

Management of devastating mesenteric trauma leading to short gut syndrome

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WHAT WOULD YOU DO?

A 60-year-old female with no previous medical history presented to our level I trauma center as a restrained passenger following a motor vehicle crash, complaining of abdominal pain. On primary survey, she was hypotensive with a blood pressure of 63/39 with an abdominal seat belt sign on exposure. She started receiving blood products and had a positive focused assessment with sonography in trauma in the upper abdominal quadrants. She was taken emergently for an exploratory laparotomy after not responding to resuscitation.

At index damage control laparotomy, she was found to have extensive injury of the central mesentery with active bleeding. The root of the mesentery was explored, with bleeding seen from a branch of the superior mesenteric vein (SMV). The bleeding was controlled with a clip while ensuring the SMV and the superior mesenteric artery (SMA) were patent. A perforation of the fourth portion of the duodenum was repaired primarily in 2 layers with 2–0 polydioxanone (PDS) suture. The right colon was removed due to a colonic perforation, and 107 cm of the mid-small bowel was resected with associated mesenteric injury. Extensive Morel-Lavallée lesions were seen in the abdominal wall bilaterally. An Abthera wound vac was placed in the abdomen, and the patient was taken to the intensive care unit (ICU).

Postoperatively, the patient underwent completion imaging, revealing an occlusion of the SMV and hyperenhancement of the remaining bowel with no other traumatic injuries ([figure 1](#)). Despite ongoing resuscitation, she was noted to have a worsening lactic acidosis and pressor requirement. She returned to the OR for exploration with ischemia of the remaining distal small bowel ([figure 2](#)). The bowel was necrotic with a clear demarcation at 40 cm of jejunum from the ligament of Treitz. The root of the SMA had a palpable pulse, but the distal segmental branches were thrombosed. Vascular surgery was present and suspected that the SMV thrombosis led to the distal SMA occlusion. Given no role for vascular intervention, the SMA was ligated distal to the middle colic artery, and the SMV was ligated at the same level. Necrotic bowel was resected. The patient was temporarily closed and returned to the ICU with 40 cm of small bowel distal to the Ligament of Treitz and mid-transverse colon to the rectum in discontinuity. Remaining bowel viability was to be re-evaluated on return to the OR.

How would you manage the remaining bowel in the setting of extensive abdominal wall damage in a patient with only this isolated abdominal trauma?

- Controlled drainage of the proximal bowel with gastric decompression.
- End jejunal ostomy with a possible mucus fistula.
- Jejunum-colonic anastomosis.
- Do not offer further surgery and refer patient to palliative.

WHAT WE DID AND WHY

C. Jejunum-colonic anastomosis

The patient went to the ICU after resection of the remaining distal small bowel and ligation of the SMV and SMA with a temporary closure. Her pressors were down-titrated, and lactic acid was normalized. Given the extensive small bowel resection, the patient was at high risk for short gut syndrome with only 40 cm of jejunum left, the remaining left colon, and an intact duodenum that suffered a perforation in the fourth section. We discussed the high likelihood of total parenteral nutrition (TPN) dependence and associated risk with the patient's family. The family understood that even if the patient survived, she would need referral to a small bowel transplant center for management and possible transplant.

She returned to the operating room on post-operative day 3, and the remaining bowel was healthy without signs of ischemia. On her CT of the abdomen and pelvis, her abdominal wall was injured from the accident with disruption of her rectus abdominis muscles and severe fascial retraction with large Morel-Lavallée lesions in the subcutaneous space ([figure 3](#)). We wanted to attempt bowel salvage to avoid further losses. Performing an anastomosis would prevent the need for an endostomy through a difficult abdominal wall and save centimeters of bowel lost during stoma creation. We reconstructed the bowel by doing a hand-sewn jejunal colonic anastomosis. Hand-sewn anastomosis was selected to avoid any further loss of viable bowel length that could occur with a stapled anastomosis through orientation or technical error leading to revision. The staple line was removed from the jejunal end, and the small bowel was sewn end-to-side to the remaining transverse colon. The anastomosis was constructed in two layers. An inner layer with full thickness running 3–0 PDS and an outer layer interrupted 3–0 silk ([figure 4](#)).

Devastating mesenteric injuries cause disruption of collateral blood supply, which can impact bowel

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Figure 1 Coronal CT abdomen/pelvis with superior mesenteric vein thrombosis and hyperenhancement of remaining bowel.

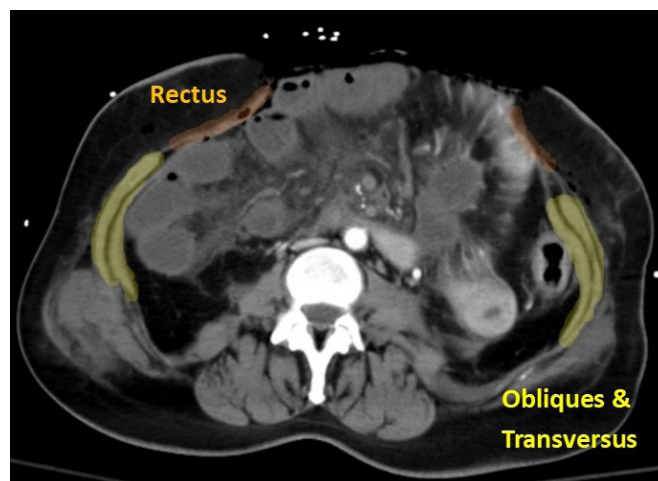


Figure 3 Axial CT with abdominal wall labeled. Oblique and transversus abdominus muscles labeled in yellow showing retraction. Rectus abdominis muscles labeled in orange with disruption of the right and the left severely damaged.

perfusion and is important to understand for management. Fullen *et al* developed an anatomic classification of SMA injuries by zones: zone 1, aorta to the inferior pancreaticoduodenal artery (IPDA); zone 2, inferior pancreaticoduodenal to middle colic artery; zone 3, distal to middle colic; and zone 4, segmental branches. The distal zone 3 ligation of the SMA suggests the 40cm of jejunum is supplied either from preserved segmental jejunal branches or from the IPDA. The mid-transverse colon near the anastomosis is supplied through the inferior mesenteric artery via not only the marginal artery but also the middle colic



Figure 2 Intraoperative photograph of ischemic small bowel in the right abdomen supplied by the superior mesenteric artery. Proximal jejunum noted in the left abdomen and the remaining transverse colon is elevated without signs of ischemia.

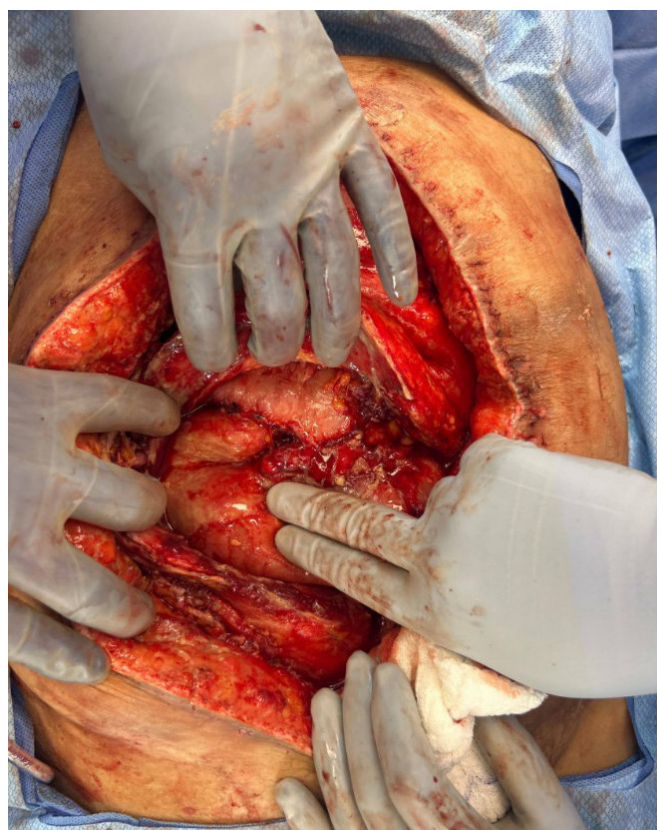


Figure 4 Jejunal-colonic anastomosis.

artery from the SMA, which is still seen on follow-up CT scans from the SMA stump. The anatomy of the SMA is variable and complex, which is why delayed closure was chosen to re-evaluate perfusion. While primary repair or bypass is preferred for proximal SMA trauma; ligation is an option with the more distal ligations at zone 3 or 4 being associated with a higher chance of good outcomes as seen in case series by Fullen and others.^{1,2}

Postoperatively, she was started on TPN and returned to the OR on hospital day 6 without any new findings. The abdominal wall was closed with a bridging Vicryl mesh. She recovered from surgery but was noted to have bilious output from the midline on hospital day 13. Re-exploration with mesh explantation did not show a source of leak with the anastomosis intact, but the remainder of the abdomen had thick adhesions. An abdominal drain was placed and the skin was closed to manage her as a controlled leak. CT scans did not show a radiograph leak, but her postoperative drain was bilious, consistent with a clinical leak. Her drain output decreased and changed to a non-bilious color from a presumed healed leak with conservative management of strict *nil per os* (NPO) and parenteral nutrition. She was discharged home on TPN with referral to a small bowel transplant center. Postdischarge, she has been out of the hospital with frequent clinic follow-up to monitor her recovery. The patient was started on oral nutrition for pleasure without any observed changes in her abdominal drain output. The drain was removed, and she is tolerating oral intake at home while continuing TPN 24 hours a day. Unfortunately, her insurance limits out-of-state transplant evaluation, but she is following with gastroenterology for short gut syndrome management.

Short gut syndrome is defined as intestinal malabsorption associated with less than 200 cm of small bowel.³ Traumatic injuries both blunt and penetrating do contribute to the incidence of this rare disease.⁴ Patients can generally avoid TPN if they have a minimum of 60–90 cm of small bowel with colon or 150 cm of small bowel with no colon.⁵ Malabsorption can lead to fluid loss from diarrhea, excess acid secretion and poor nutritional absorption due to high transit times, which can be treated with medications. Transplant centers often re-establish intestinal continuity for the greatest treatment benefit.⁵ Medications like teduglutide, a glucagon-like peptide-2, help the intestine absorb more fluid by stimulating the growth of the intestinal lining surface area by increasing the height of the villi and depth of the crypts.⁶ Patients who fail medical management may benefit from small bowel transplantation. Bowel transplantation is generally considered for patients who have failed parenteral nutrition due to liver disease, line-associated complications, diseases with high risk of

death or low acceptance of parenteral nutrition.⁶ Examples of diseases with high risk of death include desmoid tumors associated with familial adenomatous polyposis, congenital mucosal disorders, ultrashort bowel syndrome with only 20 cm of bowel.⁶ Small bowel transplant can be isolated to the small intestine or multivisceral with concurrent liver transplantation.⁷ This case highlights the available options for patients facing devastating mesenteric injuries.

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