Traumatic Injury of the Superior Mesenteric Vein: Ligate, Repair or Shunt?

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Abstract

We report a case of SMV injury in a critically ill patient. The patient was a 19-year-old woman involved in a motor vehicle collision. Her injuries included grade II splenic and renal lacerations, devascularized and lacerated right and transverse colon, a transected transverse mesocolon, a massive shear injury of her abdominal wall, and two partial SMV transections. At initial damage control laparotomy, the SMV was ligated, the devascularized bowel resected and a temporary abdominal closure applied. At re-operation, a mesocaval shunt using saphenous vein was employed. The shunt failed and the patient required a saphenous vein jump graft. Although visceral vascular injuries are rare, ligation of the SMV in a damage control situation is acceptable. This case study is the first to discuss appropriate treatment when interruption to a patient's collateral visceral venous drainage limits the surgeon's ability to ligate. In these situations, bypass shunts may be successful.

Key Words

Superior mesenteric vein · Injury · Shunt

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Introduction

Traumatic injury of the superior mesenteric vein (SMV) is frequently associated with significant morbidity and mortality. Although management options include ligation, venorrhaphy and various shunts, clinical equipoise remains. We present a case of SMV injury in a critically ill, blunt mechanism patient with multiple associated injuries.

Case Report

An otherwise healthy 19-year-old woman presented to a Level I trauma center after surviving a high-energy motor vehicle collision. She was a backseat passenger in a sport utility vehicle that collided with a concrete barrier at highway speed. Seat belt use was confirmed.

The patient was managed according to the Advanced Trauma Life Support protocol on arrival. Her initial blood pressure was 92/55 mmHg, her pulse was 119 beats/min, her respiratory rate was 22 breaths/min and her Glasgow coma scale was 13. Her vital signs stabilized with 2 l of crystalloid solution. Pulmonary and cardiovascular examinations were normal. Her abdominal examination revealed distension, diffuse tenderness and a massive disruption of her anterior abdominal wall with associated epidermal ecchymosis. Her hemoglobin was 78 g/l. Chest and pelvis radiographs were normal. Computed tomography (CT) confirmed a grade II splenic laceration, grade II renal laceration, free intra-peritoneal fluid, and a large disruption of the patient's abdominal wall (Figure 1). Her chest and head CT scans were normal.

After intubation, the patient was given 2 units of packed red blood cells and prepared for an emergent laparotomy. The abdomen was packed in the standard fashion. Approximately 2 l of intra-peritoneal blood was evacuated. Injuries included: non-bleeding splenic and renal lacerations, a devascularized and lacerated

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Figure 1. Computed tomography of the patient's massive abdominal wall injury and intra-peritoneal free fluid.

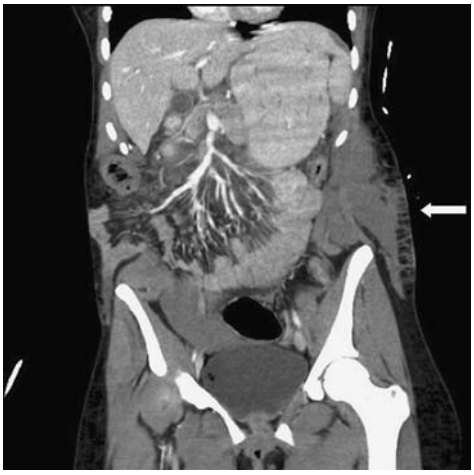

Figure 2. Mesocaval shunt.

right and transverse colon, a transected transverse mesocolon, two partial SMV transections (1 cm in length each, with approximately 1 cm between lacerations) just proximal to the third portion of the duodenum, and a massive bilateral shear injury of the patient's abdominal wall extending posteriorly to her flanks.

Damage control maneuvers were employed as the patient was hypothermic (temperature = 35.4°C), acidotic (pH = 7.19) and coagulopathic (INR = 1.8). Control of the SMV injury was achieved with two vascular clamps. The vein was then ligated with a non-absorbable stitch. An extended right hemicolectomy was completed without intestinal anastamosis. A temporary abdominal closure (TAC) was applied and the patient was admitted to the intensive care unit (ICU) for physiologic stabilization.

Approximately 10 h after the initial procedure (temperature = 37.6°C, pH = 7.38, INR = 1.1, lactate = 6.1), she was returned to the operating room for a second laparotomy. Her small bowel was dark in color. The vascular surgery service was consulted and performed a mesocaval shunt using a reversed saphenous vein graft (Figure 2). Her small bowel immediately became pink and well perfused. She was then heparinized, once a splenectomy was completed. Her abdominal wall was also partially reconstructed. Another TAC was applied and she was returned to the ICU.

Unfortunately, within 60 min of the procedure, her small bowel once again appeared ischemic through the clear plastic TAC drape. At both Doppler ultrasound and operative exploration, the graft was patent however flow through the conduit was poor. The mesocaval shunt was then taken down and replaced with a saphenous vein jump graft. This graft bypassed the injury by connecting the proximal and distal SMV. The small bowel responded favorably.

She underwent a final operative procedure 24 h later for an end ileostomy and definitive abdominal wall closure. Only 7 cm of additional intestine was resected. The patient was discharged from the ICU within 7 days, and from the hospital on post-operative day 49. She is still improving clinically at her 6-month follow-up.

Discussion

Visceral vascular injuries are rare, composing only 0.01–0.1% of all vascular trauma [1–3]. Injuries specific to the SMV are even less common with just over 100 reported in the literature [3, 4]. Unlike trauma to the superior mesenteric artery (SMA) [5], only 5–10% of all SMV injuries occur as a result of blunt trauma [3]. Furthermore, multiple associated injuries are typical, and act as important contributors to patient outcome [3–5]. These most commonly include trauma to the small bowel, pancreas, SMA, inferior vena cava (IVC), duodenum, stomach, colon, liver, abdominal aorta and kidney, in order of decreasing frequency [6]. Overall, the mortality rate associated with one injured intra-abdominal vessel approximates 45% [3]. While patient numbers range from 2 to 45 in published series, survival associated with SMV injuries varies from 43 to 100% [4–15]. The range in survival for any series with greater than 10 SMV injuries however, is 43–81% [5, 6, 8–11, 13, 15].

The appropriate management of injuries to the SMV has been debated extensively in the literature for nearly 50 years [2, 16]. Although expert opinion ranges from venorrhaphy in nearly all cases [6], to simple ligation for most injures [4], there appears to be very little difference in mortality among patients [5]. Donahue et al. [4]

actually showed an improvement in patient survival in those who underwent ligation (85%) versus venorrhaphy (64%). This is especially impressive considering that most ''patients in the group undergoing ligation were more physiologically compromised than those who had a primary repair'' [4]. This also confirms the importance of identifying the need for damage control measures early on in a physiologically stressed patient.

Upon presentation, it was evident that our patient was in significant distress secondary to an intra-abdominal injury. The patient underwent a CT scan because of her immediate hemodynamic stabilization with fluid resuscitation, as well as the extremely close proximity of the scanner and hence a limited time delay. Recognizing the importance of arresting hemorrhage and controlling intestinal spillage in a swift damage control fashion while in the operating room, the SMV was ligated and the injured intestine removed. Not only is SMV ligation an acceptable management option, but it is an absolute requirement in a damage control situation [3, 4, 6]. Continued venous drainage from the bowel is typically achieved via the inferior mesenteric vein, retro peritoneal perforators and Porto systemic collateral circulation [3, 4]. Although we were prepared to manage a splanchnic hypervolemia/systemic hypovolemia syndrome [3], we did not predict that such a large disruption of the patient's collateral venous supply (right and middle colic veins) would induce global intestinal ischemia. As a result of dusky small bowel and a persistently elevated serum lactate, a mesocaval shunt was employed in an attempt to decompress the intestinal venous congestion. This graft was unsuccessful almost immediately because of the poor pressure differential between the SMV and IVC (Figure 1). Basic conduit physiology dictated that the graft was too long and narrow. Its replacement with a saphenous vein bypass shunt has been previously described [6, 13, 17]. Graham et al. [6] reported using this technique in 2 of 45 patients with SMV injuries. Both patients survived.

Conclusion

While the debate outlining the best general management of injuries to the SMV will likely continue, it is clear that each patient must be evaluated individually. Taken as a whole, the literature [1–19] now recognizes that in a hemodynamically stable, single system injured patient, the SMV injury can be repaired via venorrhaphy. In a damage control situation however, arresting hemorrhage and returning the patient to the ICU for physiologic stabilization is of paramount importance. In these patients, SMV ligation is an acceptable option. On rare occasions, massive interruption to a patient's collateral venous drainage may limit the surgeon's ability to ligate. In these instances, bypass shunts may be successful.

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