Endovascular recanalization of occluded superior mesenteric artery using retrograde access through the inferior mesenteric artery

Eduardo Keller Saadi, MD,[a] Gustavo Oderich, MD,[b] Eduardo Medronha, MD,[a] Rodrigo Petersen Saadi,[a] Marina Petersen Saadi,[a] *and* Cristiano Jaegger, MD,[a] *Porto Alegre, RS, Brazil; and Rochester, Minn*

ABSTRACT

Symptomatic occlusion of the superior mesenteric artery can be treated by open repair, hybrid procedure, or endovascular revascularization. In most cases, endovascular procedures are done by the antegrade approach. We report a case of a 67-year-old woman who presented with acute-on-chronic mesenteric ischemia successfully treated by retrograde endovascular recanalization of an occluded common hepatomesenteric trunk through the inferior mesenteric artery and arc of Riolan. (J Vasc Surg Cases and Innovative Techniques 2017;3:155-8.)

The two major causes of acute mesenteric arterial occlusion are embolism and thrombosis. Mesenteric arterial thrombosis typically results from in situ, acute-on-chronic occlusion of an atherosclerotic ostial lesion or chronic progression of near-occlusive lesions due to atherosclerotic plaque disruption. Regardless of the pathophysiologic mechanism, the patient presents with acute-on-chronic ischemia, and thrombosis usually occurs at the origin of the vessel.[1] The diagnosis depends on a high level of clinical suspicion. Rapid detection and early treatment are essential to prevent intestinal infarction and its systemic complications. Definitive diagnosis relies on imaging studies, such as computed tomography and conventional angiography.

Recent reports indicate that endovascular intervention may be as effective as open surgical approaches.[1-4] Endovascular options for patients with total mesenteric arterial occlusion include pharmacologic or mechanical thrombectomy and balloon angioplasty with arterial stent placement. The latter can be performed by antegrade arterial access (from the brachial or femoral approach) or, alternatively, a hybrid, retrograde open mesenteric stent (ROMS) technique.[1] We describe a novel technique in a patient with flush occlusion of a rare variant anatomy (common hepatomesenteric trunk) who underwent endovascular treatment with angioplasty and stenting by the retrograde approach through collateral networks from the inferior mesenteric artery (IMA). The patient provided written informed consent for publication of this report, which was approved by the Ethics and Research Committee of Hospital Mãe de Deus.

CASE REPORT

A 67-year-old woman with a long-standing history of postprandial abdominal pain and food fear presented with acute, severe epigastric pain radiating to the precordium. Her medical history was notable for hypertension and hypothyroidism. The patient was evaluated for acute coronary syndrome; the results included a normal electrocardiogram without ST elevation, normal troponin levels, a Thrombolysis in Myocardial Infarction (TIMI) risk score of 2 (low risk), and CRUSADE bleeding score with moderate risk. Coronary angiography showed mild stenosis in the circumflex artery. Computed tomography angiography (CTA) of the aorta and its branches demonstrated flush occlusion of the superior mesenteric artery (SMA) and celiac trunk. There was a patent IMA with large meandering artery (arc of Riolan) that provided collateral flow to the SMA and celiac trunk.

The patient was treated by a percutaneous endovascular approach in a hybrid room using local anesthesia with sedation. Aortography confirmed total occlusion of the common hepatomesenteric trunk (SMA with large replaced hepatic artery) with no evidence of a proximal stump. Selective IMA angiography showed a large arc of Riolan with retrograde filling of the common hepatomesenteric trunk (Fig 1). Angiography also demonstrated a separate occluded trunk that gave origin to a left gastric and splenic artery (gastrosplenic trunk).

TECHNIQUE

Bilateral transfemoral percutaneous access was used with 6F sheaths for aortography. The patient was systemically heparinized with 1 mg/kg of intravenously administered heparin. Selective SMA and IMA angiography was performed using a 5F Mikaelson catheter (Cook Medical, Bloomington, Ind). Initially, we attempted to access the SMA by antegrade catheterization from the right femoral approach. However, we were not able to successfully cross

From the Hospital Mãe de Deus, Porto Alegre, RS[a]; and the Division of Vascular and Endovascular Surgery, Mayo Clinic, Rochester.[b]

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Correspondence: Eduardo Keller Saadi, MD, Hospital Mãe de Deus, Rua Pedro Weingartner, 125/801, Porto Alegre, RS 90430-140, Brazil (e-mail: esaadi@terra.com.br).

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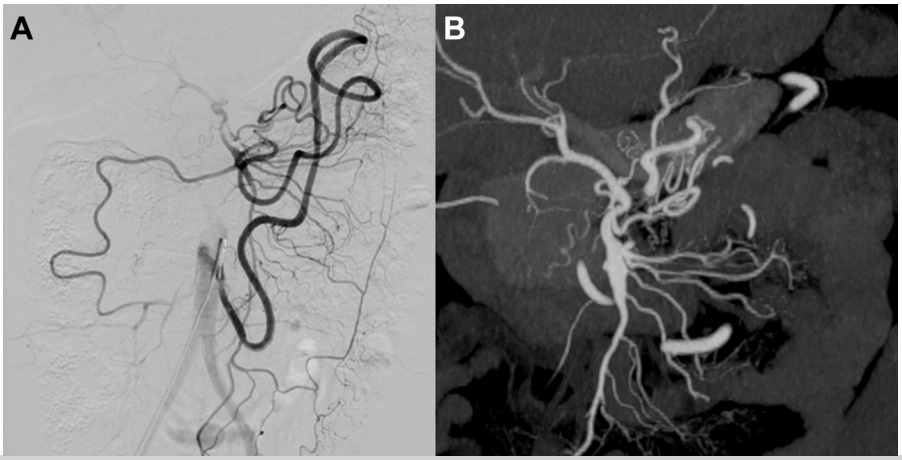

Fig 1. A, Inferior mesenteric artery (IMA) angiography showed a large arc of Riolan with retrograde filling of the common hepatomesenteric trunk. **B,** Computed tomography angiography (CTA) also demonstrated a separate occluded trunk that gave origin to a left gastric and splenic artery.

Fig 2. The 0.014-inch guidewire was crossed retrogradely into the aorta by the Riolan arc and was snared through the contralateral right femoral sheath.

the lesion. Using the left femoral approach, the IMA was selectively catheterized with a 5F, 65-cm Radifocus Glidecath (Terumo, Somerset, NJ). A coaxial technique was used with 3F Rebar microcatheter (Medtronic Covidien, Minneapolis, Minn) and 0.014-inch X-Celerator 300-cm guidewire (Medtronic Covidien) to cross the arc of Riolan and the occluded SMA in retrograde fashion. The guidewire was advanced into the aorta and was snared through the contralateral right femoral sheath (Fig 2). Once through-and-through access was established, the occluded SMA was predilated using a 3 × 20-mm balloon through the right femoral approach, followed by placement of a 7- × 19-mm balloon-expandable bare-metal stent (Dynamic; Biotronik, Berlin, Germany). Completion angiography showed widely patent SMA and replaced hepatic artery with no evidence of residual stenosis and excellent antegrade flow with normal opacification of jejunal branches (Fig 3, *A*). The patient had complete resolution of symptoms with no complications and was discharged home 48 hours later. The patient was closely monitored for changes in physical findings and had no clinical or imaging evidence of ongoing bowel ischemia after the procedure. Therefore, we elected not to perform laparoscopic or open abdominal exploration.[1,2,5] Dual antiplatelet therapy with clopidogrel and aspirin was used for 6 months, after which aspirin was used indefinitely. Follow-up CTA was performed 2 months after the procedure and demonstrated a widely patent stent with no evidence of restenosis (Fig 3, *B*). The patient was advised to continue with follow-up surveillance by duplex mesenteric ultrasound every 6 months in the first year and annually thereafter. CTA would be obtained if there were recurrent symptoms or evidence of flow-limiting restenosis by duplex ultrasound.[1]

DISCUSSION

Endovascular therapy has surpassed open surgical reconstructions as the primary method to treat mesenteric artery disease in most patients.[1] Despite significant advances in medical care and endovascular treatment, acute mesenteric ischemia continues to be a challenging problem with high morbidity and mortality rates.[2,4,6] Whereas open revascularization is a durable procedure, there is high risk of morbidity (15%-47%) and mortality (17%).[7-11] In patients with acute mesenteric ischemia, mortality rates are even higher, reaching up to 60% in contemporary reports.[12-14] The case herein

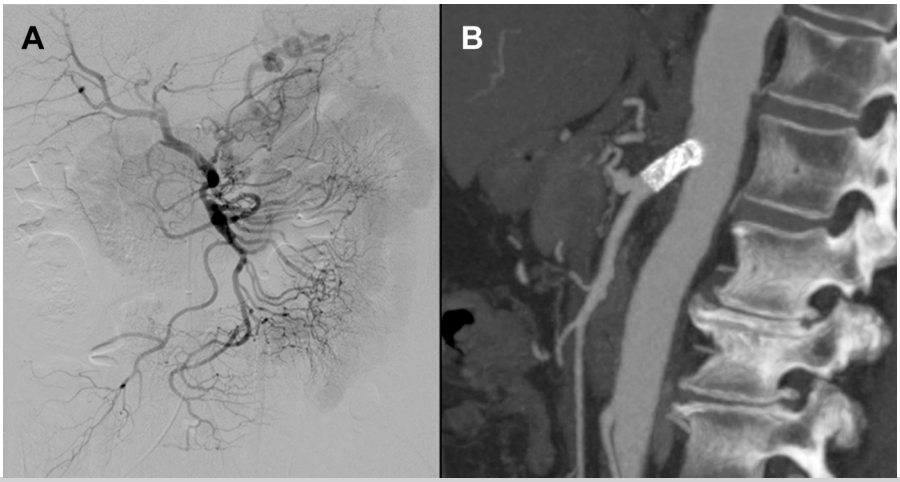

Fig 3. A, Completion angiography showed widely patent superior mesenteric artery (SMA) and replaced hepatic artery with no residual stenosis and excellent antegrade flow with normal opacification of jejunal branches. **B,** Control computed tomography angiography (CTA) demonstrated widely patent stent with no evidence of stenosis.

described illustrates a subacute presentation that was initially investigated as an acute coronary syndrome. The patient also had an anatomic variation with a large replaced hepatic artery originating from the SMA (hepatomesenteric trunk) and a gastrosplenic trunk. This anomaly is reported in only 0.4% of the population.[15-17]

Percutaneous treatment of SMA occlusions in patients with mesenteric ischemia is an alternative to open surgical revascularization.[10,18,19] In most cases, an antegrade approach is obtained through brachial or radial access. Advantages of this approach include better angle for vessel catheterization and greater guidewire support, which is often needed with chronic organized occlusions. Limitations of brachial access are the risks of access-related complications (eg, hemorrhage, pseudoaneurysm, and neurapraxia) and cerebral embolization. Endovascular recanalization can be a challenge if there is a flush occlusion where the vessel origin cannot be adequately identified by angiography. In these cases, the absence of a stump does not allow adequate advancement of a catheter and sheath to engage the occluded vessel. This is needed for adequate guidewire and catheter support to cross the lesion. In the case herein presented, the short lesion length was considered favorable for attempted endovascular recanalization by retrograde technique through collateral networks. Other cases with longer and calcified occlusions are more suitable to either open surgical repair or ROMS. This case is novel because of use of retrograde access through the arc of Riolan. This was done using a coaxial system with microcatheter to cross the lesion. In addition, flow was preserved into the replaced hepatic artery. Crossing of chronic occlusions through collateral networks such as the arc of Riolan can be difficult or impossible if there is significant calcification or organized thrombus. In these cases, a conventional antegrade endovascular technique or ROMS can be used.

The case reported also illustrates a rare anatomic variation with two separate occluded trunks: a common hepatomesenteric and another with the left gastric and splenic artery (gastrosplenic trunk). After a failed attempt to recanalize the SMA using the antegrade approach, we successfully accessed the SMA in retrograde fashion through the IMA with a microcatheter. Snaring of the wire was critical to provide enough support for advancement of a small balloon (3 $\times$ 20 mm) and a bare-metal stent (7 $\times$ 19 mm) through the occlusion. Another adjunctive technique reported in patients with acute mesenteric occlusions is local administration of tissue plasminogen activator.[1] Although this technique may be useful in patients with large thrombus burden, it can be associated with hemorrhagic or embolic complications, and its efficacy has not yet been determined. We elected not to use thrombolysis because of the relatively short length of occlusion.

Oderich et al demonstrated that covered stents are associated with less restenosis and fewer recurrences and reinterventions in patients treated for chronic mesenteric ischemia.[7] However, these are avoided in lesions crossing large branches, and in this case selection of a bare-metal stent was ideal to avoid encroaching on the large replaced hepatic artery. Because the patient had a previous history of mesenteric angina and now presented with acute symptoms, it is possible that an occlusion occurred in an atherosclerotic plaque. Open surgery and a hybrid procedure with distal puncture of the SMA would have been alternative treatments. The rare anatomic variation of the occluded origin of the SMA

as a single trunk with the hepatic artery (hepatomesenteric trunk) was not identified by preoperative angiotomography, which represented one more challenge for this patient.

CONCLUSIONS

This case illustrates a novel approach to endovascular recanalization of SMA occlusion using retrograde IMA collaterals and a coaxial system to cross the lesion. Although the technique may be limited in patients who have calcified chronic occlusions, it should be used selectively in patients with flush subacute occlusions suitable to crossing with a microwire system.

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