Hybrid repair of symptomatic superior mesenteric artery dissection, utilizing open septectomy

Paul Dyrud, MD,[a] Eric Hohenwalter, MD, FSIR,[b] Amer Rasheed, MD,[c] *and* Michael Malinowski, MD, FACS,[d] *Milwaukee, WI*

ABSTRACT

We present a case of acute isolated superior mesenteric artery dissection with symptomatic bowel malperfusion requiring surgical intervention. We recommend clinicians and surgeons maintain a high clinical suspicion for mesenteric ischemia in patients presenting with isolated superior mesenteric artery dissection and describe a hybrid open surgical/endovascular approach that can safely be utilized in patients requiring intervention. (J Vasc Surg Cases Innov Tech 2024;10:101481.)

Keywords: Dissection; Isolated superior mesenteric artery dissection; Superior mesenteric artery; Superior mesenteric artery septectomy; Surgical treatment

Isolated superior mesenteric artery dissection (ISMAD) refers to dissection occurring solely in the superior mesenteric artery (SMA). Initially, this was considered rare, but it now appears to be on the rise, particularly among the Chinese population.[1] Most patients with ISMAD are symptomatic (74%), with abdominal pain as the most common symptom (91%).[2] Most cases of symptomatic ISMAD resolve completely with conservative management; however, cases may progress to aneurysmal rupture, intestinal necrosis, and even death.[2-4] Treatment options for patients with ISMAD include conservative management, with or without antithrombotic therapy and anticoagulation, and endovascular/surgical therapy.[4-6] Endovascular therapy usually involves placement of an SMA stent. Open surgery usually consists of bypass or direct surgical reconstruction.[6-8] There have been approximately 3000 cases of ISMAD reported worldwide, with a mean patient age of 55.1 years and a male predominance (89%).[1]

We describe the case of a 45-year-old male who presented with acute onset of severe abdominal pain and was discovered to have acute ISMAD. He underwent emergent repair, given concern for mesenteric ischemia. We performed open SMA septectomy and circumferential pledgetted arterial reconstruction with patch angioplasty and retrograde stent placement. Informed consent was obtained from the patient for the publication of this report and accompanying images.

CASE REPORT

The patient is a 45-year-old male with no significant past medical history who presented to our satellite hospital emergency department with 1.5 hours of severe and worsening abdominal pain and one episode of emesis. His vitals on arrival were normal, including temperature 97.8 °F, heart rate 83 beats per minute, blood pressure 125/85 mmHg, respiratory rate 16 breaths per minute, and oxygen saturation 95% on room air. Exam noted a medium-build Caucasian male with normal body habitus. His abdomen was soft, non-distended, but with diffuse pain on palpation. He rated his abdominal pain 8 of 10 and received 0.5 mg of hydromorphone in the emergency department with minimal improvement in pain. Labs showed hemoglobin 14.5 g/dL, white blood cell count 11.3 (×10e3/μL), platelets 167 (×10e3/μL), creatinine 1.10 mg/dL, normal liver chemistries, and lactic acid 0.9 mmol/L. His computed tomography (CT) scan (Fig 1) showed long segment SMA dissection with significant narrowing in the true lumen and thrombosed false lumen from just beyond the orifice to the jejunal and right colic branches, with normal enhancing bowel throughout. Vascular surgery was contacted by the emergency department, therapeutic intravenous heparin was started with bolus, and the patient was accepted in transfer to the surgical intensive care unit at our institution. Although he received additional doses of intravenous hydromorphone prior to and on arrival, when interviewed by the vascular surgery team, he reported ongoing abdominal pain. Given his persistent pain, we felt that he was at elevated risk for progression, with concern for ongoing mesenteric ischemia. The decision was made to proceed immediately to the operating room for abdominal exploration for evaluation of bowel viability with SMA reconstruction. Given the length of the dissection, which involved jejunal and right

From the Department of Surgery, Division of Vascular and Endovascular Surgery, Medical College of Wisconsin[a]; the Department of Radiology, Division of Vascular and Interventional Radiology, Medical College of Wisconsin[b]; the Department of Radiology, Division of Vascular and Interventional Radiology, Medical College of Wisconsin[c]; and the Department of Surgery, Division of Vascular and Endovascular Surgery, Medical College of Wisconsin.[d]

Correspondence: Paul Dyrud, MD, Vascular and Endovascular Surgery Fellow, Department of Surgery, Division of Vascular and Endovascular Surgery, Medical College of Wisconsin,1345 Blazing Star Court, Oconomowoc, WI 53066 (e-mail: pdyrud@mcw.edu).

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

2468-4287

https://doi.org/10.1016/j.jvscit.2024.101481

Fig 1. Preoperative computed tomography (CT) shows long segment superior mesenteric artery (SMA) dissection with significant narrowing in the true lumen and thrombosed false lumen from just beyond the orifice to the jejunal and right colic branches.

colic branches, we were concerned initially that a totally endovascular approach with stent placement may occlude proximal branches, leading to further intestinal ischemia. Upon entering into the abdomen, there was evidence of diffuse ischemia throughout, with most of the small bowel appearing purple and blue and without peristalsis. After this exploration, the patient had a significant and prolonged episode of hypotension with systolic blood pressures in the 60s and heart rates into the 30s. The operation was momentarily paused to allow our anesthesia colleagues to resuscitate the patient for roughly 10 to 15 minutes, which resulted in improvement back to his baseline vitals after aggressive fluid resuscitation. At this point, the decision was made to proceed with exposure of the SMA at the root of the mesentery. Intraoperative ultrasound was performed to assist with isolating the SMA and determining the extent of dissection; a representative image is shown in Fig 2. The SMA was directly exposed, and all side branches were carefully dissected out and controlled with vessel loops. At this point proximally, we were in a retropancreatic location, which was the maximal extent of our proximal open exposure. The patient was systemically heparinized. Proximal and distal clamp control was obtained. The true lumen was entered and defined throughout the entirety of the dissected SMA segment, and in correlation with the CT scan was highly diminutive. Open septectomy was performed (shown in Fig 3), and extensive reconstruction of the artery was performed with free pledget sutures to make sure to tack down proximal and distal endpoints in complete circumferential rings of our intimal flap as well as recreation of the mid portion where the open septectomy was performed

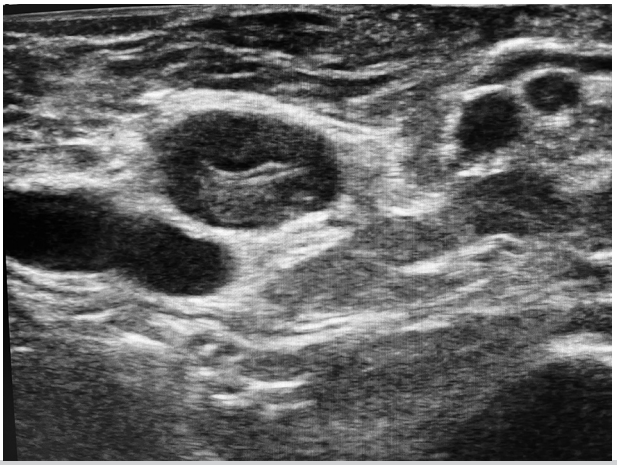

Fig 2. Intraoperative ultrasound demonstrates false lumen thrombus and diminutive true lumen.

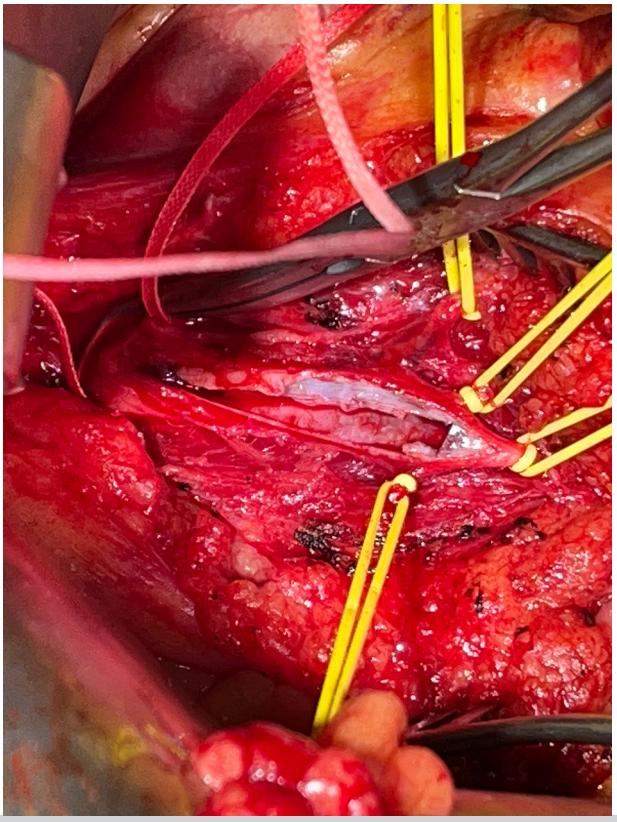

Fig 3. Superior mesenteric artery (SMA) septectomy.

(pledgetted reconstruction is shown in Fig 4). At this point, all lumens had appropriate backbleeding, and a patch repair was performed once again using free pledgets throughout with a 6-cm length bovine pericardial patch (completed repair is shown in Fig 5). Flow was resumed to the bowel, and there was evidence of pulsatility at all major branch points. There was complete return of normal coloration of the small bowel. Based on the fact that the patient did have extension of his dissection into the proximal SMA, which was not accessible

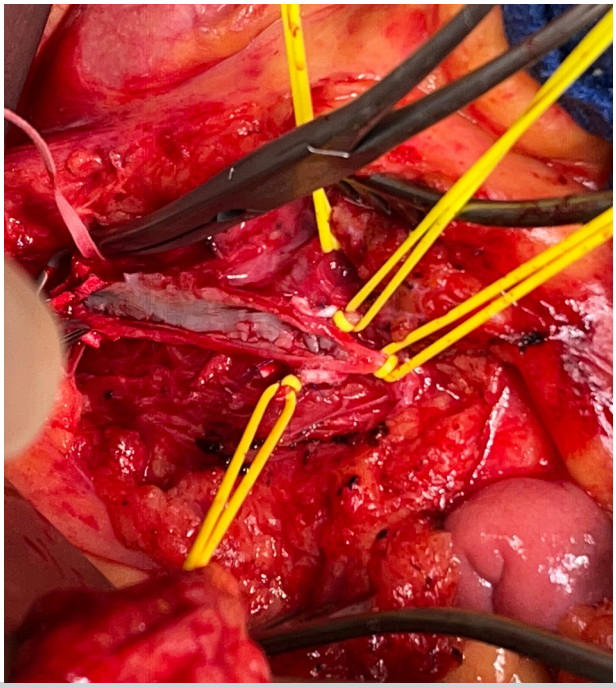

Fig 4. Superior mesenteric artery (SMA) septectomy after pledgetted reconstruction.

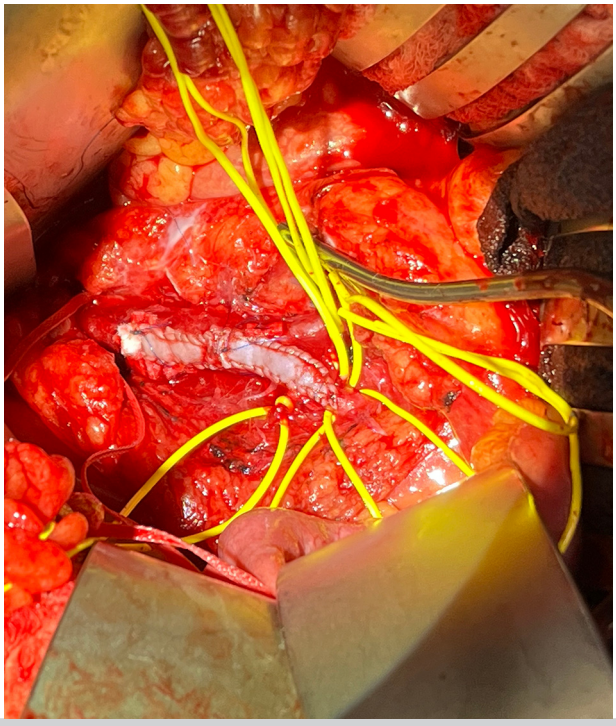

Fig 5. Completion patch angioplasty.

through our open exposure, retrograde angiography was performed through a 6-French sheath and demonstrated proximal SMA true lumen narrowing extending in proximity to but not including the origin. At this point, the entry tear of that dissection in the intramural hematoma was treated with a 7- × 39-mm bare-metal balloon expandable stent with good angiographic result post deployment (completion retrograde angiography is shown in Fig 6). The proximal landing zone was approximately 1 cm distal to the SMA origin, as the SMA did not demonstrate any narrowing or dissection at the orifice. Given the vessel friability in the acute dissection setting, we did not perform any further post deployment dilation. There was a small area of residual dissection that did not appear flow-limiting. Additionally, stenting this would have resulted in significant side branch coverage. There was no evidence of any rupture or disruption of the artery, and there was intact outflow through all main branches. At this point, our sheath was removed, and the arteriotomy was closed with an interrupted 5-0 figure-of-eight stitch. Some additional pledgetted repair was necessary after stenting at our proximal suture line and would have been exceedingly difficult, given the state of the vessel wall in the setting of fresh dissection had we not initially performed circumferential pledgetted repair. The patient had a strong pulse throughout the SMA with triphasic Doppler signals at all major branch points. The bowel was evaluated at this point and appeared pink and viable and with good peristalsis throughout. As is the practice at our institution, at this point, we asked our acute care surgery colleagues to evaluate the small bowel and colon for any signs of ischemia, and our acute care surgery surgeon agreed that there were no ongoing signs of malperfusion or nonviable portions. An ABthera

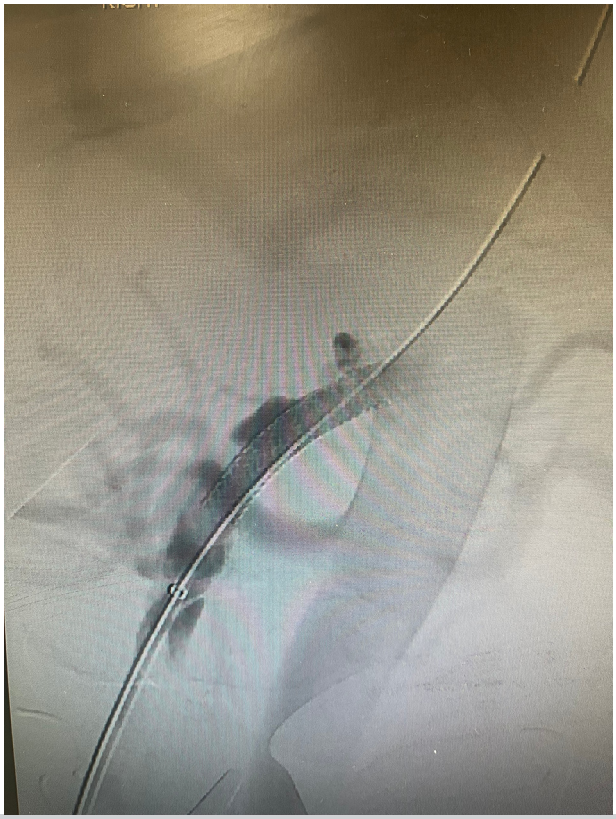

Fig 6. Completion retrograde superior mesenteric artery (SMA) angiography.

Fig 7. Postoperative computed tomography (CT) scan demonstrates widely patent proximal superior mesenteric artery (SMA) stent and SMA patch reconstruction.

temporary vacuum-assisted abdominal closure device was placed, with a plan to return to the operating room in 24 to 48 hours or sooner if indicated based on clinical status. The patient was awakened from general anesthesia at that time and transferred back to the surgical intensive care unit.

His immediate postoperative course was unremarkable, and he was transferred to the floor on postoperative day 1. His heparin was continued, and he was started on rectal aspirin, with subsequent change to just daily oral aspirin 81 mg and clopidogrel with resumption of diet. A nasogastric tube was maintained for gastric decompression, and he returned to the operating room for abdominal washout and closure at 48 hours after his initial operation. The entirety of the small bowel and colon was evaluated and was healthy appearing. He was discharged to home on postoperative day 8. In outpatient follow-up, he continues to do well and is maintained on aspirin and clopidogrel, and 6-week CT scan (with representative image shown in Fig 7) demonstrated widely patent proximal SMA stent and SMA patch reconstruction with some evidence of a single distal branch occlusion downstream that appeared to be chronic with well-collateralized flow around this area. He continues taking dual antiplatelet therapy with planned repeat visit in 6 months with CT scan.

DISCUSSION

Initial medical management of ISMAD with heart rate and blood pressure control, aspirin, and often anticoagulation with heparin often resolves the need for procedural intervention. At our institution, we use heart rate goals of less than 80 bpm, and systolic blood pressure goals of less than 120 mmHg. If we proceed with medical management alone, we generally re-image at 48 hours, depending on clinical course. We feel that having a low threshold for proceeding to the operating room is important based on clinical symptoms alone and especially when CT angiographic findings demonstrate long segment and narrowed true lumen, as patients can have imaging findings that underestimate the level of intestinal ischemia as in this young, otherwise healthy patient. In the reported patient, in addition to having no evidence of hypo-enhancing bowel on CT, his labs, including his lactic acid, remained normal, and therefore, the decision to proceed to the operating room was based on clinical gestalt and heavily influenced by his ongoing abdominal pain despite several doses of intravenous hydromorphone.

From an operative standpoint, we feel that performing patch repair with circumferential felt pledgets at the proximal and distal extents of the septectomy is highly important and cannot be understated because of the friability of the artery in the acute dissection setting to preserve proximal and distal endpoint patency and integrity but also to create a durable zone to stent into from the proximal arterial tear. This is also critical to maintain involved branch perfusion, including the jejunal and right colic branches as seen in this patient. In the case described, after our patch repair was complete, we accessed the pericardial patch to perform retrograde stenting after preplacing a figure-of-eight closing stitch. After achieving pulsative inflow following stenting, there was some distention of the patch and partial disruption of the proximal suture line of the patch, causing significant momentary bleeding. In the absence of preplaced pledgets, it would have been difficult to safely reinforce our suture line and could have led to significant ongoing hemorrhage, given the inability to gain higher level proximal control without visceral rotation and the extreme friability of the vessel wall due to acute dissection.

CONCLUSION

We present a case of acute ISMAD with symptomatic bowel malperfusion requiring surgical intervention. The proposed technique of open arterial exploration with septectomy with proximal and distal circumferential pledgetted wall reconstruction with patch angioplasty allows for safe and durable access for retrograde stent placement to prevent arterial rupture, hemorrhage, or continued dissection physiology that could be fatal in this young patient cohort.

DISCLOSURES

None.

REFERENCES

1. Mei J, Jia Z. Isolated superior mesenteric artery dissection: an updated review of the literature. *J Interv Med*. 2023;6:69–73.
2. Jia Z, Chen W, Su H, et al. Factors associated with failed conservative management in symptomatic isolated mesenteric artery dissection. *Eur J Vasc Endovasc Surg*. 2019;58:393–399.
3. Subhas G, Gupta A, Nawalany M, Oppat OF. Spontaneous isolated superior mesenteric artery dissection: a case report and literature review with management algorithm. *Ann Vasc Surg*. 2009;23:788–798.
4. Wang J, Yazhou H, Jichun Z, 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.
5. Ahn HY, Cho BS, Mun YS, et al. Treatment results for spontaneous isolated superior mesenteric artery dissection according to our previous guidelines and collective literature review. *Ann Vasc Surg*. 2014;28:1595–1601.
6. Kimura Y, Kato T, Moriaki I. Outcomes of treatment strategies for isolated spontaneous dissection of the superior mesenteric artery: a systematic review. *Ann Vasc Surg*. 2018;47:284–290.
7. Park YJ, Park KB, Kim DI, Do YS, Kimand DK, Kim YW. Natural history of spontaneous isolated superior mesenteric artery dissection derived from follow-up after conservative treatment. *J Vasc Surg*. 2011;54:1727–1733.
8. Takahashi B, Nakayama Y, Shiroma S, Ido K. Three case report of spontaneous isolated dissection of the superior mesenteric artery: with an algorithm proposed for the management. *Ann Vasc Dis*. 2015;8:120–123.

Submitted Dec 19, 2023; accepted Feb 27, 2024.