

# Open reconstruction of multiple huge superior mesenteric artery aneurysms

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## ABSTRACT

Open reconstruction of superior mesenteric artery aneurysms is very difficult, especially if the lesion is extensive. Aneurysmal lesions were found in a 74-year-old woman during a medical checkup. Computed tomography scan showed a 6.8-cm aneurysm arising 4 cm distal to the superior mesenteric artery origin, in succession to a 2.7-cm aneurysm, and further distal small aneurysms with string-of-beads appearance. The first, second, and third jejunoileal arteries, the middle colic artery, and the ileocolic artery were originated from the aneurysms. Open reconstruction was done using a branched saphenous vein graft. Computed tomography scan confirmed the patency of the grafts. She had no major troubles for another 4 years. (*J Vasc Surg Cases and Innovative Techniques* 2020;6:571-5.)

**Keywords:** Superior mesenteric artery aneurysm; Splanchnic artery aneurysm; Open repair; Saphenous vein graft

Superior mesenteric artery (SMA) aneurysm is a rare disease.<sup>1,2</sup> There is no strong consensus for treatment. Simple ligation is associated with the risk of bowel ischemia. Although endovascular repairs can be performed for limited cases, the surgeon has to sacrifice some branches. However, open surgery can effectively reconstruct maximum branches and hence avoid bowel ischemia. Therefore, it is more effective for an extensive SMA aneurysm, which has many branches. Herein, we report a surgical approach involving the reconstruction of four branches for multiple huge SMA aneurysms. The patient consented to the publication of all details and images in this case report.

## CASE REPORT

A 74-year-old woman underwent ultrasound examination as part of a medical check-up, which found aneurysmal lesions in her abdomen. She denied having any previous abdominal symptoms. She had no significant medical or family history of an aneurysmal disease or connective tissue disorder. There was a pulsatile mass on her upper abdomen. The diagnostic studies included echocardiography, white blood cell count, C-reactive protein, erythrocyte sedimentation rate, and antinuclear antibody; all results were negative.

Computed tomography (CT) showed a 6.8-cm fusiform aneurysm arising 4 cm distal to the SMA origin, in succession to a

2.7-cm aneurysm, and further distal, small aneurysms with a string-of-beads appearance. The first, second, and third jejunoileal arteries, the middle colic artery, and ileocolic artery were originated from the aneurysms (Fig 1). Selective angiography of the inferior mesenteric artery showed an ascending branch of the left colic artery. Angiography of the celiac artery did not show collateral flow to the SMA branches.

A laparotomy was performed through a midline incision. The SMA main trunk and branches were encircled, except the first and second jejunoileal arteries, which originated from the posterior aneurysm wall. After clamping the proximal and distal main trunk and branches, the aneurysms were incised. Back-flow was observed from the first and second jejunoileal arteries. The first jejunoileal artery and the middle colic artery were suture ligated. The second jejunoileal artery origin was found by trimming the surrounding aneurysm wall. Reconstruction was performed using reversed saphenous vein grafts, and its diameter was around 3.5 mm. First, the SMA main trunk was reconstructed using a saphenous vein interposition graft. Next, a vein graft branch was created via side-to-end anastomosis. The branch was used for the reconstruction of the second jejunoileal artery by side-to-end anastomosis and the third jejunoileal artery by end-to-end anastomosis. The ileocolic artery was reimplemented onto the SMA interposition vein graft (Fig 2). Graft clamping and declamping were done repeatedly during the creation of anastomoses. The time

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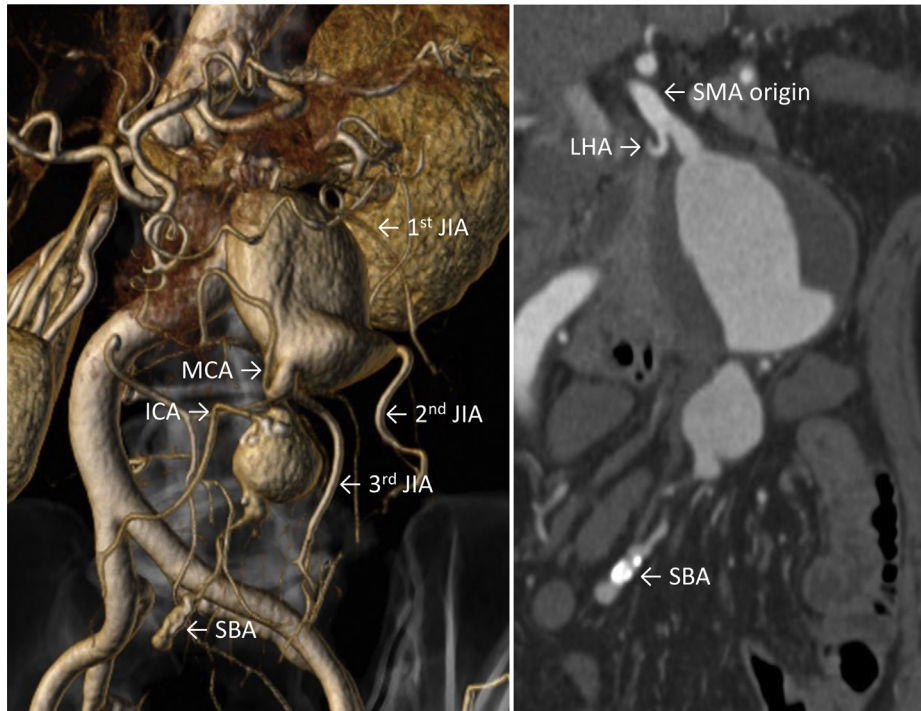
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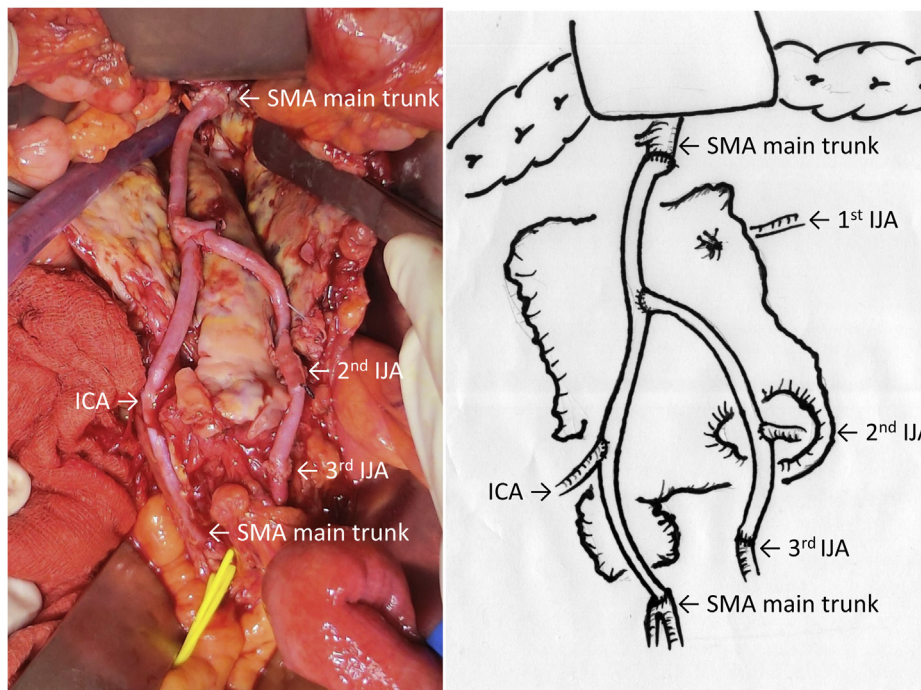
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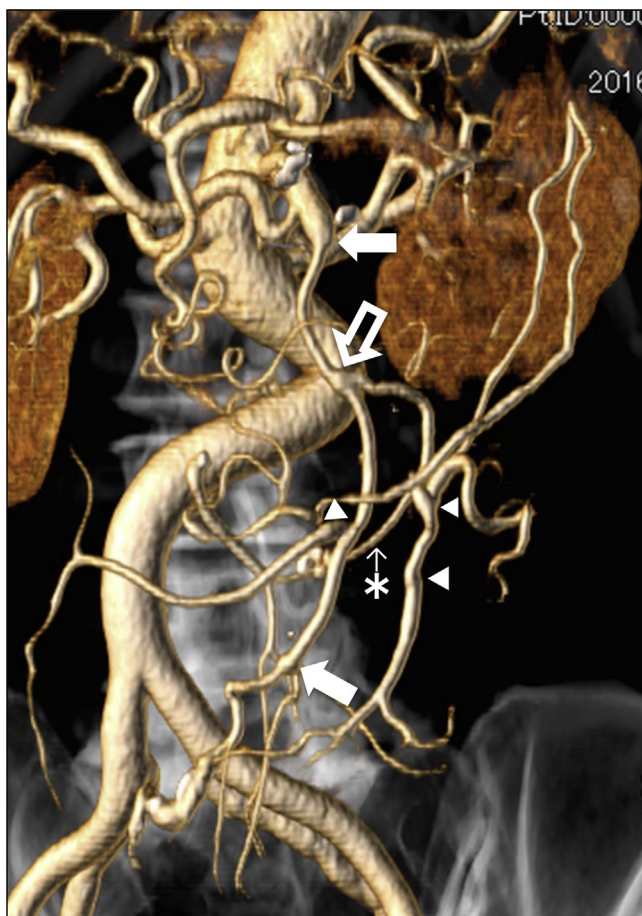
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**Fig 1.** Computed tomography (CT) scan showing two fusiform aneurysms and small aneurysms with spring-of-beans appearance (SBA) in the superior mesenteric artery (SMA). ICA, ileocolic artery; JIA, jejunioileal artery; LHA, left hepatic artery; MCA, middle colic artery.



**Fig 2.** Intraoperative view after the superior mesenteric artery (SMA) branches were reconstructed and schematic presentation. ICA, ileocolic artery; JIA, jejunioileal artery.



**Fig 3.** Computed tomography (CT) scan on the 5th postoperative day showing patency of the branched vein graft. *Arrows*, the proximal and distal side of the SMA main trunk interposition graft; *Open arrow*, the bifurcation of the branched vein graft; *Arrow heads*, the anastomoses of the second, third jejunoileal arteries and the ileocolic artery; *Asterisk arrow*, the left colic artery.

between the first clamping and the last declamping was 3 hours 10 minutes. Surgical intervention was not done for the small aneurysms with a string-of-beads appearance. An intraoperative survey of the graft was done by a Doppler flowmeter after the completion of all reconstructions. Although the flow of the third jejunoileal artery was not visible, it was recovered after the insertion of a catheter and recognized as a vascular spasm. The color of both the small and large intestines was intact at the end of the operation.

Five hours after the operation, melena occurred and continued for 2 days. CT on postoperative day 5 showed patency of the

branched vein graft and reconstructed arteries and slight edema in the small intestine (Fig 3). After oral intake was started on postoperative day 7, she suffered from diarrhea; it was alleviated by medication but continued for several months. The pathologic findings of the huge aneurysmal wall were destroyed media with disrupted elastic fibers and fibrocellular intima thickening (Fig 4). A CT scan 4 years after the surgery showed patency of the graft, development of the ascending branch of the left colic artery, and no change in the distal small aneurysms (Fig 5). She was followed up for 4 years without any major trouble.

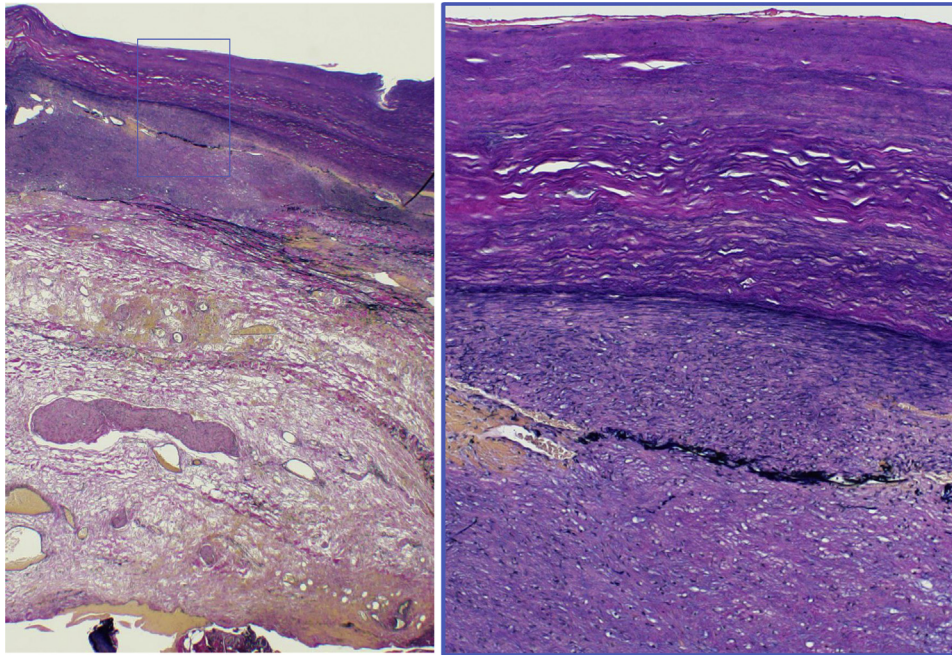
## DISCUSSION

Splanchnic artery aneurysm is a relatively uncommon entity. The most common site of aneurysmal disease is the splenic artery (60%), followed by the hepatic artery (20%). The SMA aneurysm is the third most common type of all splanchnic artery aneurysms, accounting for 5% to 8%.<sup>1-6</sup>

According to the historical reports, about 60% of SMA aneurysms were mycotic aneurysms, and the most common cause was *Streptococcus* infection secondary to left-sided endocarditis.<sup>1,4,5</sup> More contemporary studies indicated that an infectious etiology was uncommon, and the most common pathologic finding was atherosclerosis.<sup>1,6</sup> Our case was diagnosed as sclerotic aneurysm because of the degeneration of elastic fibers and medial smooth muscle cells. The CT scan of the small aneurysms showed a string-of-beads appearance. It is typical in the renal artery in fibromuscular dysplasia. However, the pathologic specimen of our case did not show the specific findings of fibromuscular dysplasia, namely, irregularly arranged subendothelial mesenchymal cells within a loose matrix of fibrous connective tissue projecting into the vessel lumen.<sup>7</sup> And there were no typical findings of segmental arterial mediolysis, which have been reported as rare cases of SMA aneurysm.<sup>3,4,6,8</sup> And the clinical presentation and serology workup excluded the main collagen disorders.

The rupture of SMA aneurysms is a life-threatening complication. The incidence of SMA aneurysm rupture was reported to range from 10% to 38%. And, the mortality rate of SMA aneurysm rupture reached 40% to 60%.<sup>4-6,9</sup> The size of nonruptured SMA aneurysms ranged from 1.0 to 8.0 cm.<sup>6,9</sup> However, the extent of rupture could not be predicted based on the size. In general, elective repair is recommended for aneurysms larger than 2.0 cm.

Some previous reports have recommended simple ligation of the aneurysm with the assessment of bowel



**Fig 4.** Histologic specimen of the aneurysm wall showing destroyed media with disrupted elastic fibers and fibrocellular intima thickening (elastica-van Gieson stain, original magnification: right  $\times 20$ , left  $\times 100$ ).

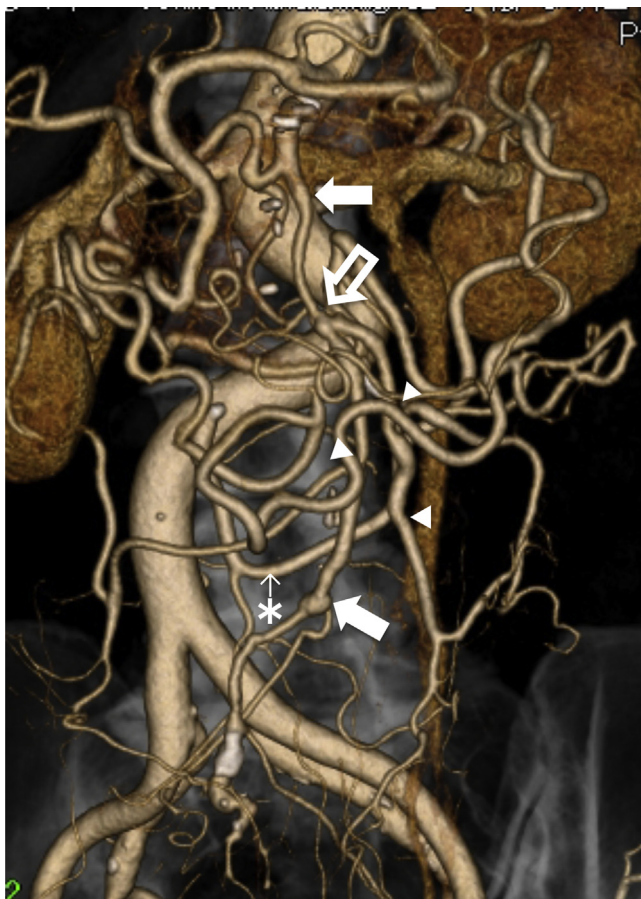
viability.<sup>6,10</sup> This procedure is acceptable for some cases that have enough collateral circulation from the celiac artery or the inferior mesenteric artery. The assessment of bowel viability is performed by visual inspection, Doppler signals, intravenous fluorescent administration, and second-look exploration. If bowel ischemia is present, revascularization, or bowel resection is needed.

Recent reports have shown promising long-term results with aneurysmectomy and revascularization using an autologous vein graft or prosthetic graft.<sup>8,9,11,12</sup> Because the aneurysms in this case were huge, extensive, and multiple, almost all the jejunoileal branches were originated from the aneurysms. We predicted poor collateral circulation from the celiac artery and requirement of embolization for the residual small aneurysms in the future. We chose revascularization of the SMA main trunk, the two jejunoileal arteries, and the ileocolic artery. The middle colic artery was not reconstructed because it had collateral supply from the ileocolic artery and the left

colic artery. However, the collateral supply was not enough considering the consequence of the postoperative melena and diarrhea. It was assumed that intraoperative bowel ischemia was the additional cause of melena, and SMA plexus dissection was also correlated with diarrhea.

Recently, endovascular repairs such as transcatheter embolization or stent graft replacement have been proven as useful alternatives to open surgery.<sup>9,13-15</sup> However, the indication for endovascular repairs is confined to anatomically suitable lesions and still has the risk of bowel ischemia.

An adequate repair for the SMA aneurysms should be chosen based on the size, site, shape, extent, and collateral circulation of the lesions. Open repair is optimal for extensive cases because it can reconstruct more branches. In this article, we presented open reconstructive surgery using an autologous vein graft for multiple huge SMA aneurysms.



**Fig 5.** Computed tomography (CT) scan at 4 years post-operative showing development of the ascending branch of the left colic artery and the marginal artery. *Arrows*, the proximal and distal side of the superior mesenteric artery (SMA) main trunk interposition graft; *Open arrow*, the bifurcation of the branched vein graft; *Arrow heads*, the anastomoses of the second, third jejunoileal arteries and the ileocolic artery; *Asterisk arrow*, the left colic artery.

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