Endovascular Management of Inflammatory Superior Mesenteric Artery Aneurysm: A Case Report and Review of Literature

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Abstract
Superior mesenteric artery aneurysm (SMAA) is a rare clinical entity which can present with a wide spectrum of symptoms. It is associated with a high risk of rupture, morbidity, and mortality. Variable clinical manifestations often lead to misdiagnosis and improper therapies with high mortality ranging from 8.5% to 25%. We present a case of a 60-year-old male patient who presented with abdominal pain and a palpable pulsatile mass in the right hypochondriac and epigastric regions. He was diagnosed to have a large SMAA which was treated successfully with stent grafts.

Keywords: Aneurysm, endovascular management, superior mesenteric artery aneurysm

INTRODUCTION
The incidence of splanchic aneurysm is 0.1%–2% in general population, which increases to about 10% with advancing age.[1] Splenic and hepatic artery aneurysms account for the majority of visceral artery aneurysms (VAAs) (60% and 20%, respectively); only 5.5% of are attributable to the superior mesenteric artery (SMA).[2,3] Two decades ago, infection was the major underlying cause for SMA Aneurysm (SMAAs).[4] With the increasing use of computed tomographic (CT) scans, the incidence of detected asymptomatic SMAAs is rising. We report a case of 60 years old male, who presented with a large pulsatile abdominal mass. A giant SMAA was detected and subsequently treated with endovascular intervention.

CASE REPORT
A 60-year-old male patient presented with a history of the epigastric pain of 3 months duration. There was no history of nausea, vomiting or weight loss. He was a smoker with no other comorbidities. On systemic examination, large pulsatile mass was palpable in the epigastrium and right hypochondriac regions. CT angiogram revealed 10.8 cm × 7 cm × 14 cm [Figure 1] saccular aneurysm 1 cm distal to the origin of the SMA with two smaller saccular aneurysms (2 cm × 1.9 cm and 1.6 cm × 1.6 cm, respectively) [Figure 2] in distal SMA. On further evaluation, patient had raised C-reactive protein (CRP-90 mg/L) and erythrocyte sedimentation rate (ESR) (110 mm/h), along with accelerated hypertension. The patient was treated with steroids and anti-hypertensive medications, discharged and was readmitted a month later, after control of hypertension and acute inflammatory process (CRP-8 mg/L and ESR-18 mm/h). The endovascular approach was preferred as surgical option was considered to be more morbid.

Under general anesthesia, with a left transbrachial approach, 7 Fr × 60 cm sheath was inserted, and its tip parked only proximal to the origin of SMA, which was cannulated with 5 Fr Cobra catheter over 0.035″ TERUMO wire. This was then exchanged for super stiff 0.035″ × 260 cm Amplatz wire and parked distally in a branch of SMA. The proximal SMA

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aneurysm was then excluded with stent grafts (three balloon mounted stent grafts, Life Stream-BARD-6 mm × 58 mm, 6 mm × 37 mm, 5 mm × 37 mm) [Figure 3] with adequate overlap between them. Poststenting angiogram showed no endoleak [Figure 3], with good flow in SMA and distal branches. He made an uneventful recovery and remains asymptomatic at the 6th month follow-up. The duplex scan showed complete exclusion of proximal aneurysm and no endoleak. He continues to be on regular surveillance for the smaller distal SMA aneurysm.

**Discussion**

VAAs and pseudoaneurysms are associated with a significant risk of rupture and death.[5,6] These are rare and account for 5.5% of all VAAs (combined degenerative, inflammatory, connective tissue disorder, etc.). Hence, large studies documenting their outcomes are lacking in the literature.[7] Both sexes are equally affected, with a higher risk of rupture in males.[8] Most patients with mycotic aneurysms are under 50 years of age, and patients with atherosclerotic aneurysms are usually in their seventh or eighth decades.[9] In a series from the Mayo Clinic reported in 2002, only 5% of patients were thought to have an infection as the primary cause, whereas 62% were secondary to atherosclerosis.[2] This is also validated in more recent reports.[9] Search results using PubMed, Cochrane Library, Medline, and Medscape research databases, about SMA case series and individual management of the SMA are tabulated in Table 1.

Stone et al.[2] in their study reported in their series that 48% of all patients were asymptomatic, and in the study by Jiang et al. it was about 70%.[9] Two important reasons of increased incidence of asymptomatic SMAAs are increased use of CT scan for other diagnostic purpose and widespread use of antibiotics which could potentially prevent an infectious cause of SMAAs.[2,10,11] Symptomatic patients may present with abdominal pain, nausea, vomiting, and pulsatile mass or gastrointestinal bleeding. The acute presentation can be with a picture of hemorrhagic shock secondary to rupture or with features of small bowel ischemia caused by thrombosis in 38% and carries mortality risk of 35%.[2,10] The indications for repair include SMAAs with a diameter >2 cm, symptomatic and rapidly growing SMAA. Controversies persist regarding the absolute indications.[12,13]

De Bakey and Cooley described the first successful resection without revascularization of a mycotic SMAA caused by bacterial endocarditis in a young female in 1953.[14] Open surgical repair is considered as “gold standard” for all SMAAs in patients who require intervention. It can be performed by surgical resection with arterial reconstruction, or by ligation of the vessel without reconstruction.[15] The evolution of endovascular techniques has also impacted the management of visceral artery aneurysms. In general, the minimally invasive procedures are associated with less morbidity and mortality (4.6% in open repair vs. 1.2% in an endovascular repair-randomized study done on 354 patients), shorter hospitalization, fewer complications, and a better
Table 1: List of individual case management and case series on superior mesenteric arteries with complication

| Article | Number of patients | Age (years) | Symptoms (%) | Aneurysm data (%) | Em/El | OR/ER/NM | Tec success (%) | 30 days mortality (%) | Complication % (Follow up months) |
|---------|--------------------|-------------|---------------|-------------------|--------|----------|-----------------|------------------------|-------------------------------|
| Carmeci and McClenathan, 2000[22] | 5 | 59* | 100 AbP, 80 R | NA | NA | 4/1/0 | 100 | 0 | 0 (30) |
| Stone et al., 2002[2] | 21 | 59* | 48 AS, 24 AbP, 38 R | 62 calcified; 5 infectious | 8/13 | 12/3/6 | NA | 38 in emergent group; 0 in elective group | 0 in emergent group; 25 in elective group (56) |
| Marone et al., 2011[12] | 6 | 58* | NA | Mean size 3.4 cm | NA | 3/3/0 | 100 | 17 | 17 (NA) |
| Jiang et al., 2011[13] | 10 | 57* | 70 AS, 10 AbP, 10 R | Mean size 3.5 cm | 1/9 | 2/5/2 | 100 | 10 | 11 (30.6) |
| Ray et al.[19] | 1 | 57 | AbP | 3.5 cm | Conservative size 35 mm | - | - | 0 | 0 (11 years) |
| Drescher et al.[23] | 1 | 64 | Asymptomatic | NA | El | 0/1/0 | 100 | 0 | NA |
| Gandini R et al.[20] | 1 | 68 | Hypotension | 19.6 cm × 13.1 cm | Em | 0/1/0 | 100 | 0 | 0 (3 months) |

*Average age. Em: Emergency, El: Elective, OR: Open repair, NM: Nonoperative management, AbP: Abdominal pain, AS: Asymptomatic, R: Rupture, NA: Not available, ER: Endovascular repair

perioperative quality of life.[16] Endovascular treatment also plays an important role in the emergent treatment of ruptured SMAAs with technical success rates up to 90%.[17] In the current literature, there are only a few case reports and small case series that report the use of endovascular treatment of SMAAs.[2,9,17,18] Conservative management of the aneurysm is not well documented although Stone et al.[2] have managed 6 patients with 67 months follow-up and Ray et al.[19] managed 1 case for 11 years. Beta-blockers have some protective effect and can be used when patients are reluctant for surgery.[19] Aneurysms with diameter <20 mm are considered to have a low rupture rate[20] and can be managed conservatively with close follow-up, although one group reported aneurysm size as a nonreliable predictor of rupture.[21] The current follow-up protocol proposed for the endovascular management of visceral aneurysms includes imaging (duplex scan) at 3-month intervals during the 1st year and annually thereafter.[17] Future studies are still needed to show the long-term results of stenting or coil embolization of SMAAs before it can be considered a safe and effective treatment.

**Conclusion**

SMAAs remain a rare entity with a wide range of clinical presentation. High rupture and other complication rates are associated with SMAAs, and hence, early treatment is recommended for symptomatic, rapidly growing, and relatively large SMAAs. Open repair, primarily ligation, and excision of the aneurysm, remains the gold standard, but recent studies indicate that the endovascular management is feasible, but it seems unlikely to have large series, since these are rare entities.

**Declaration of patient consent**

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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**Conflicts of interest**

There are no conflicts of interest.

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