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CLINICAL CASE REPORT

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Case Report of Percutaneous Retrograde Transcollateral Recanalization of the Superior Mesenteric Artery via the Celiac Artery for Acute Mesenteric Ischemia

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Abstract: Revascularization for acute mesenteric ischemia (AMI) can be achieved through a bypass from the aorta or iliac arteries, embolectomy, open exposure of SMA and retrograde recanalization and stent, or percutaneous antegrade stenting. Flush occlusion of the SMA can make antegrade recanalization very challenging and is usually unsuccessful.

We present a novel approach for recanalization of superior mesenteric artery (SMA) via the celiac artery for acute mesenteric ischemia. A 69-year-old lady with previous endarterectomy of SMA and extensive small bowel resection presented with severe abdominal pain, emesis, leukocytosis, and imaging finding of new SMA flush occlusion. She refused to consent for a laparotomy. Percutaneous retrograde transcollateral recanalization of SMA was performed via the celiac artery through the pancreaticoduodenal arcade, and the SMA then stented. This resulted in subsequent resolution of patient's symptoms and discharge.

SMA revascularization with retrograde transcollateral wiring technique is an important tool in the armamentarium of the vascular care specialist when antegrade percutaneous approach and open exposure via laparotomy are not an option.

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Abbreviations: AMI = acute mesenteric ischemia, CA = celiac artery, Fr = French, GDA = gastroduodenal artery, SMA = superior mesenteric artery, WBC = White blood cell.

INTRODUCTION

Treatment for acute mesenteric ischemia (AMI) traditionally involves exploratory laparotomy to assess bowel viability and revascularization of visceral arteries, usually the superior mesenteric artery (SMA). Revascularization can be achieved through a bypass from the aorta or iliac arteries, embolectomy, open exposure of SMA and retrograde recanalization and stent, or percutaneous antegrade stenting via a femoral or brachial approach. In patients without clinical evidence of acute bowel ischemia, percutaneous antegrade stenting of the SMA is preferred as is the least invasive. Flush occlusion of the SMA, however, can make antegrade recanalization very challenging and is usually unsuccessful.

Transcollateral recanalization of occluded vessels has been previously described for lower extremity disease with good outcomes. Urasawa et al[1] have described retrograde recanalization of superficial femoral artery using profunda femoris collaterals, whereas successful transcollateral recanalization of chronically occluded tibial arteries has also been demonstrated.[2] There have been a few reports of totally endovascular transcollateral recanalization of SMA in cases of chronic mesenteric ischemia[3–5] and also open laparotomy with retrograde SMA stenting;[6] however, totally endovascular retrograde transcollateral recanalization of SMA via the celiac artery (CA) has not been described in AMI.

We report a case of AMI with flush occlusion of the SMA and hostile abdomen, who underwent totally endovascular retrograde recanalization of the SMA via the CA through the gastroduodenal artery (GDA) and pancreaticoduodenal arcade.

CASE REPORT

A 69-year lady with a past medical history of hypertension, hyperlipidemia had 4 months prior presented with acute onset of diffuse abdominal pain with peritonitis, and an elevated lactate and white blood cell (WBC) count. We performed an exploratory laparotomy, SMA exploration with direct repair of dissection flap and thrombectomy, bovine pericardium patch angioplasty, and extensive small bowel resection. Her bowel was ultimately put in continuity with 160 cm length of small bowel left. An angiogram was performed before discharge which showed no flow limiting stenosis in the proximal SMA. She was discharged to rehab where she was recovering with anticoagulation therapy using warfarin which was started for the SMA dissection.

She now presented with severe abdominal pain, nausea, vomiting, and diarrhea of 4 h duration. Computed tomographic scan of the abdomen without contrast at an outside hospital showed small bowel with wall thickening. Magnetic resonance angiography at the outside hospital showed occlusion of the SMA. She was subsequently transferred to our hospital. On examination, her abdomen was tender and she had a WBC count of 20,000. There were no obvious peritoneal signs. Despite a lengthy conversation, she refused to consent for an open exploratory laparotomy to allow for examination of the bowel. Further bowel resection, if needed, would have made her dependent on total parenteral nutrition, and she preferred palliative care over laparotomy and possible bowel resection. She would only consent to a less invasive procedure and thus, we decided to attempt endovascular recanalization of the SMA.

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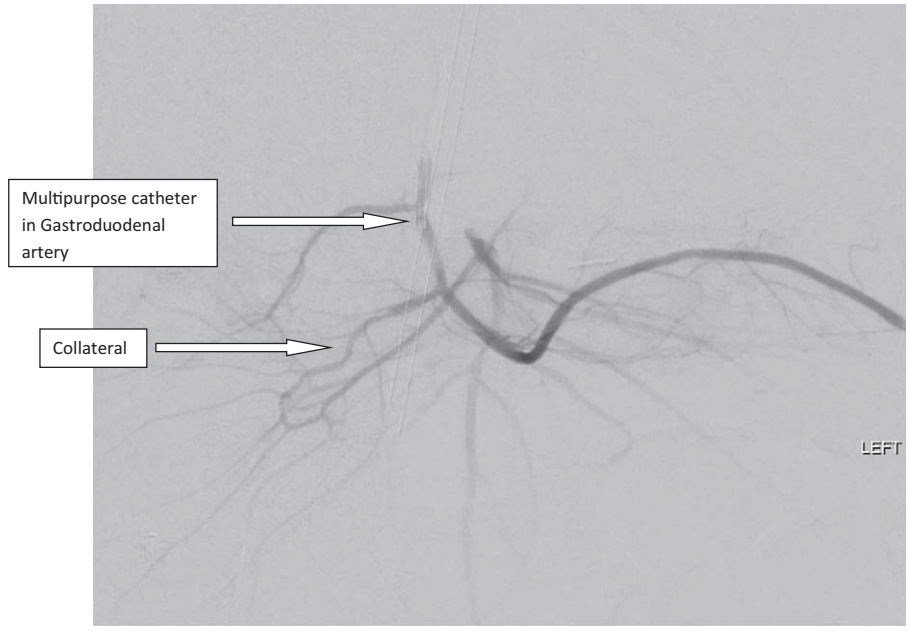

FIGURE 1. Selective angiogram through gastroduodenal artery demonstrating pancreaticoduodenal arcade and distal SMA. SMA = superior mesenteric artery.

In the operating room, the left brachial artery was used for access due to the steep angulation of the SMA. A 5-fr sheath was placed percutaneously using the Seldinger technique. The descending thoracic aorta was selected and abdominal aortogram obtained using a 5-fr pigtail catheter (Merit Medical Systems, South Jordan, UT). The SMA was seen to be flush occluded. Attempts at antegrade recanalization of SMA were unsuccessful. We then selected the CA and then the GDA using an advantage glidewire (Terumo, Tokyo, Japan) and 5-fr multipurpose catheter (Cordis, Miami Lakes, FL). Selective angiogram (Figure 1) revealed the pancreaticoduodenal arcade with filling of the SMA. Using Choice PT (Boston Scientific, Heredia, Costa Rica) and Traverse (Abbott Vascular, Santa Clara, CA) 0.014 wires and Progreat (Terumo, Tokyo, Japan) microcatheter, the SMA was selected and crossed, thus entering the aorta (Figure 2).

A 7-fr sheath was placed percutaneously in the right brachial artery. The traverse wire was then snared using an Amplatz Gooseneck snare (EV3, Plymouth, MN) and brought out through the 7-fr sheath. A left brachial artery–aorta–CA–collateral–SMA–aorta–right brachial artery loop was thus created. The snare catheter was then advanced into the SMA and selective SMA angiogram taken (Figure 3A) revealing a short segment lesion at the origin of the SMA without any flow limiting lesion distally. The Advantage Glidewire was then advanced through the catheter antegrade into the SMA. A 6 × 38 mm ICAST (Atrium Medical, Hudson, NH) balloon-expandable covered stent was then deployed at the SMA origin and then postdilated using a 7−mm balloon. Completion angiogram showed widely open SMA with normal filling of its branches (Figure 3B). Given patient's INR was >2, the brachial sheaths were sutured in place and removed in a few hours after INR reversal by holding manual pressure. She was placed on clopidogrel. The postoperative course was uneventful. The abdominal pain and WBC count improved within a few days and the patient was successfully discharged back to rehab on general diet.

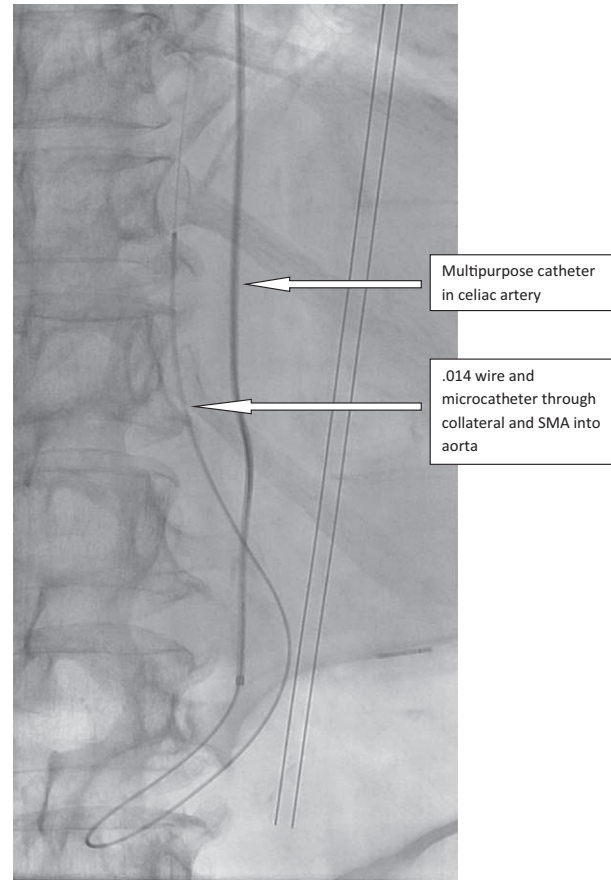

FIGURE 2. Recanalization of SMA through celiac artery with microcatheter and 0.014 wire through the multipurpose catheter. SMA = superior mesenteric artery.

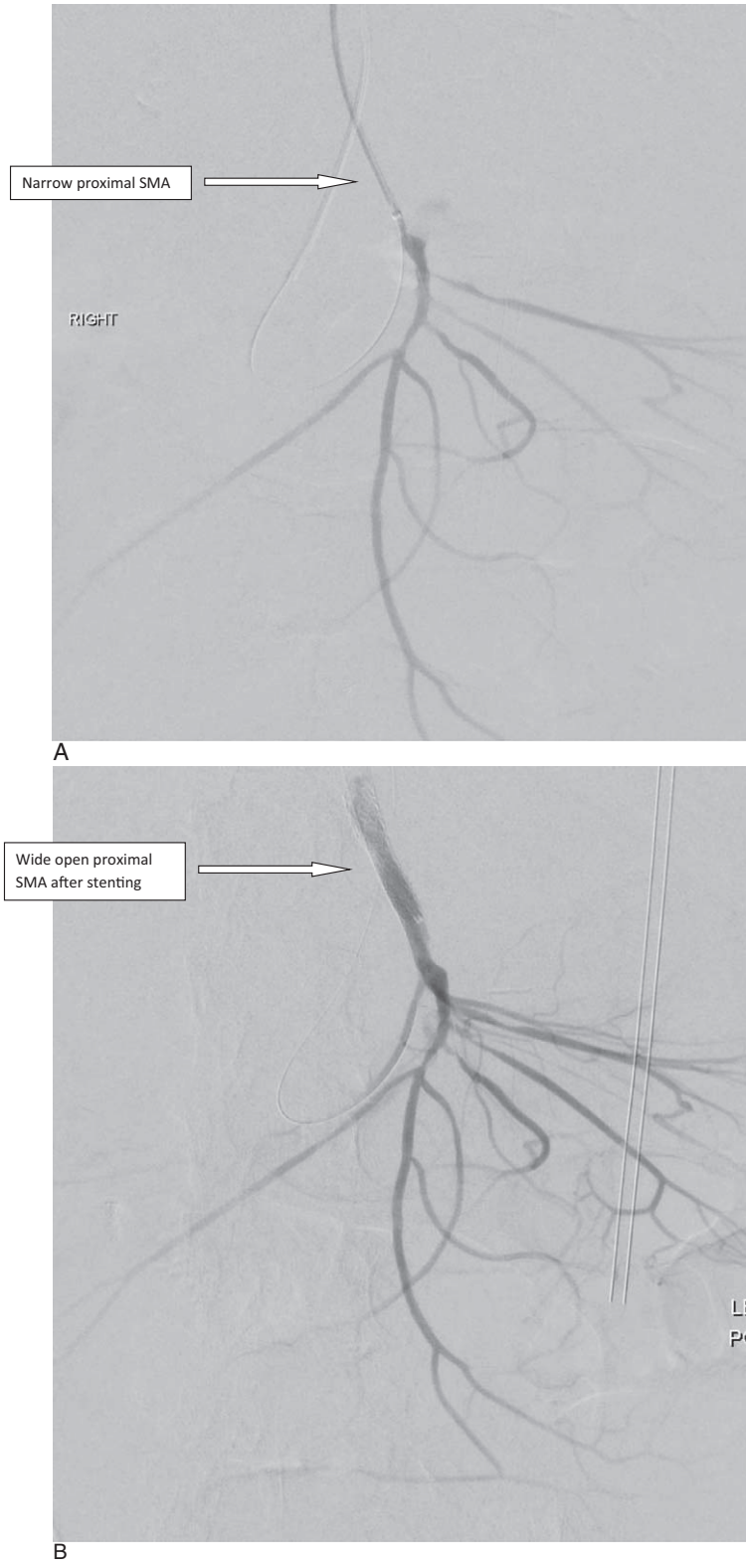

FIGURE 3. (A) Antegrade catheterization of SMA over the celiac through-and-through wire with pre-SMA intervention angiogram. (B) Completion angiogram of SMA after deploying proximal covered stent. SMA = superior mesenteric artery.

Three and 6-month follow-ups in clinic revealed patient to be doing well and gaining weight. Mesenteric duplexes revealed the stent to be patent with normal velocities. Patient consent was obtained for the purpose of this report.

DISCUSSION

Most cases of AMI undergo exploratory laparotomy with concomitant visceral artery revascularization. Our patient had 4 months prior undergone bowel resection and SMA endarterectomy with patch angioplasty with subsequent resolution of symptoms, but now presented a second time with AMI. Given she did not want a potential bowel resection, and a flush SMA occlusion which we could not cross antegrade, we resorted to trying to cross the SMA in a retrograde fashion using the transcollateral wiring technique.[1,2]

Use of this technique requires one to be facile with use of microcatheters. Placing the support multipurpose catheter in the GDA gave us enough purchase to use a microcatheter. We prefer the progreat microcatheter due to its flexible tip, low profile, hydrophilic coating, and use of tungsten coil for kink resistance. After reentry into the aorta and snaring of the wire, a through and through wire access across both brachial arteries was established. It is important that subsequent pulling of this wire be smooth or inside the microcatheter, else a ''cheese cutting'' effect could be created at the pancreaticoduodenal arcade. This also protects against dissection of the arcade vessels.

Once we obtained antegrade SMA access, we decided not to balloon the SMA origin. Due to the ease with which our wire passed retrograde, we were worried that there was thrombus present along with a stenosis and this was the cause for the occlusion. Ballooning this might have showered the clot. Thus, we directly placed an ICAST balloon-expandable covered stent which opens from the ends to the middle thus limiting a clot shower. Appropriate gantry angles are a must to make sure that there is enough stent projection into the abdominal aorta. We preferred brachial access over femoral access in this case due to the steep angle of the SMA which would have made passing the relatively stiff ICAST stent difficult from the groin.

Given our worry that there was potentially thrombus present, thrombolysis and percutaneous aspiration are potential therapeutic options. Thrombolysis was not performed as it takes time and patient's symptoms were more acute, needing acute mesenteric revascularization. Percutaneous aspiration could definitely have been performed. This usually necessitates losing wire access to the vessel to do the aspiration using a catheter which is pulled back across the thrombus. Given how hard it was to cannulate the SMA initially and we had to go through the celiac artery, we did not think it was prudent to do percutaneous aspiration and lose access to the SMA.

We have increasingly started to use covered stents rather than bare metal stents (BMS) in the mesenteric vessels, especially if concerned about thrombus. Although these potentially require larger sheaths, limited reports in literature demonstrate much better long-term patency with covered stents versus bare metal stents (92% 3-year primary patency with covered stents vs 52% with BMS by Oderich et al).[7]

In conclusion, although unconventional, SMA revascularization with retrograde transcollateral wiring technique is an important tool in the armamentarium of the vascular care specialist when antegrade percutaneous approach and open exposure via laparotomy are not an option.

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