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Rare Visceral Artery Aneurysm and Complete Celiac Axis Occlusion

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Background	After incidental visceral artery aneurysm discovery, a female underwent attempted endovascular therapy, followed by open excision with interposition bypass using the greater saphenous vein.
Summary	Our patient presented with an incidental left upper quadrant hyper-enhancing mass discovered by plain film at a chiropractor's office prior to spinal manipulation for chronic back pain. The patient was referred to vascular surgery following a CT scan which revealed a 2.4 cm peripherally calcified lesion suggestive of a superior mesenteric artery aneurysm (SMAA). The patient was scheduled for endovascular therapy (EVT). The aortogram revealed the aneurysm with both inflow and outflow vessels. A selective angiogram of the SMA revealed previously unobserved complete retrograde filling of the gastroduodenal artery (GDA) to the hepatic, left gastric, and splenic arteries. EVT was abandoned in favor of resection with reconstruction. An exploratory laparotomy was performed with resection of the distal SMA aneurysm with interposition of the greater saphenous vein (GSV). Final pathology resulted in a 3.5 × 2.5 × 2.4 cm mesenteric arterial aneurysm with moderate atherosclerosis and dystrophic calcification. Visceral artery aneurysms are generally rare, with limited studies and only a recent consensus on management. However, the location of this aneurysm and the concomitant celiac axis occlusion causing retrograde filling highlight the importance of attention to surrounding vascular networks during angiography and may provide an additional framework for treatment protocols in the future.
Conclusion	SMA aneurysms should be treated with EVT as the first approach. Prior to EVT therapy, careful attention must be given to vascular collateral networks. Open procedures may be required, as in this case, if embolization, coiling, and/or covered stent therapy is contraindicated.
Keywords	visceral aneurysms; superior mesenteric artery aneurysm

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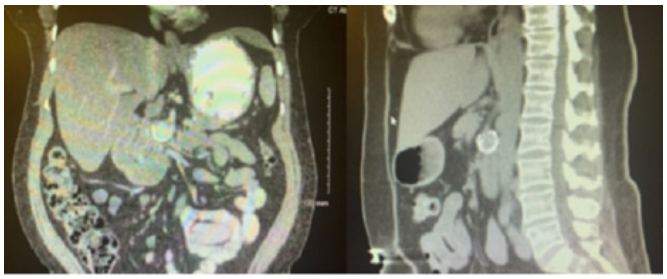
Case Description

Visceral artery aneurysms (VAA) are rare vascular entities with an estimated incidence of 0.01 to 0.2%.[1] The natural history is not well defined and varies depending on celiac, superior mesenteric, inferior mesenteric, gastroduodenal, hepatic, splenic, or renal location. Contributing etiologic factors include atherosclerosis, pancreatitis, fibromuscular dysplasia, genetic syndromes, and trauma. Each factor may contribute to a true aneurysm or pseudoaneurysm formation. VAAs are often asymptomatic and found incidentally; however, presentation may include abdominal pain and back pain. Superior mesenteric artery aneurysms represent 3 to 9% of all VAAs.[1,2] SMAAs require treatment regardless of their size, as the rupture rate ranges from 38 to 50%, with rupture-associated mortality of 30 to 90%.[1] Here, we report a rare presentation of a distal SMAA in the setting of complete celiac axis occlusion resulting in retrograde filling from the gastroduodenal artery to the hepatic, left gastric, and splenic arteries.

The patient is a 55-year-old female with a history of anxiety, GERD, hiatal hernia, hypertension, pancreatitis, tobacco abuse, and remote blunt abdominal trauma who presented to a chiropractor for progressive back pain. Anteroposterior and lateral lumbar films revealed a hyper-enhancing mass in the left upper quadrant. Spinal manipulation was aborted. Additional imaging revealed a peripherally calcified lesion measuring 2.4 cm that the radiologist deemed suggestive of a pseudoaneurysm of the SMA (Figure 1).

Figure 1. Pseudoaneurysm off Superior Mesenteric Artery. Published with Permission



She was subsequently referred to a vascular surgeon and scheduled for an arteriogram. She had a prior cesarean section and an endometrial ablation. The risks were thoroughly explained to the patient, who elected to only undergo EVT at the time and discuss open treatment if EVT were unsuccessful.

In a hybrid operative suite, access was obtained through the right common femoral artery under ultrasound guidance in a retrograde manner with 5F sheath placement. There was conversion to 6F RDC Destination Terumo sheath (Terumo Medical Corporation, Tokyo, Japan). An aortogram was initially performed in which celiac occlusion was observed directly off its origin. Then, selective SMA first-order arteriography was performed and revealed a calcified arterial segment of the SMA with inflow and outflow through the aneurysm. The outflow vessel then filled the GDA, hepatic, gastric and splenic vessels in a retrograde fashion, which was attributed to the celiac occlusion; the procedure was aborted due to these findings (Figure 2). As previously discussed, she was then admitted to the hospital for open preoperative planning. Vein mapping was completed before OR. An exploratory laparotomy was performed with mobilization of the duodenum to obtain proximal and distal control of the aneurysmal segment (Figure 3). The segment was excised, and an interposition bypass was performed utilizing the greater saphenous vein in an end-to-end fashion with 6-0 Prolene (Figure 4). Adequate flow was ensured distally with palpation and doppler signal. Her abdomen was closed in the usual fashion without drain placement. Final pathology reported a mesenteric arterial aneurysm, 3.5 × 2.5 × 2.4 cm overall, with moderate atherosclerosis and dystrophic calcification (Figure 5). The patient was discharged on postoperative day six. She had returned to work and daily activity without back pain by her two-week follow-up appointment.

Figure 2. Pre-arteriogram Catheterization of SMA Aneurysm and Subsequent Runoff Revealing Retrograde Filling Secondary to Celiac Occlusion. Published with Permission

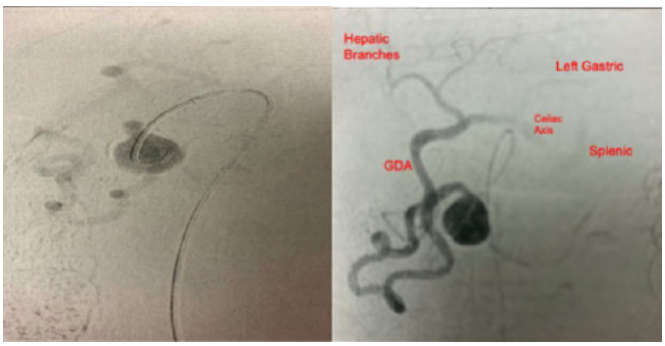


Figure 3. Pseudoaneurysm off Superior Mesenteric Artery. Published with Permission

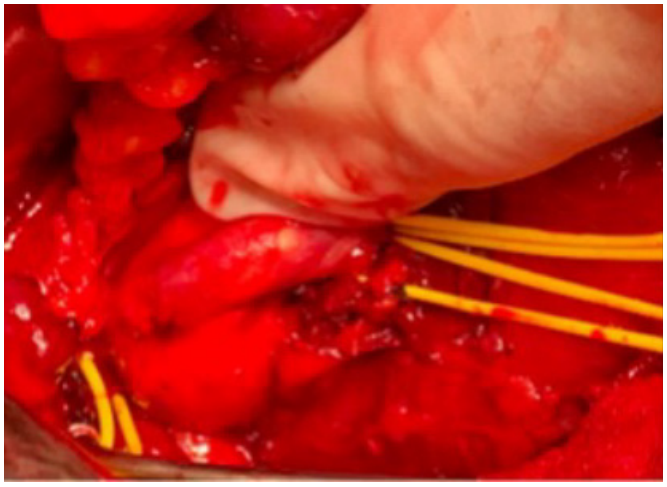


Figure 4. End-to-end Greater Saphenous Vein Reconstruction. Published with Permission

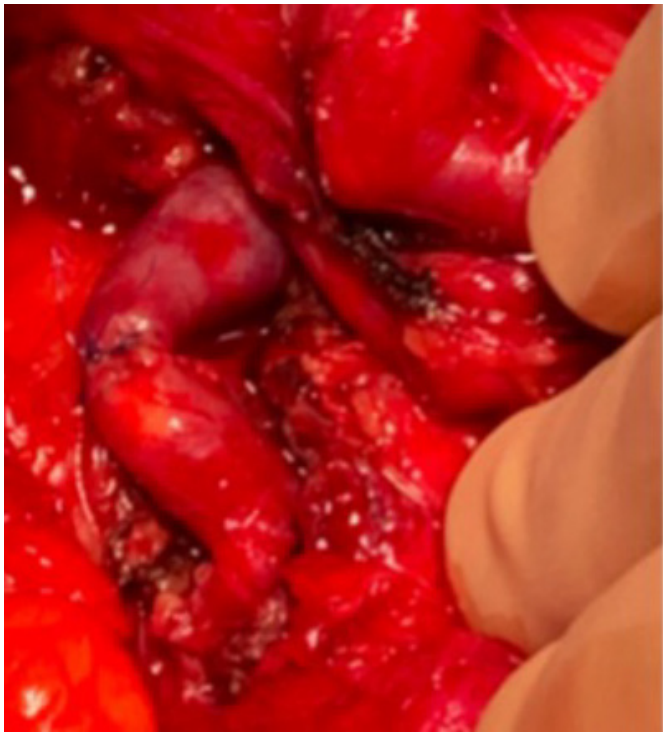


Figure 5. Excised Aneurysm With Inflow Vessel Visualized. Published with Permission

Discussion

Surgeons previously debated the comparative effectiveness of endovascular and open approaches in managing visceral artery aneurysms.[2,3,11] With one in four VAAs estimated to present as a life-threatening rupture, a consensus was urgently needed.[3] At the time of surgery, a committee of experts within the Society of Vascular Surgery (SVS) had not yet established consensus guidelines on VAA management. However, the SVS' recent recommendations were updated in July 2020. With continued expansion and risk of rupture, repair is recommended for all true SMAA and pseudoaneurysms at the time of diagnosis.[11] Endovascular therapy has now evolved into the "first approach" for SMAA repair, given the minimally invasive nature, shorter recovery time, and lower risk of morbidity and death compared to open surgery.[2,9–11] The ability to treat endovascularly revolves around embolization, coiling and/or covered stent placement. However, EVT is limited by the technician's knowledge, anatomic location, collateralization, and patient factors. Open repair allows ligation, total or partial excision and patching, primary repair, plication, and ex vivo reconstruction. An expansion of hybrid suites has led to an increase in on-table conversion to open if either EVT is too difficult to be performed or a contraindication exists, as in this case.

The patient's celiac occlusion limited her EVT options. Coil packing her aneurysm alone could have occluded the outflow tract with subsequent potential for developing catastrophic ischemia along the retrograde path. Alternatively, stenting across the aneurysm was considered, but concern over later occlusion was again deemed unsafe in the setting of celiac occlusion. In a recent study, the one-year primary patency rate of visceral vessel stenting in the setting of mesenteric ischemia was 65%.[5] Another study reported a one-year failure rate of approximately 30%.[5,6] Finally, a combination of celiac angioplasty with stenting and SMA stenting was ruled out in favor of an open approach over patency and feasibility concerns. Duplex surveillance of three-year primary patency rates after mesenteric revascularization has been reported to be 62% after EVT and 82% after surgical bypass.[7,8] Despite these reported patency and failure rates, EVT would have still been preferred if proper collateralization existed due to the decreased morbidity compared to open procedures. The overall mortality from elective repair of SMAA is <15%.

Alternatively, median arcuate ligament syndrome (MALS) should be considered in cases of distal SMAA and, more commonly, pancreaticoduodenal artery and gastroduodenal aneurysms. Ideally, transabdominal duplex ultrasound would have been performed in addition to the CTA assessment, as it is a dynamic study accounting for diaphragm changes during respiration. Our patient had no evidence of crura hypertrophy or diaphragmatic compression on preoperative imaging. Therefore, median arcuate ligament release was not considered at the time of surgery; however, MALS should be ruled out during applicable VAA workup.[11] Our patient's request limited our immediate conversion to open therapy as an adjunct to our "EVT first approach." Following bypass of the excised aneurysm, our patient will require annual CTA surveillance as recommended by the SVS.[11]

Conclusion

Visceral artery aneurysms remain a rare clinical entity. This case underscores the importance of attention to the collateral vascular networks observed during angiography and may provide an additional framework for the continued development of treatment protocols for VAA.

Lessons Learned

Superior mesenteric artery aneurysms should be treated with EVT as the first approach. Prior to EVT therapy, careful attention must be given to vascular collateral networks. Open procedures may be required, as in this case, if embolization, coiling, and/or covered stent therapy is contraindicated.

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