Successful surgical management of a suspected high-flow inferior mesenteric artery aneurysm in a patient with chronic celiac and superior mesenteric artery occlusions

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ABSTRACT

Inferior mesenteric artery (IMA) aneurysms account for approximately 1% of visceral artery aneurysms and can occur secondary to high flow because of occlusive disease in other mesenteric arteries. We describe the case of a 79-year-old man who presented with a 3.3-cm IMA aneurysm and chronic total occlusions of the celiac artery and superior mesenteric artery (SMA). After an unsuccessful attempt at endovascular SMA recanalization, he underwent an uncomplicated retrograde aorta to SMA bypass and antegrade aorta to IMA bypass. We propose that an aorta to IMA bypass after SMA revascularization is safe and effective to treat suspected high-flow IMA aneurysms. (J Vasc Surg Cases Innov Tech 2024;10:101438.)

Keywords: Celiac artery; Chronic mesenteric ischemia; Inferior mesenteric artery; Superior mesenteric artery; Visceral artery aneurysm

Visceral artery aneurysms, including those of the celiac artery, superior mesenteric artery (SMA), and inferior mesenteric artery (IMA), are rare (estimated incidence, 1-2 in 10,000 persons).[1] IMA aneurysms are exceedingly rare and thought to account for approximately 1% of these aneurysms.[2] They can result from degenerative or inflammatory causes, fibromuscular dysplasia, collagen vascular diseases, and inherited disorders.[3] Another proposed etiology is occlusive disease in other mesenteric arteries.[4-6] This can lead to increased IMA flow, flow turbulence, arterial wall stress, progressive arterial dilatation, and aneurysm formation.[4,7]

We describe the case of a 79-year-old man who presented with a 3.3-cm IMA aneurysm in the setting of chronic total occlusions (CTOs) of the celiac artery and SMA. After an unsuccessful attempt at endovascular SMA recanalization, he underwent an uncomplicated retrograde aorta to SMA bypass and antegrade aorta to IMA bypass. We believe our case has important implications for the etiology and method of repair of these aneurysms. The patient provided written informed consent for the report of his case details and associated clinical and intraoperative images.

CASE REPORT

Reporting. The case is reported in accordance with the CARE (case report) guidelines. The completed CARE checklist is provided in Appendix 1 (online only).

Case. A 79-year-old man with a family history of a paternal abdominal aortic aneurysm (AAA) underwent a screening AAA ultrasound, which reported the finding of a saccular distal AAA measuring 3.2 cm. He had a history of hypertension, myocardial infarction, and prostate cancer. He was a lifelong nonsmoker.

The patient was referred to a vascular surgeon and underwent an abdominopelvic computed tomography angiogram. The computed tomography angiogram demonstrated atherosclerotic CTOs of the celiac artery and SMA (Fig 1). These were also present on a computed tomography scan performed 17 years prior (IMA maximum diameter in 2006, 6.5 mm). There were also now innumerable "corkscrew" collaterals between the occluded celiac artery and SMA. No saccular distal AAA, as revealed by the ultrasound scan, was present. However, a new 3.3-cm IMA aneurysm was seen (Fig 2). The arc of Riolan, which measured 8 mm in diameter, collateralized with the distal SMA. The patient had no associated symptoms. The findings from his abdominal examination and laboratory analyses were unremarkable.

We recommended repair of the IMA aneurysm. Endovascular stent grafting was not possible due to an inadequate proximal sealing zone (Fig 2). Because the IMA aneurysm was suspected to result from longstanding high flow, we attempted preoperative endovascular SMA recanalization. The right common femoral artery was accessed retrograde, and a 6.5F steerable sheath was used in an attempt to engage the SMA ostium antegrade.

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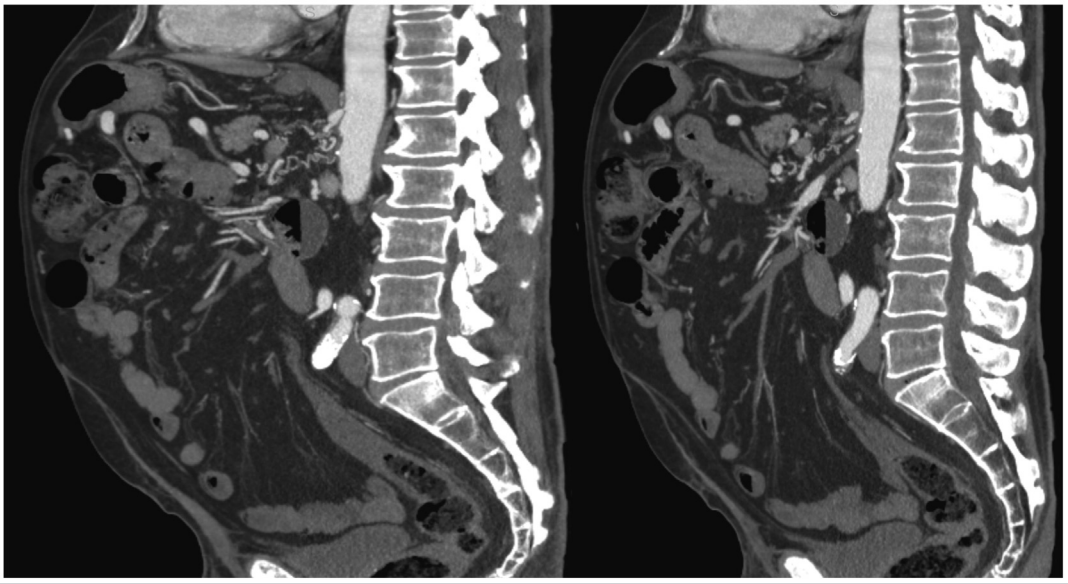

Fig 1. Computed tomography angiogram demonstrating the occluded celiac artery and associated corkscrew collaterals (**A**) and superior mesenteric artery (SMA; **B**).

Because this was unsuccessful, the sheath was advanced into the IMA. However, due to the tortuosity of the arc of Riolan, the SMA CTO also could not be crossed retrograde through the IMA (Fig 3).

The patient was, therefore, offered a concomitant retrograde aorta to SMA bypass and antegrade aorta to IMA bypass. The infrarenal aorta, arc of Riolan, IMA aneurysm, IMA beyond the aneurysm, and infrapancreatic SMA were exposed after laparotomy (Fig 4). Therapeutic intravenous heparin was administered (target activated clotting time, 300 seconds). The infrarenal aorta was clamped proximally and distally, and a bypass was performed from the infrarenal aorta to the infrapancreatic SMA using an 8-mm ringed heparin-bonded polytetrafluoroethylene (PTFE) graft tunneled anterior to the aorta in a C-configuration.

We subsequently used an 8-mm ringed heparin-bonded PTFE graft to perform an interposition bypass from the infrarenal aorta to the IMA beyond the aneurysm (Fig 5). The IMA origin was first excised back to normal-appearing aortic tissue, and the resultant aortotomy was used as the proximal anastomosis. PTFE was used to prevent graft kinking and because preoperative vein mapping demonstrated a size mismatch between the great saphenous vein and IMA (maximum great saphenous vein diameter, 4 mm; vs maximum IMA diameter, 8 mm).

The patient had strong pulses and Doppler arterial signals in the IMA and SMA distal to the bypass grafts. Heparin was reversed with protamine, the bypass grafts and aorta were covered with an omentoplasty, and the abdomen was closed. The patient was extubated and taken to the intensive care unit. The estimated blood loss was 1100 mL.

The patient had postoperative ileus for 3 days and then was discharged without complications on postoperative day 6 with prescriptions for aspirin 81 mg daily and rivaroxaban 2.5 mg twice daily. He had no symptoms suggestive of mesenteric ischemia at 2 months of follow-up. His 3-month duplex ultrasound study demonstrated patent bypass grafts (Appendixes 2 and 3, Online only).

DISCUSSION

We present a case of a 3.3-cm IMA aneurysm in a patient with longstanding CTOs of the celiac artery and SMA successfully repaired with a retrograde aorta to SMA bypass and antegrade aorta to IMA bypass. Although many patients with celiac artery and SMA CTOs will not develop IMA aneurysms, we hypothesize that this occurred in our patient because of the chronically increased IMA flow. Evidence of this included the large size of the IMA beyond the aneurysm (≥8 mm) and the extensive collateralization between the IMA and SMA through the arc of Riolan and other corkscrew, collateral vessels. Turbulent high flow can induce a "jet disorder phenomenon" that increases wall stress and the risk of aneurysmal dilatation.[4,8,9] This phenomenon has also been described in patients with aortoiliac occlusive disease.[8]

To the best our knowledge, no size threshold or other criteria have been suggested to indicate the necessity for IMA aneurysm repair. Despite this, nearly all reported cases have been repaired.[2] Reported open surgeries have included IMA resection alone,[10-13] IMA resection and concomitant IMA reimplantation,[6,8,14] SMA bypass,[15] IMA bypass,[16] and IMA and SMA bypass.[9] Reported endovascular repairs have included chimney graft repairs (when a concomitant infrarenal AAA also exists)[17] and coil embolization.[18,19] Repair is likely warranted for nearly all IMA aneurysms because IMA rupture has been

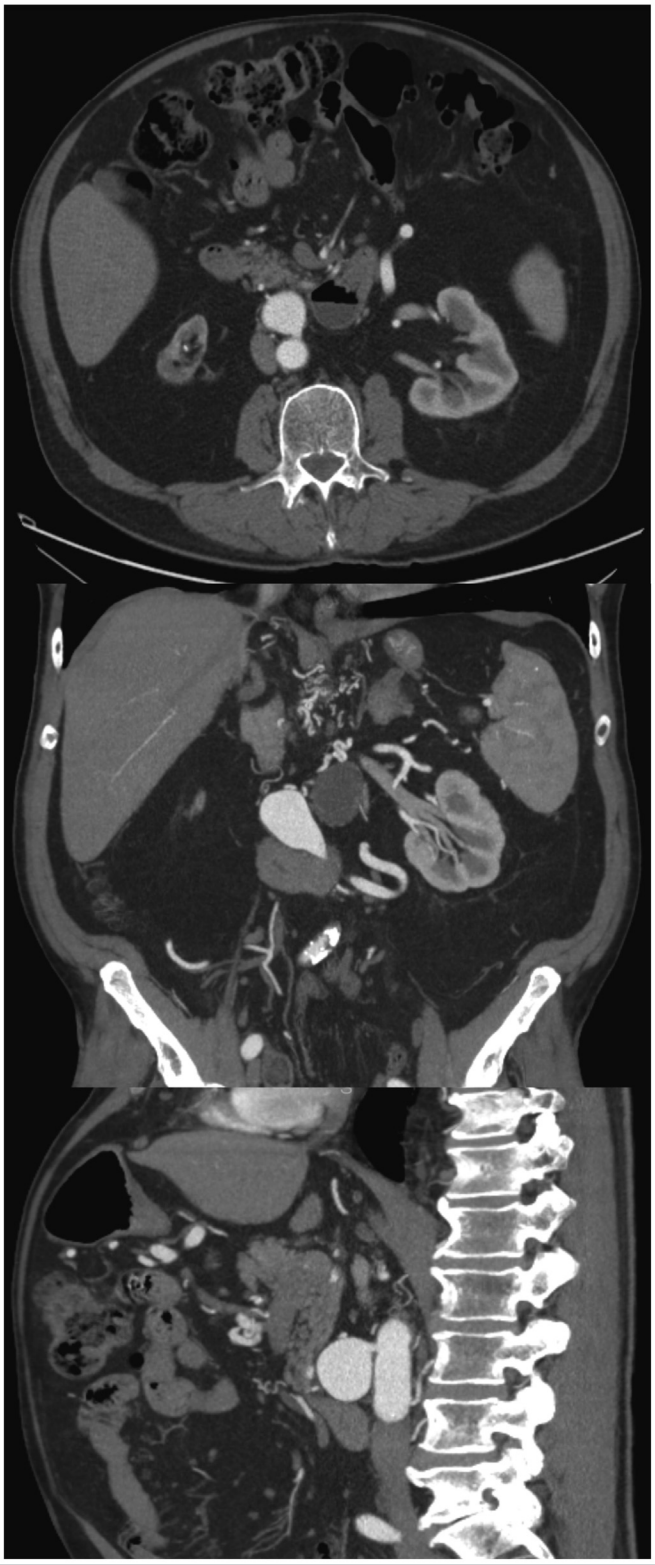

Fig 2. Axial (**A**), coronal (**B**), and sagittal (**C**) computed tomography angiography images demonstrating the inferior mesenteric artery aneurysm. The large arc of Riolan can be seen on the coronal image ascending to the superior mesenteric artery (SMA) distal to the SMA chronic total occlusion (CTO).

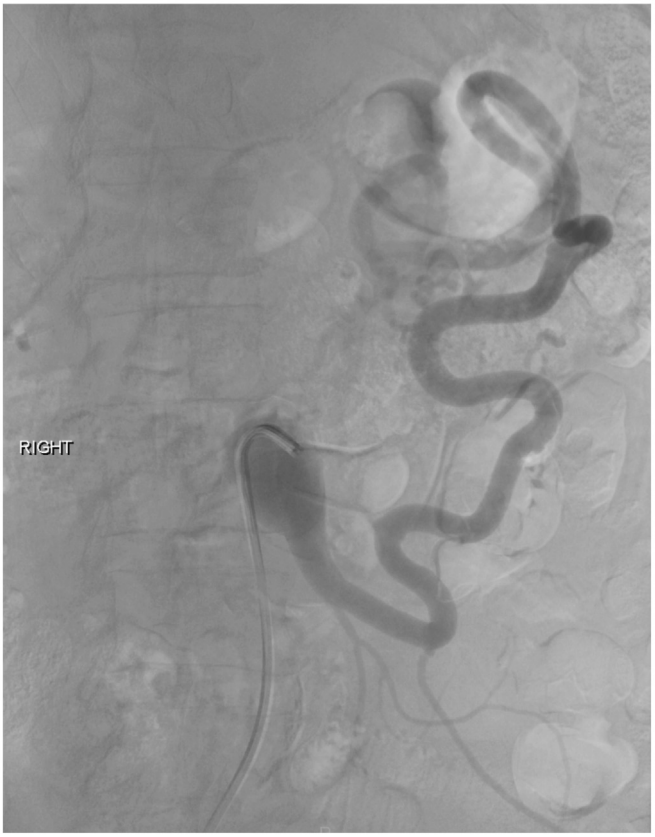

Fig 3. Inferior mesenteric artery aneurysm and arc of Riolan visualized via digital subtraction angiography during attempted retrograde superior mesenteric artery (SMA) recanalization.

reported in aneurysms as small as 1 cm.[18,20-22] Massive gastrointestinal bleeding secondary to bowel fistulization has also been reported.[23,24] The mortality associated with symptomatic IMA aneurysms is unknown given the rarity of these aneurysms and because most reports do not describe prolonged follow-up.

Although some vascular surgeons have repaired IMA aneurysms without concomitant SMA revascularization,[5,6] SMA revascularization is frequently suggested when patients present with concomitant celiac artery and/or SMA CTOs.[9,14,15,25,26] Some argue that this will resolve the jet disorder phenomenon and prevent future, progressive IMA and/or arc of Riolan aneurysmal degeneration.[9,15,27] Others argue against concomitant revascularization of the celiac artery or SMA because no data exist to support this.[5,6,16,28] We decided to pursue SMA revascularization in our case to (1) reduce flow through the IMA in the hope of preventing future aneurysmal degeneration of the IMA or its branches; (2) decrease the intraoperative mesenteric ischemia time; and (3) reestablish in-line flow to the SMA in the event of future IMA bypass occlusion. We ultimately performed SMA revascularization via a retrograde aorta to SMA bypass,

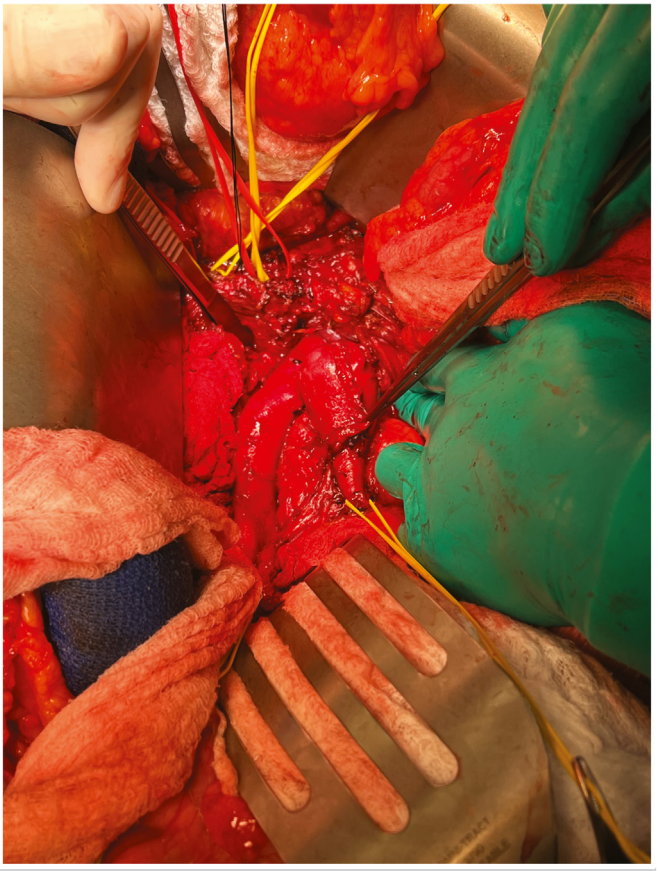

Fig 4. Intraoperative image of inferior mesenteric artery aneurysm before repair. The DeBakey forceps point to the aneurysm.

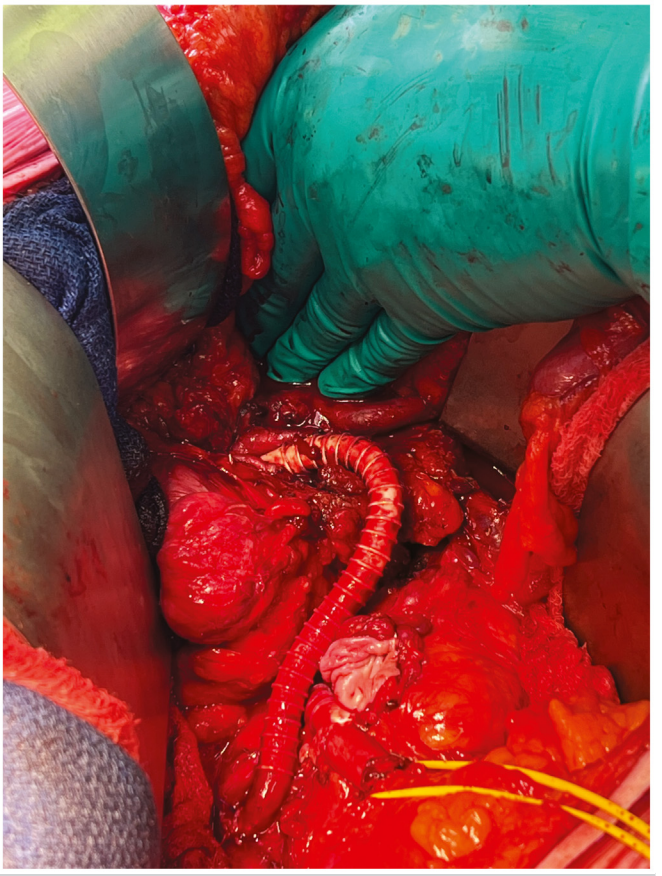

Fig 5. Intraoperative image of retrograde aorta to superior mesenteric artery (SMA) bypass and antegrade aorta to inferior mesenteric artery (IMA) bypass. The IMA beyond the IMA distal anastomosis is encircled by a vessel loop.

a technique described in several previous case reports.[14,15,27] Although endovascular SMA recanalization via angioplasty and stenting has also been described for patients with IMA aneurysms,[25] this was unsuccessful in our patient. Finally, although most reports used PTFE as a bypass conduit,[9,15,26,27,29] Dacron[8,28] and, rarely, autologous vein[14] have also been used.

CONCLUSIONS

We present a case of an IMA aneurysm that developed in a patient with known, prolonged, untreated CTOs of the celiac artery and SMA. We believe that these CTOs could have led to turbulent, high flow through the IMA, which resulted in aneurysmal degeneration. Our findings suggest that IMA aneurysms can develop in patients with prolonged, untreated celiac artery and SMA CTOs and that combined SMA and IMA revascularization is a potentially safe and effective treatment of these aneurysms.

DISCLOSURES

None.

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