

# Open thrombectomy, patch angioplasty, and retrograde stenting for isolated superior mesenteric artery dissection

Yuchi Ma, BS,<sup>a,b</sup> Bright Benfor, MD,<sup>a</sup> Shrishiv Timbalia, MD,<sup>a</sup> Mahnoor Zia, MD,<sup>a</sup> and Eric K. Peden, MD,<sup>a</sup> *Houston, TX; and Richmond, VA*

## ABSTRACT

Isolated superior mesenteric artery dissection without aortic involvement is an exceptionally rare event. Nonoperative management remains the first-line therapy. However, surgical interventions can be indicated in the event of bowel ischemia. In the present report, we describe a case of complicated isolated superior mesenteric artery dissection treated with a hybrid approach. (*J Vasc Surg Cases Innov Tech* 2024;10:101512.)

**Keywords:** Dissection; Hybrid repair; Isolated superior mesenteric artery dissection; Mesenteric Ischemia; Superior mesenteric artery

Isolated superior mesenteric artery dissection (ISMAD) without associated aortic dissection is a rare condition that can lead to bowel ischemia without timely diagnosis and management. Due to the widespread use of computed tomography angiography (CTA), the ability to diagnose ISMAD has improved, along with a decrease in mortality.<sup>1</sup> Currently, treatment of ISMAD ranges from medical therapy to surgical repair.<sup>2</sup> Although the vast majority of cases are managed nonoperatively, symptomatic ISMAD concerning for bowel ischemia warrants urgent surgical intervention.<sup>2</sup> In this report, we present a case of complicated ISMAD treated with a hybrid approach. The patient provided written informed consent for the report of his case details and imaging studies.

## CASE REPORT

A 47-year-old man with no significant clinical history was transferred from an outside hospital with complaints of constant epigastric pain that was waxing and waning in severity for several days before suddenly worsening that morning. Abdominal CTA revealed a short-segment dissection in the superior mesenteric artery (SMA) with occlusive thrombosis in the false lumen of the main trunk and jejunal branches that reconstituted distally but with no signs suggesting bowel ischemia. On admission, the patient was hypertensive at 180/101 mm Hg

and had moderate abdominal tenderness to palpation without signs of peritoneal irritation. He did not have any known cardiovascular risk factors and was not taking any medications. Given the absence of signs of complications, we opted for nonoperative management with intravenous heparin and antihypertensive agents. His symptoms improved in the following days until hospital day 6 when he started experiencing postprandial abdominal pain and tenderness on percussion. Repeat CTA demonstrated propagation of thrombus further into the distal SMA and jejunal branches with increased surrounding fat stranding (Fig 1). Given these new findings, the patient was urgently brought to the operating room for surgical management.

A midline laparotomy was performed and the entire bowel examined, with no signs of necrosis. The SMA was then identified and dissected, with its distal branches and neighboring branches of the superior mesenteric vein controlled using vessel loops (Fig 2, A). After confirmation of the dissection using intraoperative ultrasound, proximal and distal control was obtained, and a longitudinal arteriotomy was made, revealing the occlusive thrombus in the false lumen, which was consistent with the preoperative CTA findings. The arteriotomy was extended until healthy vessel was observed, and the thrombus was then evacuated (Fig 2, B). The false lumen was then tacked down with 7-0 polypropylene sutures, and patch angioplasty was done using a segment of great saphenous vein (Fig 2, C and D). Next, retrograde stenting was performed through a defect left in the patch (Fig 3, A). After confirmation of healthy true lumen proximal to the entry tear using intravascular ultrasound, an 8-mm × 40-mm Innova stent (Boston Scientific) was deployed, with the distal end of the stent landing in the proximal portion of the patch (Fig 3, B). A completion angiogram demonstrated satisfactory flow in the SMA and its branches. However, confirmatory ultrasound revealed a dissection flap at the distal end point of the patch, requiring further tacking of the false lumen and distal extension of the patch. Significant narrowing was found distal to the patch extension on repeat angiography, which we believed was due to vasospasm. This was resolved by serial dilatation and papaverine injections.

From the Department of Cardiovascular Surgery, Houston Methodist Hospital, Houston<sup>a</sup>; and the School of Medicine, Virginia Commonwealth University, Richmond.<sup>b</sup>

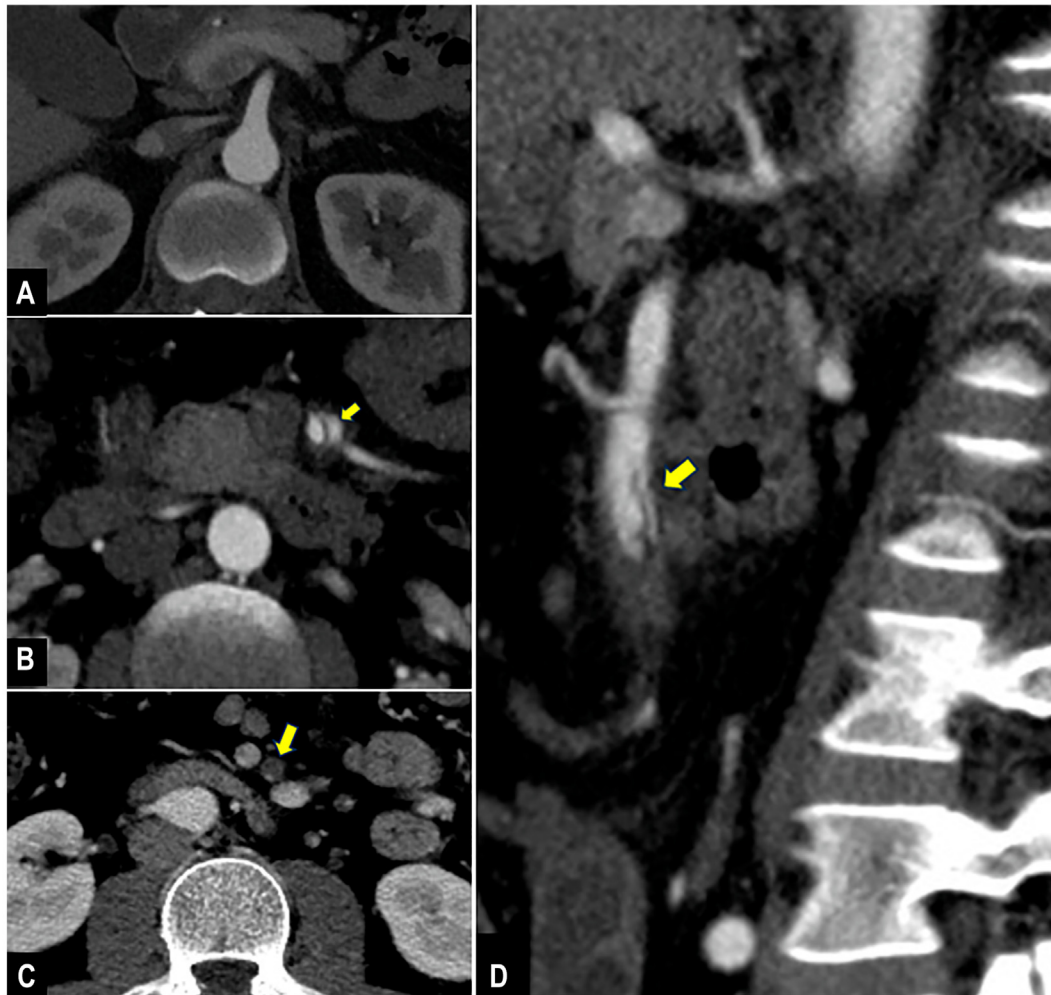
Correspondence: Eric K. Peden, MD, Department of Cardiovascular Surgery, Houston Methodist Hospital, 6550 Fannin St, Ste 1401, Houston, TX 77054 (e-mail: [ekpeden@houstonmethodist.org](mailto:ekpeden@houstonmethodist.org)).

The editors and reviewers of this article have no relevant financial relationships to disclose per the JVS policy that requires reviewers to decline review of any manuscript for which they may have a conflict of interest.

2468-4287

© 2024 The Author(s). Published by Elsevier Inc. on behalf of Society for Vascular Surgery. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

<https://doi.org/10.1016/j.jvscit.2024.101512>



**Fig 1.** Computed tomography angiography (CTA) showing isolated superior mesenteric artery (SMA) dissection. **A**, Patent origin of the SMA. **B**, Dissection flap shown at the proximal extent (arrow). **C**, Occlusive thrombus (arrow) in the false lumen of the distal SMA. **D**, Sagittal view showing SMA dissection (arrow).

Completion angiography (Fig 3, C) and ultrasound showed improvement of distal stenosis and excellent flow to the SMA branches. The immediate postoperative course was marked by complete resolution of symptoms and a widely patent SMA on CTA (Fig 4). The patient was discharged on postoperative day 6 with aspirin and apixaban. The early postoperative course was marked by abdominal pain and episodes of diarrhea due to infectious colitis, which responded well to medical treatment. Follow-up CTA on day 45 revealed a patent SMA. At 3 months, the patient was well without significant medical issues.

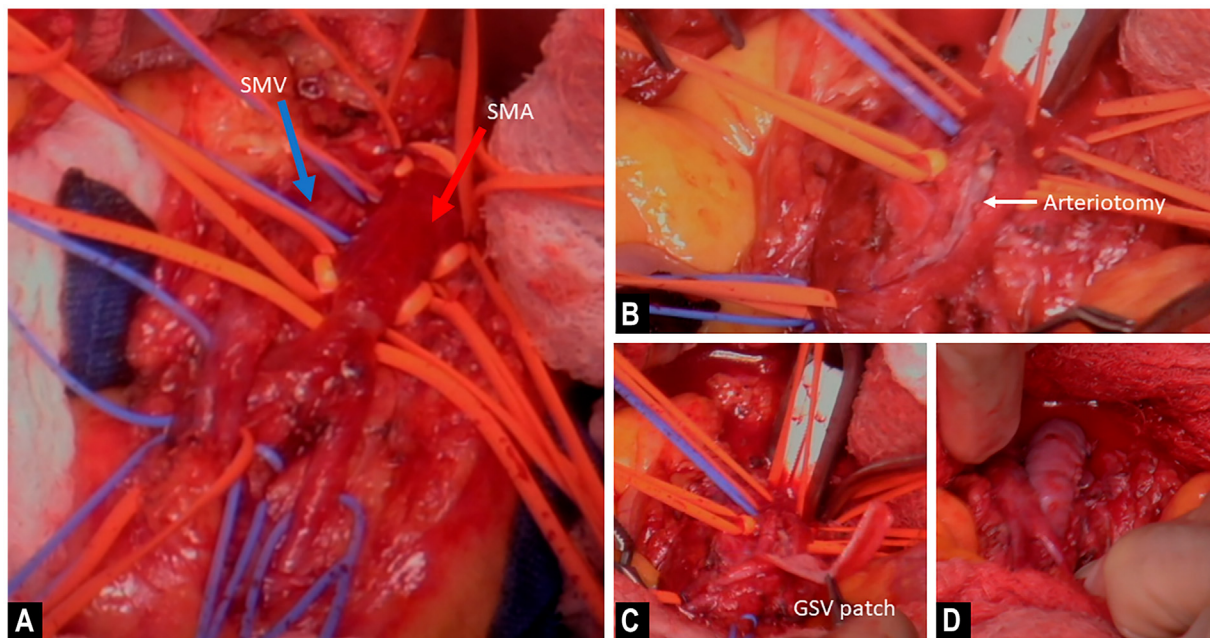
## DISCUSSION

This report details the successful hybrid management of ISMAD with worsening symptoms of malperfusion despite medical therapy. ISMADs without aortic involvement are rare events with a reported annual incidence of 0.08%.<sup>3</sup> However, this pathology is likely underreported due to a lack of specific clinical characteristics and laboratory testing. Although a variety of treatment

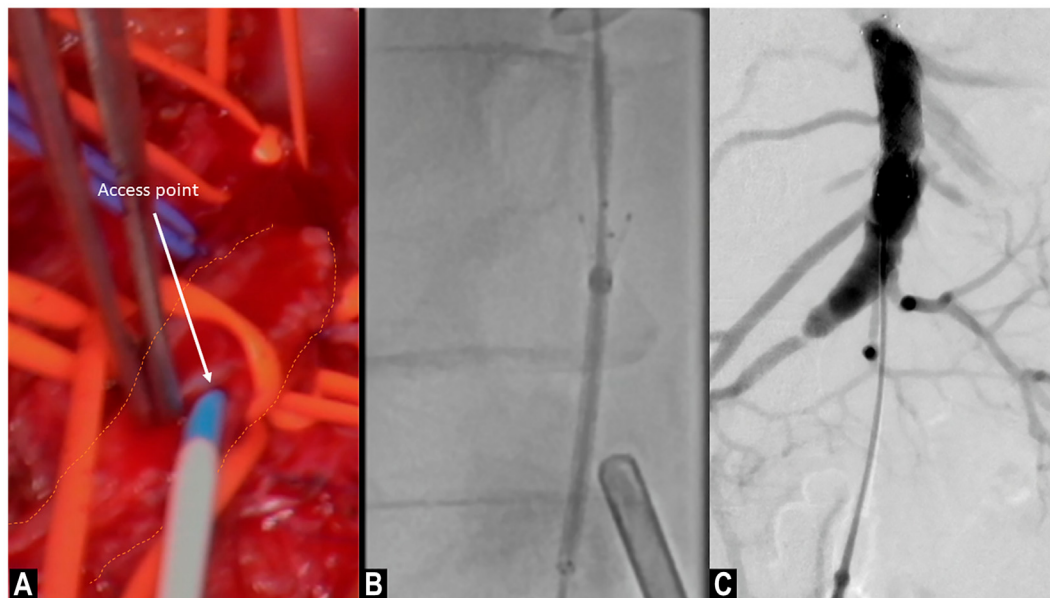
options have been reported, currently, no guideline has been established for the management of ISMADs.

The exact etiology of ISMAD is unknown; however, it has been associated with common cardiovascular risk factors.<sup>1,2,4</sup> Cases of connective tissue disorders, fibromuscular dysplasia, segmental arterial mediolysis, and blunt trauma have also been found in the literature.<sup>5-7</sup> Patients most commonly present with sudden abdominal pain; however, approximately 25% of cases are asymptomatic and discovered incidentally.<sup>4,8,9</sup>

The clinical presentation plays a major role in the initial management of ISMADs. The current case presented with a CTA scan demonstrating dissection and thrombosis localized in the proximal SMA with reconstitution of the distal branches and no signs of bowel ischemia. As a result, the patient was initially treated nonoperatively, mirroring the most common strategy reported in the literature for patients who are stable and without concerns of ischemia.<sup>1,2</sup> Medical therapy typically



**Fig 2.** Surgical repair of isolated superior mesenteric artery (SMA) dissection. **A**, Control of SMA branches and neighboring branches of superior mesenteric vein (SMV). **B**, Longitudinal arteriotomy with thrombus evacuated. **C**, Patch angioplasty using great saphenous vein (GSV). **D**, Aspect of artery after revascularization.

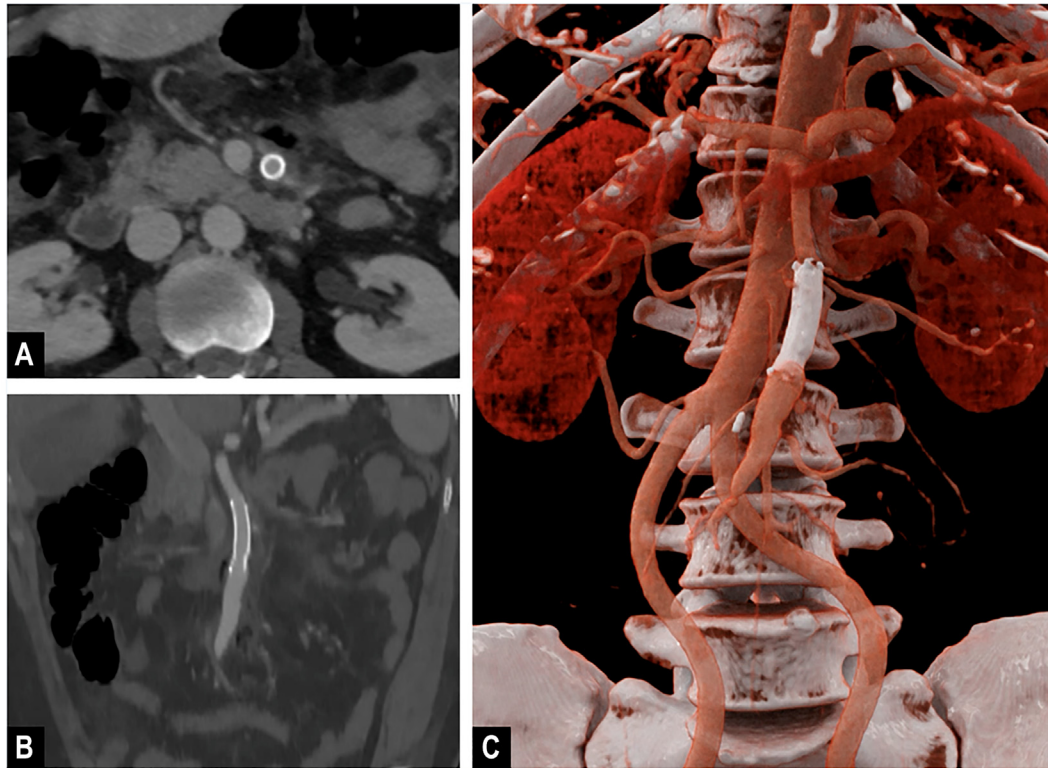


**Fig 3.** Retrograde stenting after patch angioplasty of isolated superior mesenteric artery (SMA) dissection. **A**, Insertion of sheath into a defect in the patch. **B**, Deployment of stent. **C**, Completion angiogram.

includes a combination of antihypertensive, antiplatelet, and anticoagulation medication to prevent dissection propagation and thrombus aggregation. However, no consensus has yet been reached regarding the best acute or long-term regimen.<sup>2</sup> Although numerous studies have reported the routine use of antithrombotic agents, others, including two large cohort studies, found

no differences in clinical outcomes between antithrombotic therapy and observation.<sup>10-12</sup> Furthermore, the investigators stated that antithrombotic therapy could delay thrombosis of the false lumen and lead to further propagation of dissection.<sup>10-12</sup> Medical therapy has been reported to fail for more than one third of patients.<sup>13</sup>





**Fig 4.** Postoperative computed tomography angiography (CTA) demonstrating a patent stent on multiplanar (A and B) and volume rendering (C) reconstructions.

Open surgical repair has been the treatment of choice for patients with uncontrollable abdominal pain or signs of peritonitis, bowel ischemia, aneurysm, or rupture. Options include intimaectomy, mechanical thrombectomy, patch angioplasty, resection, and bypass.<sup>1</sup> Although intimaectomy has advantages for preserving branching vessels, its long-term success is dependent on the integrity of the vessel wall, with a higher propensity for aneurysm development.<sup>14</sup> In the current case, the sudden worsening of symptoms and distal extension of thrombus on repeat CTA were concerning for rapid progression of the dissection, indicating the need for urgent repair to minimize any possible ischemia and prevent necrosis. Because the thrombus was in the false lumen, thrombolysis would have been ineffective. Additionally, the distality of the lesion made stenting alone challenging. Although the concern for bowel necrosis was small based on the CTA findings, we deemed it necessary to examine the bowel due to the aggravation of the symptoms. Ultrasound imaging was used to ensure that all the thrombus was evacuated and the entirety of the dissection was tacked down. Stenting was then performed in retrograde fashion to further reinforce the proximal edge of the repair.

Endovascular stenting is a viable option for symptomatic patients refractory to conservative management

with lesions in the proximal SMA.<sup>15,16</sup> It has also been used in conjunction with open repair, particularly when bowel examination is indicated due to possible ischemia. Stenting of the SMA has preferentially been done using self-expanding stents, rather than balloon-expandable stents, due to their flexibility and ability to conform to the curvature of the SMA.<sup>16</sup> In the present case, a self-expanding stent was used in the proximal portion of the SMA, where the curvature is the greatest.

## CONCLUSIONS

A hybrid approach involving open thrombectomy, patch angioplasty, and retrograde stenting is an effective technique for patients with ISMAD with concerns for bowel ischemia.

## DISCLOSURES

None.

## REFERENCES

1. Ullah W, Mukhtar M, Abdullah HM, et al. Diagnosis and management of isolated superior mesenteric artery dissection: a systematic review and meta-analysis. *Korean Circ J*. 2019;49:400–418.
2. Wang J, He Y, Zhao J, et al. Systematic review and meta-analysis of current evidence in spontaneous isolated celiac and superior mesenteric artery dissection. *J Vasc Surg*. 2018;68:1228–1240.e9.
3. Foord AG, Lewis RD. Primary dissecting aneurysms of peripheral and pulmonary arteries: dissecting hemorrhage of media. *Arch Pathol*. 1959;68:553–577.

4. Luan JY, Guan X, Li X, et al. Isolated superior mesenteric artery dissection in China. *J Vasc Surg*. 2016;63:530–536.
5. Tameo MN, Dougherty MJ, Calligaro KD. Spontaneous dissection with rupture of the superior mesenteric artery from segmental arterial mediolysis. *J Vasc Surg*. 2011;53:1107–1112.
6. Ko M, Kamimura K, Sakamaki A, et al. Rare mesenteric arterial diseases: fibromuscular dysplasia and segmental arterial mediolysis and literature review. *Intern Med*. 2019;58:3393–3400.
7. Shirakabe K, Kanzaki M. Isolated superior mesenteric artery dissection following blunt trauma: a case report. *Surg J*. 2023;9:e89–e91.
8. Kimura Y, Kato T, Nagao K, et al. Outcomes and radiographic findings of isolated spontaneous superior mesenteric artery dissection. *Eur J Vasc Endovasc Surg*. 2017;53:276–281.
9. Luan JY, Li X, Li TR, Zhai GJ, Han JT. Vasodilator and endovascular therapy for isolated superior mesenteric artery dissection. *J Vasc Surg*. 2013;57:1612–1620.
10. Heo SH, Kim YW, Woo SY, Park YJ, Park KB, Kim DK. Treatment strategy based on the natural course for patients with spontaneous isolated superior mesenteric artery dissection. *J Vasc Surg*. 2017;65:1142–1151.
11. Yun WS, Kim YW, Park KB, et al. Clinical and angiographic follow-up of spontaneous isolated superior mesenteric artery dissection. *Eur J Vasc Endovasc Surg*. 2009;37:572–577.
12. Loeffler JW, Obara H, Fujimura N, et al. Medical therapy and intervention do not improve uncomplicated isolated mesenteric artery dissection outcomes over observation alone. *J Vasc Surg*. 2017;66:202–208.
13. Froment P, Alerci M, Vandoni RE, Bogen M, Gertsch P, Galeazzi G. Stenting of a spontaneous dissection of the superior mesenteric artery: a new therapeutic approach? *Cardiovasc Intervent Radiol*. 2004;27:529–532.
14. Satokawa H, Seto Y, Yamamoto A, et al. A case report of aneurysmectomy after thrombo-intimectomy for spontaneous isolated superior mesenteric artery dissection. *Ann Vasc Dis*. 2012;5:204–207.
15. Kim YJ, Beeman BR. Symptomatic spontaneous superior mesenteric artery dissection treated with endovascular stent repair. *J Surg Case Rep*. 2021;2021:rjab326.
16. Lim EH, Jung SW, Lee SH, et al. Endovascular management for isolated spontaneous dissection of the superior mesenteric artery: report of two cases and literature review. *J Vasc Intervent Radiol*. 2011;22:1206–1211.

Submitted Feb 12, 2024; accepted Apr 9, 2024.