Endovascular Repair of an SMA Aneurysm With Complex Aortic Pathology

With careful planning, stent graft repair can be successfully utilized in even the most complex visceral artery aneurysms.

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Visceral arterial aneurysms (VAAs) represent a rare clinical entity. It is estimated that aneurysms of the superior mesenteric artery (SMA) account for approximately 6% of VAAs. Due to the rarity of VAAs, their natural history is relatively unknown. However, when rupture occurs, they stand to confer significant morbidity and mortality. The infrequency with which VAAs are encountered has resulted in a lack of consensus regarding treatment for asymptomatic lesions. VAAs are best diagnosed using CT imaging and are frequently incidental findings. CT angiography with reconstruction provides the most detailed imaging for endovascular or operative planning. The generally accepted threshold for inter-

Figure 1. The patient’s 4.3-cm SMA aneurysm.
Figure 2. A visceral arteriogram showing the SMA aneurysm.
Figure 3. Completion visceral arteriogram demonstrating aneurysm exclusion.
vention in asymptomatic lesions includes a diameter > 1.5 to 2 cm. Symptomatic lesions presenting with pain, ischemia, expanding aneurysms, and aneurysms in women of childbearing age should be repaired. Pseudoaneurysms and ruptured or bleeding aneurysms must be treated immediately.

Although trans catheter-based therapies, including embolization, have proven successful in the treatment of anatomically amenable lesions, open surgical repair has historically been the gold standard. Endovascular stent therapy has only recently emerged as a viable alternative for the management of VAAs and is particularly useful for patients with prohibitive surgical risk or aneurysm anatomy that is not amenable to embolization or operative intervention. In this article, we present a case in which endovascular stent graft repair was used to treat an SMA aneurysm in the setting of complex aortic pathology.

CASE REPORT
A 62-year-old man with a history of hypertension, stroke, and renal insufficiency presented with a type B aortic dissection and visceral malperfusion in the setting of a 5-cm ascending aortic aneurysm, a 5.5-cm abdominal aortic aneurysm, and a 4.3-cm SMA aneurysm. He underwent urgent thoracic endovascular aneurysm repair with the Gore TAG endoprosthesis (Gore & Associates). He then underwent staged open repair of his juxtarenal abdominal aortic aneurysm. The patient ultimately required “arch hybrid” repair of his thoracic aorta due to a type I endoleak with persistent flow into the false lumen. The patient recovered well, at which point, repair of the SMA aneurysm was considered (Figure 1).

Initial exposure of the left femoral artery was performed with access via a micropuncture needle, wire, and a 5-F sheath. A multipurpose angiographic catheter and Glidewire (Terumo Interventional Systems, Inc.) were advanced with unsuccessful access of the true lumen due to his arterial dissection. The right femoral artery was exposed, which allowed access to the true lumen. A pigtail catheter was positioned, and visceral aortography was performed (Figure 2). The Sos Omni catheter (AngioDynamics) and Glidewire were used to access the SMA origin. A Rosen wire was placed, and the 5-F sheath was changed to an 11-F Check-Flo Performer introducer (Cook Medical). Next, two overlapping 10-mm X 5-cm Viabahn stents (Gore & Associates) were placed and balloonned using an 8-mm balloon. Completion arteriography demonstrated good flow through the SMA trunk and branches with complete aneurysm exclusion (Figure 3).

The patient recovered well from the procedure without any evidence of bowel ischemia. He was discharged on dual-antiplatelet therapy with aspirin and clopidogrel. His SMA stent remains patent at 1-year follow-up, as well as evidence of aneurysm sac shrinkage (Figure 4).

DISCUSSION
Despite their low incidence, when encountered, VAAs pose a significant risk. The natural history of VAAs is poorly understood but assumed to result in aneurysm growth with the potential for rupture or distal embolization. The etiology remains elusive and was formerly thought to be primarily infectious. However, VAAs are more commonly found in association with various collagen vascular disorders and atherosclerotic disease. Pseudoaneurysms may occur secondary to trauma or iatrogenic injury due to inadvertent thermal injury to the vessel wall.

Open surgical interventions have classically been the main therapeutic option for VAAs, and open repair most often requires aneurysm ligation and exclusion along with arterial reconstruction, including aneurysmorraphy or graft interposition/bypass. Given the necessity for exposure, vascular cross-clamping, and the potential complications therein, open repair is associated with greater morbidity and mortality. Nonetheless, surgical repair has demonstrable long-term success.

Endovascular interventions have emerged as a therapeutic option for patients who are unfavorable surgical candidates. However, the endovascular experience with VAAs has primarily centered on coil embolization. Although embolization has good success rates, it is limited by aneurysm anatomy. Transcatheter embolization is relatively contraindicated for large fusiform aneurysms, those with broad necks, and aneurysms with branch vessels or isolated end-organ perfusion.
Furthermore, potential complications include coil migration, aneurysm reperfusion, and the risk for mesenteric ischemia. 

Endovascular stenting broadens treatment options but requires important anatomic considerations such as an appropriate landing zone, vessel caliber, and tortuosity, in addition to the location of branch vessels. The mechanics of stent delivery systems must also be carefully considered in terms of the size of the delivery system along with system and graft rigidity. Notably, the endovascular stent graft approach may not be suitable for all aneurysms, including those arising from vessels with multiple branches, large size > 5 cm with limited landing zones, and those of infectious etiology. Complications of this approach may include stent migration, endoleak, or occlusion. Moreover, all patients with mesenteric interventions must be closely examined for signs of end-organ ischemia. 

There are limited series systematically comparing VAA management strategies and outcomes. However, small series and case reports have demonstrated technical success, with good short-term patency. Comparisons of open versus endovascular stent graft repair of VAAs have demonstrated equivalent short-term efficacy and minimal morbidity and mortality with endovascular treatment. 

Multilayer flow-modulating stents were designed to address more complex aneurysms with visceral branches. Such stents are engineered to limit turbulent flow within the aneurysm while preserving inline flow to collateral vessels and to the end organ. Results have demonstrated good technical success and patency rates at short-term follow-up (mean, 34.7 months) using the Cardiatis multilayer flow-modulator stent (Cardiatis). Morbidity and mortality were statistically equivalent between the surgical and stented groups. However, Balderi et al demonstrated that while achieving high technical success and short-term results, midterm results were unsatisfactory, with complications including incomplete sac shrinkage, aneurysm reperfusion, and graft occlusion.

CONCLUSION

Both open and endovascular approaches were evaluated for the patient in the case presented. Open repair would require aneurysm ligation and revascularization of the SMA, in which antegrade inflow could not be achieved given the presence of a dissected and aneurysmal supraceliac aorta. Retrograde bypass from the previous abdominal aortic graft could have been attempted, but it carried significantly greater risks than the endovascular approach. With respect to endovascular alternatives, the fusiform nature of the aneurysm served as a contraindication to transcatheter embolization. Furthermore, covered stent graft exclusion of the SMA aneurysm proved ideal given the sufficient proximal and distal landing zones.

This case demonstrates that with careful consideration of aneurysm anatomy along with patient comorbidities, endovascular stent graft repair may be successfully utilized for even the most complex VAAs. Although further investigation is required to determine long-term durability, stent graft repair may serve as a viable alternative or adjunct to open repair.

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