# Superior Mesenteric Artery Stent Fracture: A case report

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**Abstract:**

Over the past decades, endovascular repair of mesenteric ischemia (MI) has gained grounds over traditional surgical repair. Despite its initially promising results, complications such as stent fractures can occur. In defiance of the low reported rates of stent fractures and in the face of the ever-growing number of patients treated endovascularly the need to establish a treatment strategy in dealing with stent related complication is evident. Here we report our experience of a superior mesenteric artery (SMA) stent fracture successfully treated with the use of a stent graft.

**Keywords:** Superior mesenteric artery, Stent fracture, Endovascular repair, Mesenteric ischemia

## INTRODUCTION

Mesenteric ischemia (MI) is a rare medical condition which is responsible for about 0,1% of hospital admissions, with high mortality rates. Its pathophysiology includes inadequate blood supply, inflammatory injury and eventually necrosis of the intestine wall. In particular, chronic mesenteric ischemia (CMI) is of atherosclerotic aetiology in about 95% of cases. Its presentation lacks of specific clinical or raucous signs, therefore the diagnosis is difficult to establish at an early stage. Valuable diagnostic techniques for diagnosing CMI are digital subtraction angiography (DSA), computed tomography imaging (CT), magnetic resonance imaging (MRI) and mesenteric duplex ultrasonography (US)[1].

Endovascular revascularization has been favoured over open surgery repair due to lower morbidity, mortality, and shorter hospital stay. Although endovascular approaches have been questioned for their long-term efficacy, recently published studies have demonstrated the long-term superiority of percutaneous mesenteric artery stenting (PMAS) over traditional surgical techniques. The aim of this report is to present our experience of a patient who had PMAS of the SMA and readmitted to our department because of stent fracture[2].

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## CASE REPORT

A 56-year-old male patient was referred to the Vascular Surgery outpatient department due to symptoms of peripheral artery disease and chronic bowel ischemia. The patient reported prior endovascular repair of abdominal aortic aneurysm and diminishment of his pain-free walking distance to less than 100 meters over the last two months. Additionally, he reported postprandial discomfort and pain a few hours after eating. On clinical examination, we detected the absence of left femoral artery pulse, which showed proximal arterial obstruction. His ABI index on the left lower limb was 0.35. An abdominal and pelvic CTA scan was performed depicting thrombotic occlusion of the left iliac limb and significant stenosis in both the coeliac axis and superior mesenteric artery. We proceeded with endovascular repair of left iliac limb occlusion and SMA stenting.

In the operating theatre, the lesion could not be crossed either by antegrade access, through the brachial artery, or by retrograde access through the left femoral artery. Our initial method is to attempt to gain access through the femoral artery, when the angle is not to steep. Otherwise, our preferable option is brachial access, but here it was not possible. The operators performed a right to left fem-fem bypass with a PTFE ring supported 8mm graft and subsequently an SMA stenting using the right femoral artery for access. We used a balloon-expandable 8x56 mm stent. The final angiogram depicted a fully expanded patent stent in the superior mesenteric artery. The patient was discharged two days after the procedure with an ABI index of 0.97 and remission of bowel ischemia symptoms.

On the first appointment of the follow-up period, the patient complained of persistent postprandial discomfort. He immediately underwent an abdominal x-ray which raised the suspicion of SMA stent fracture, a fact consolidated upon per-

forming a new abdominal CTA (Figure 1) (Figure 2) (Figure 3) (Figure 4). Because of the emerging risk of SMA thrombosis, the patient was planned for OR. The procedure was performed under local anesthesia. A 7 Fr -45cm Arrow sheath was placed in the left axillary artery with the final tip at the ostium of the SMA stent. Angiography showed the high-grade stenosis and fracture of the stent. The lesion was crossed with a 0.035" stiff Terumo™ guide-wire. We decided to bridge and cover the two parts of a stent with a Bentley BeGraft 9 x57 mm stent. Angiography after stent placement showed the absence of residual stenosis and very good flow. The SMA remained intact without the obstruction of any branch. After the successful completion of the operation we managed to suture the artery with 6-0 prolene suture. There were no peri- or postoperative complications and the patient was completely asymptomatic after the procedure. The patient was discharged the next day on dual antiplatelet therapy (Salospir 100mg & Plavix 75mg for 1 month and therefore continuation only of Plavix) and underwent a follow-up CT scan 3 months later depicting patent SMA stent graft.

## DISCUSSION

Superior mesenteric artery is the main blood supplier to the intestine. In cases of SMA stenting the extensive shear stress caused by the high-pressure blood flow, the mechanical stress during motion movements and compression forces during the respiratory cycle are speculated to enhance stent deformity and even rupture.

The endovascular treatment has been established as the favourable technique for CMI because of excellent short and long-term outcomes regarding its safety and efficacy while concomitantly allowing for potential surgical or endovascular re-interventions in cases of stent related complications such as incidents of restenosis. Furthermore, due to high peri-operative mortality associated with open mesenteric bypass (up to 50%) in combination with patient co-morbidities, our initial attempt is the endovascular first-approach.

SMA stent fracture is uncommon, with few reports in the English literature. The lack of reported incidents and case control trials don't allow for conclusions to be drawn regarding a

**Figure 1**: Curved multiplanar reformatted image (MPR) showing the centerline lumen of the superior mesenteric artery. Note the displaced wall calcifications, the hyperdense stent and the discontinuity (outlined by the arrowheads) representing the stent fracture

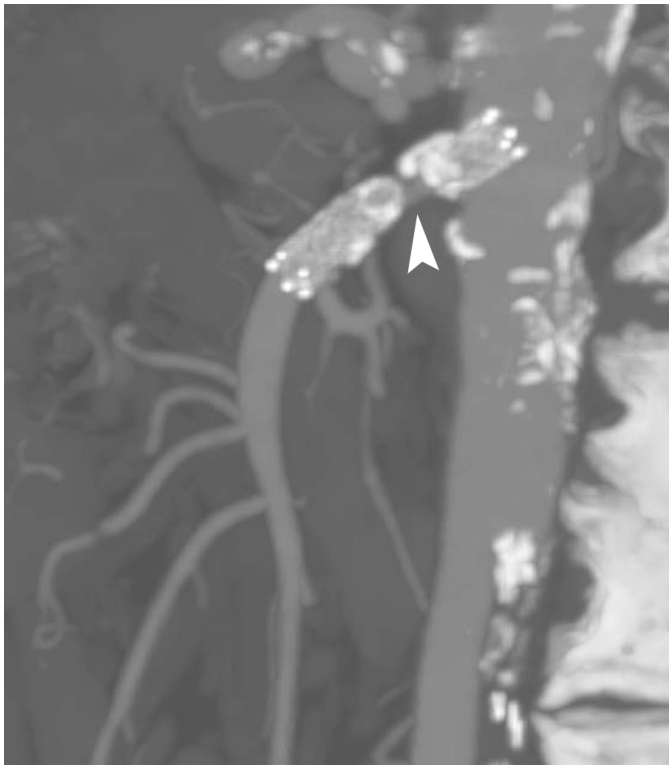

**Figure 2:** Thick slab Maximum Intensity Projection (MIP) image confirming the stent fracture (arrowhead).

**Figure 3:** Volume rendering image better visualizing the findings in three dimensions

**Figure 4:** Transparent volume rendering image better visualizing the findings in three dimensions

definite mechanism leading to stent distortion. Nevertheless, stent material, design and characteristics (self or balloon expandable), as well as the patient's anatomy, seem to play a pivotal role in fracture occurrence.

Regarding our patient, initially a balloon expandable stent was placed in the SMA to treat the superior mesenteric artery occlusive disease with successful short-term results and an uncomplicated perioperative period. During his routine re-evaluation and while the postprandial symptoms persisted, it was found out that the stent in SMA was fractured. According to stent fracture classification presented by Allie et al. our device sustained a type III fracture[3]. Eventually, we placed an additional stent, without facing major technical setbacks applying the stent-in-stent technique. This time, in fear of future device fractures and loss of stent integrity, we favoured the use of a stent graft.

Stent fractures are more common regarding the stenting of superficial femoral artery (SFA), and this is due to the mobile nature of the SFA, especially in its distal portion inside the Hunter's canal where the vessel is subject to compression and bending forces.

The mechanism by which our stent failed to support the patency of the vessel could not be identified. Robins et al. in their publication of recurrent SMA stent fractures where they also used a balloon expandable stent which too suffered a fracture type III, respiratory cycle and diaphragmatic movement- in our case was not found any diaphragmatic massive hypertrophy from initial CTA- was identified as the ethology for repeated stent fractures[4]. Similar fracture morphology with (Type IV) or without (Type III) device migration as well as device preference (balloon expandable stents) is described by several authors regarding SMA stenting, suggesting a consistency in fractures patterns that is open to interpretation[5-7]. In particular regarding stent selection, Sharafuddin et al. in their publication dating almost two decades back, have advised against the use of balloon expandable stents in the SMA in fear of stent crushing due to external compression forces[8]. For the time being, we are in anticipation of the results by the Co-BaGI randomized control trial comparing covered stents and bare-metal stents for the treatment of CMI[9].

Despite the initial excitement, the overall improved safety and shorter length of hospitalization, endovascular treatment of chronic mesenteric ischemia has not yet live up to the initial expectations with primary patency and perioperative mortality rates directly comparable to surgical repair while high early restenosis rates produce skepticism[10].

## CONCLUSION

Endovascular treatment of SMA stenosis is a viable alternative to surgical repair. Stent fractures are early device complications that can be effectively treated with the stent-in-stent technique. Additionally, it is our belief that the philosophy around SMA stenting should mimic that of SFA stenting. The respiratory cycle, along with the repetitive diaphragmatic movements, constitutes the SMA a mobile vessel and it should be treated as such.

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