadvantage is the inability to spatulate the distal anastomosis. When placing mesenteric covered stents, one must be cognizant to avoid important proximal branches, which need to be identified first. The CA proximal branches are the left gastric and dorsal pancreatic, which can both be covered given robust collaterals. In the SMA, however, the first branch is the inferior pancreaticoduodenal artery, which is crucial for collateral communication with the CA. This artery must be preserved.

Based on this information, patients undergoing endovascular mesenteric revascularization at our institution undergo covered stent dilation of the SMA and CA to 7 mm or greater when feasible. Of the nearly 15 patients treated with this strategy at our institution, there have not been any stent graft occlusions or restenosis, with varied follow-up of 3 months to 3 years.

CONCLUSION

The extensive comorbidities of patients with CMI make endovascular options attractive. The poor durability of endovascular treatment has affected the role of endovascular stenting as a bridge or an option in the worst surgical candidates. As this case illustrates, PTFE-covered stenting in mesenteric revascularization likely approximates synthetic antegrade bypass. Complete CA and SMA revascularization with PTFE-covered stenting appears to be an excellent long-term option in many patients. However, several years of data are necessary to evaluate this option fully. ■

Larry Horesh, MD, is with the Savannah Vascular Institute in Savannah, Georgia. He has disclosed that he holds no financial interest in any product or manufacturer mentioned herein. Dr. Horesh may be reached at (912) 629-7800; lhoresh@yahoo.com.

1. Furrer J, Grüntzig A, Kugelmeier J, et al. Treatment of abdominal angina with percutaneous dilatation of an arteria mesenterica superior stenosis. Preliminary communication. Cardiovasc Intervent Radiol. 1980;3:43-44.
2. Saddekni S, Sniderman KW, Hilton S, et al. Percutaneous transluminal angioplasty of nonatherosclerotic lesions. AJR Am J Roentgenol. 1980;135:975-982.
3. Matsumoto AH, Tegtmeyer CJ, Fitzcharles EK, et al. Percutaneous transluminal angioplasty of visceral arterial stenoses: results and long-term clinical follow-up. J Vasc Interv Radiol. 1995;6:165-174.
4. Matsumoto AH, Angle JF, Spinosa DJ, et al. Percutaneous transluminal angioplasty and stenting in the treatment of chronic mesenteric ischemia: results and long-term follow-up. J Am Coll Surg. 2002;194(1 Suppl):S22-S31.
5. Oderich GS, Bower TC, Sullivan TM, et al. Open versus endovascular revascularization for chronic mesenteric ischemia: risk-stratified outcomes. J Vasc Surg. 2009;49:1472-1479.
6. Peck MA, Conrad MF, Kwolek CJ, et al. Intermediate-term outcomes of endovascular treatment for symptomatic chronic mesenteric ischemia. J Vasc Surg. 2010;51:140-147.
7. Sarac TP, Altinel O, Kashyap V, et al. Endovascular treatment of stenotic and occluded visceral arteries for chronic mesenteric ischemia. J Vasc Surg. 2008;47:485-491.
8. Brown DJ, Schermerhorn ML, Powell RJ, et al. Mesenteric stenting for chronic mesenteric ischemia. J Vasc Surg. 2005;42:268-274.
9. Oderich GS, Macedo TA, Malgor R, et al. Natural history of mesenteric artery stent restenoses and clinical and anatomic predictors for reintervention in patients with chronic mesenteric ischemia. J Vasc Surg. 2009;49(Suppl):S54.
10. Fioole B, van de Rest H, Meijer J, et al. Percutaneous transluminal angioplasty and stenting as first-choice treatment in patients with chronic mesenteric ischemia. J Vasc Surg. 2010;51:386-391.
11. Thomas JH, Blake K, Pierce GE, et al. The clinical course of asymptomatic mesenteric arterial stenosis. J Vasc Surg. 1998;27:840-844.
12. Cho JS, Carr JA, Shepard AD, et al. Long-term outcome after mesenteric artery reconstruction: a 37-year experience. J Vasc Surg. 2002;35:453-460.
13. Jimenez JG, Huber TS, Ozaki CK. et al. Durability of antegrade synthetic aortomesenteric bypass for chronic mesenteric ischemia. J Vasc Surg. 2002;35:1078-1084.
14. McAfee MK, Cherry KJ, Naessens JM, et al. Influence of complete revascularization on chronic mesenteric ischemia. Am J Surg. 1992;164:220-224.
15. Kruger AJ, Walker PJ, Foster WJ, et al. Open surgery for atherosclerotic chronic mesenteric ischemia. J Vasc Surg. 2007;46:941-945.
16. Dahl TJ, Stout CL,Veale WN, et al. Our experience with 140 visceral artery stents: should celiac artery stenting be abandoned? J Vasc Surg. 2010;51:1071.