Double-barrel stenting for endovascular repair of a superior mesenteric artery dissecting aneurysm

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ABSTRACT

The patient was a 58-year-old man with a history of hypertension who had incidentally been found to have a 2.7-cm dissecting fusiform superior mesenteric artery aneurysm involving a long segment of a proximal to distal superior mesenteric artery. Double-lumen anatomy was present, with the true lumen perfusing the proximal and mid-small bowel and the false lumen perfusing the distal small bowel and the ileocolic artery. The patient elected to undergo endovascular repair using double-barrel stenting with self-expanding and balloon-expandable covered stents, as described. Computed tomography angiography after 1 year demonstrated patent stents. (J Vasc Surg Cases Innov Tech 2021;7:641-4.)

Keywords: Mesenteric aneurysm; Endovascular repair; Double-barrel

Double-barrel stenting has been described in many contexts, such as the management of cerebral artery aneurysms.[1-3] Additionally, the double-barrel stenting technique has been used to preserve external and internal iliac artery flow, especially in cases of dissection or aneurysms.[4,5] Double-barrel stenting involves the parallel deployment of stents with a similar origin but different outflow targets. Although multiple reports have demonstrated the use of the technique, to the best of our knowledge, no studies have reported double-barrel stent repair of visceral artery dissecting aneurysms. We have reported the use of this technique for the endovascular repair of a dissecting superior mesenteric artery (SMA) aneurysm. The patient provided written informed consent for the report of their case.

CASE REPORT

The patient was a 58-year-old man with a history of poorly controlled hypertension and bladder cancer who was incidentally found to have a SMA aneurysm with dissection during renal ultrasound scanning. The patient denied any symptoms and did not have a history of trauma or connective tissue disorders or a family history of connective tissue disorders. He underwent a genetic workup with negative findings. His infectious workup was also negative, and his pathology was attributed to his history of hypertension. Computed tomography angiography (CTA) demonstrated a 2.7-cm dissecting fusiform SMA aneurysm involving a long segment of the proximal to distal SMA (Fig 1). Additionally, the patient was found to have a 1.7-cm celiac artery aneurysm (Fig 1). With respect to the SMA, double lumen anatomy was present, with the true lumen perfusing the proximal and mid-small bowel and the false lumen perfusing the distal small bowel and ileocolic artery. Extensive discussion was held with the patient regarding the options for repair, including surgical, hybrid, and endovascular repair. Open surgical repair would have required extensive dissection of the proximal SMA with an interposition graft to the true lumen distally and fairly distal exposure to the level of the ileocolic artery branch with an additional bypass graft. Hybrid repair would have required covered stent placement of the proximal SMA into the true lumen with aneurysm sac exclusion and subsequent bypass to the ileocolic artery. Endovascular therapy would have involved double-barrel stenting into the true lumen distally and the ileocolic artery through the false lumen. Given the feasibility of an endovascular approach and the ability to circumvent laparotomy and extensive dissection of a large segment of the SMA, the patient elected for endovascular repair.

The patient was taken to the operating room. Bilateral femoral artery access was obtained. The patient underwent systemic anticoagulation with intravenous heparin 100 U/kg with the goal of an activated clotting time >250 seconds. The SMA was catheterized, and the mesenteric angiogram revealed proximal dissection ~1 cm distal to the origin of the SMA. The true lumen was perfusing the proximal and mid-jejunal branches (Fig 2). An 0.035-in. wire was advanced into the SMA false lumen and out to the distal branches. Next, we were able to re-enter the true lumen and visualize the ileocolic branch (Fig 3). This was isolated without significant collateralization. Intravascular ultrasound was performed to confirm the true and false dissection lumens. Intravascular ultrasound also confirmed the aneurysmal sac and

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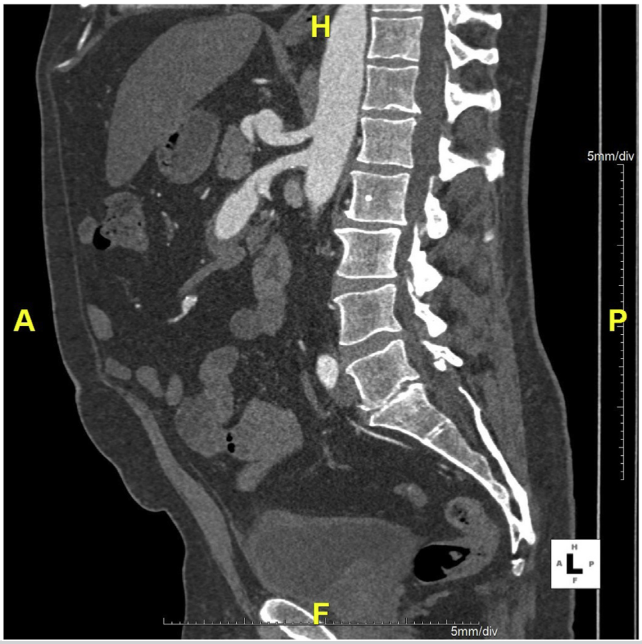

Fig 1. Sagittal view of the celiac artery aneurysm and superior mesenteric artery (SMA) dissecting aneurysm.

the re-entry point of true perfusion in the distal aspect of the SMA. No significant dissection flap movement appeared to be present. The true lumen was catheterized again and confirmed to supply the proximal and mid-jejunal branches but did not communicate well with the ileocolic artery.

The SMA was selectively catheterized from the left common femoral artery, resulting in double access of the SMA to allow for stent deployment. A Gore Viabahn VBX 7 × 29-mm stent (W.L. Gore & Associates, Newark, Del) was deployed in the origin of the SMA proximal to the area of dissection. Next, while maintaining wire access in the true lumen, a 5 × 75-mm Viabahn stent was advanced into the false lumen and then further extended with a 5 × 100-mm Viabahn stent for reinforcement down to the ileocolic branches and still preserving the distal jejunal branches. A 5 × 19-mm VBX stent was then placed in the proximal aspect of the SMA in a kissing fashion with the 7 × 29-mm VBX stent to create a double-barrel configuration (Fig 4). The completion angiogram revealed successful aneurysm exclusion with no evidence of endoleak and good perfusion to all jejunal and ileocolic branches (Fig 5). The patient tolerated the procedure well. He was discharged on postoperative day 1 with aspirin and clopidogrel (Plavix). He continued taking clopidogrel for 30 days postoperatively. The patient was seen for routine follow-up at 2 weeks postoperatively with duplex ultrasound and CTA at 6 weeks and a plan for surveillance CTA every 6 months for 2 years and annually afterward. The CTA at 1 year after repair demonstrated patent stents with continued aneurysm sac exclusion with no endoleak (Fig 6, *A-C*). Three-dimensional reconstruction of the repair is shown in Fig 6, *D*. Duplex ultrasound confirmed patent SMA stents with normal velocities.

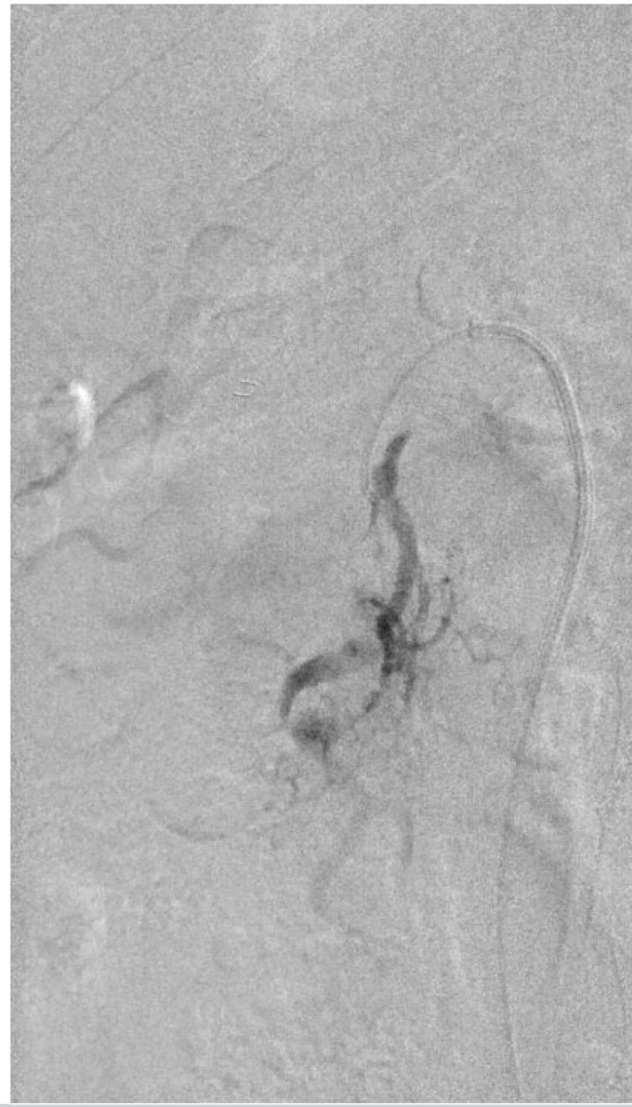

Fig 2. Angiogram of the true lumen demonstrating perfusion of the proximal and midjeunal branches without filling of the ileocolic artery.

DISCUSSION

Spontaneous dissection of the SMA is a rare occurrence, especially in the absence of aortic dissection.[6] Typically, such as in our patient, the dissection will begin 1 to 3 cm from the orifice of the SMA.[7] SMA aneurysms account for only 5.5% of visceral aneurysms, with most patients presenting at age ≥50 years.[8] The Society for Vascular Surgery clinical practice guidelines have recommended repair of all true SMA aneurysms and pseudoaneurysms as soon as diagnosed, regardless of size.[9]

Although open surgical resection and reconstruction has been the reference standard for repair of visceral artery aneurysms, endovascular repair has also been shown to be safe and effective if the anatomy permits.[10] Our case presented a unique challenge because segments of bowel perfusion were dependent on both the true

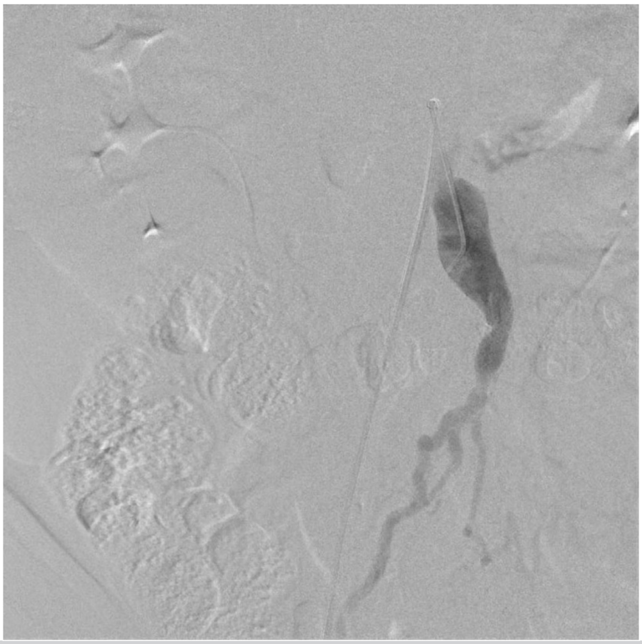

Fig 3. Angiogram of the false lumen demonstrating in-line flow into the ileocolic artery.

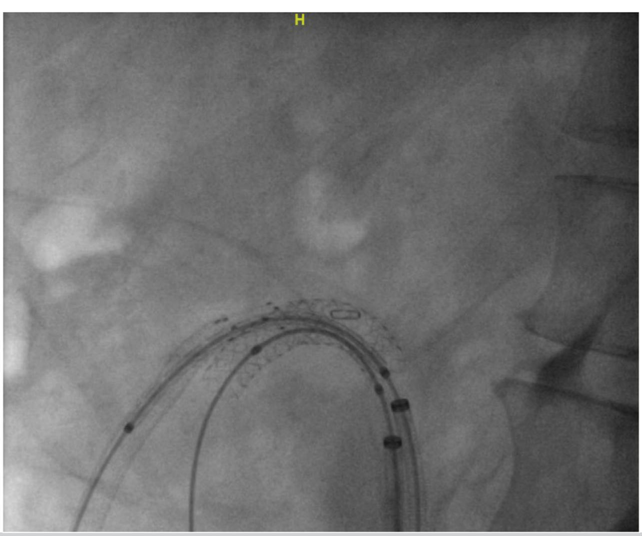

Fig 4. Endovascular stent graft repair of the dissecting superior mesenteric artery (SMA) aneurysm using a double-barrel configuration.

lumen flow and the false lumen flow. This meant simple exclusion of the false lumen and pseudoaneurysm with a stent graft required concomitant ileocolic artery revascularization. A hybrid option included placement of a covered stent into the true lumen with embolization of the false lumen with open ileocolic artery bypass. Although certainly feasible, this option was not pursued owing to the extensive dissection required with associated risk of injury to small jejunal branches and the patient's preference for an entirely minimally invasive

Fig 5. Completion angiogram demonstrating perfusion of the proximal superior mesenteric artery (SMA), ileocolic branch through the false lumen (*white arrow*), and distal SMA (*black arrow*), with filling of the jejunal branches and successful aneurysm sac exclusion.

intervention. Furthermore, the feasibility of the endovascular double-barrel stenting technique allowed us to maintain end-organ perfusion through both channels.

Visceral artery anatomy and stent selection are critical for double-barrel stenting. VBX stents were chosen for the proximal portion of the SMA given the need for precise deployment and because we believe these provide better conformability and seal created with balloon-expandable covered stents deployed in a kissing fashion. Viabahn stents were selected for placement distally owing to the need for trackability and flexibility when traversing the false lumen to land in the ileocolic branch origin. Covered stents were selected to exclude the aneurysm, which on computed tomography and angiography had no branches other than the ileocolic branch that had been stented. The native vessel luminal equivalency is 70% of the total diameter of stent grafts placed. Our preference has been to use ≥5-mm stent grafts; therefore, a double-barrel technique using two 5-mm stent grafts would require a vessel diameter of 7 mm. A visceral artery diameter <7 mm would preclude the technique we have described.

CONCLUSIONS

The present case report has demonstrated the technical success and continued patency of double-barrel

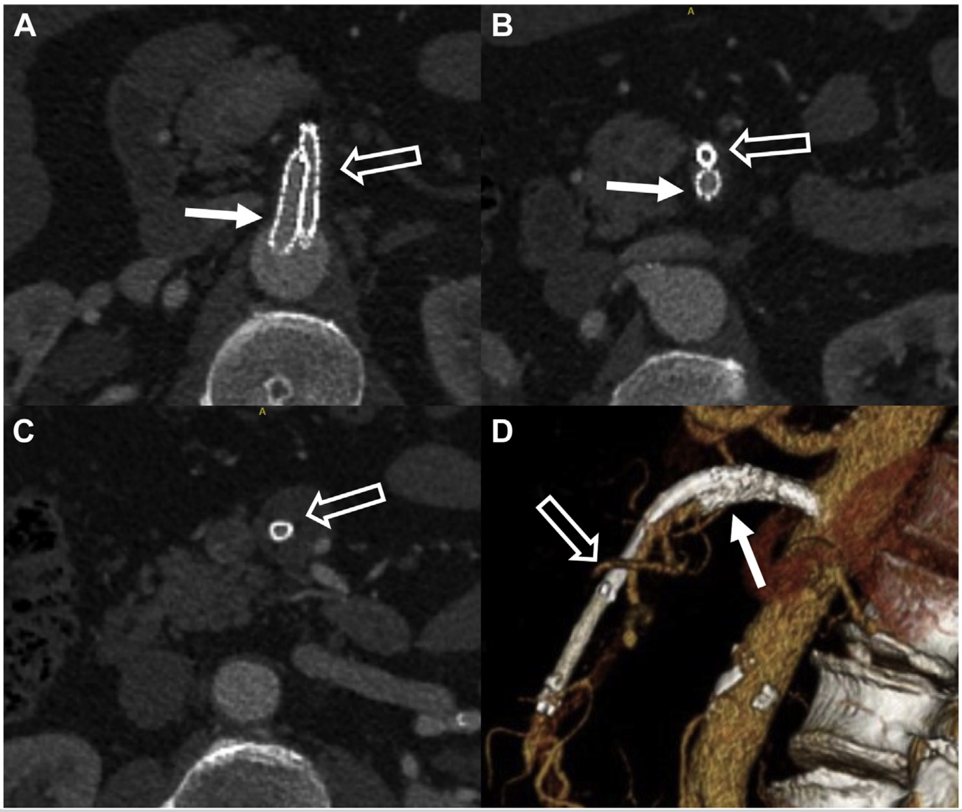

Fig 6. A-D, Surveillance computed tomography angiogram (CTA) at 1 year demonstrating a patent stent into the true lumen (*solid white arrow*) and a patent stent through the false lumen into the ileocolic branch (*hollow white arrow*), with no evidence of an endoleak.

stenting for endovascular repair of a SMA dissecting aneurysm.

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