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## Case Report

## Superior mesenteric vein injury in penetrating abdominal trauma: Case report and a literature review

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## ABSTRACT

Injury in the superior mesenteric vein (SMV) is notably rare among abdominal visceral vascular lesions and has high morbidity and mortality. A case of a young patient victim of abdominal stab wound (ASW) with an injury to the SMV and infrarenal aorta was reported. Several factors contributed to the favorable outcome of the patient including rapid response to trauma, hemodynamic stability, and the absence of patient comorbidities. The operative method initially includes rapid abdominal bleeding control and great saphenous patch preparation for the treatment of venous injury associated with damage control surgery and hemodynamic resuscitation at the intensive care unit. The patient was admitted to the surgical emergency room and, despite the severity of the injuries, presented a favorable result after operative treatment.

Abdominal vascular injuries represent one of the most lethal injuries encountered in trauma patients [1]. These injuries, which are considered only a small fraction (0.1–1 %) of all vascular trauma cases, become even more uncommon when the SMV are involved [2]. The effective treatment relies on the adequate resuscitation and immediate surgical intervention, incorporating proximal and distal control, owing to the hemorrhagic shock being the primary cause of mortality. This scenario presents a significant adversity due to: complexity of the surgical technique, difficult exposition, subsequent massive bleeding, presence of associated injuries, different methods of surgical repair and second-look surgery [3]. The study delineates a successfully treated case resulting from an abdominal stab wound (ASW) to the abdomen with surgical intervention for a concomitant visceral vascular lesion involving the SMV and infrarenal aorta.

## Case Report

A male patient of 14 years of age was admitted at the surgical emergency unit, victim of an ASW in the abdomen. At the admission, the patient had a clear airway, blood pressure 110/70 mmHg, heart rate 75 beats per minute, Glasgow Coma Scale of 15 and exposure showed evisceration (epiplon) through the wound in the epigastrium (Fig. 1). The Focused Assessment with Sonography for Trauma (FAST) has shown fluid in perihepatic space. Transfusion protocol was initiated due to the Assessment Blood Score (ABC Score) and immediate transfer to the operating room (OR). Exploratory laparotomy was performed which revealed a 2 cm perforation in

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transverse colon and retroperitoneal hematoma in zone 1. Abdominal retro cavity was explored with identification of a great amount of blood controlled by digital compression. Control of the supraceliac aorta was performed at the lesser gastric curvature. Cranial reflection of the transverse colon was performed and section of the ligament of Treitz until the location of the left renal vein, renal arteries and proximal third of the superior mesenteric artery without any signs of active bleeding. In sequence, right medial rotation of the ascending colon was performed with visualization of the vena cava and right renal vein without signs of bleeding. After the reflection of the transverse colon in cranial direction, the Ruge's venous quadrilateral was dissected. An injury that affected over 70 % of the circumference of the proximal third of the superior mesenteric vein was identified (Fig. 2). Due to the patient's hemodynamic stability, repair of the superior mesenteric vein was chosen with a patch of the great saphenous vein, with continuous stitches, using polypropylene thread (Fig. 3). At the transverse colon injury a suture was performed. Also, a Barker peritoneostomy was performed. The patient was transferred to the Intensive Care Unit (ICU) and returned to the OR in 24 h for a Second-look surgery. New sources of bleeding weren't found, the intestine was viable and the primary closure of the abdominal wall was performed. On the seventh postoperative day, he remained at the ICU with fever and it was decided to perform a tomography. There weren't any findings of abdominal abscess however a pseudoaneurysm of the abdominal aorta was identified. Digital subtraction aortography was performed, which confirmed a pseudoaneurysm in the right posterolateral wall of the aorta, distal to the origin of the right renal artery (Fig. 4). The repair of the pseudoaneurysm by laparotomy was performed using continuous stitches of polypropylene thread. Because of the moderated distension of the bowel, a new Baker peritoneostomy was performed. After 24 h, the Second-look surgery was performed



**Fig. 1.** Stab wound in the epigastrium, evisceration of abdominal contents (epiplon) indicated by arrows.

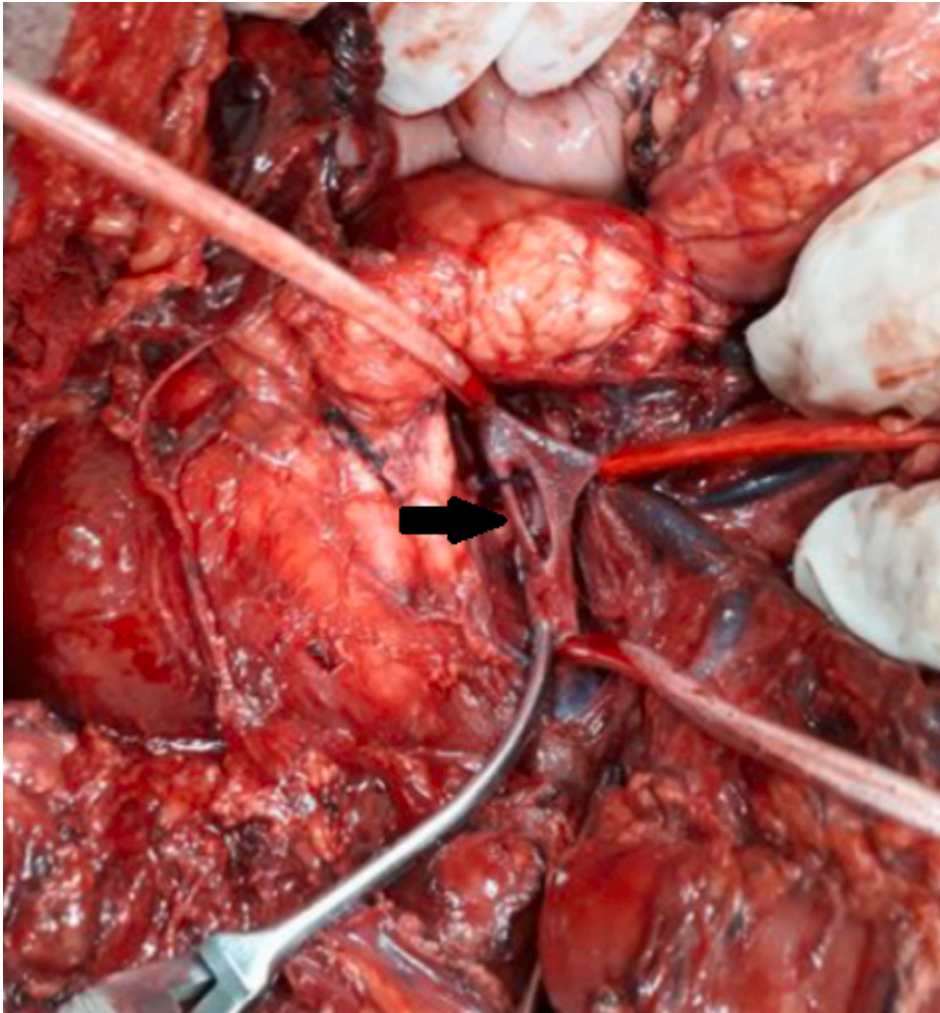


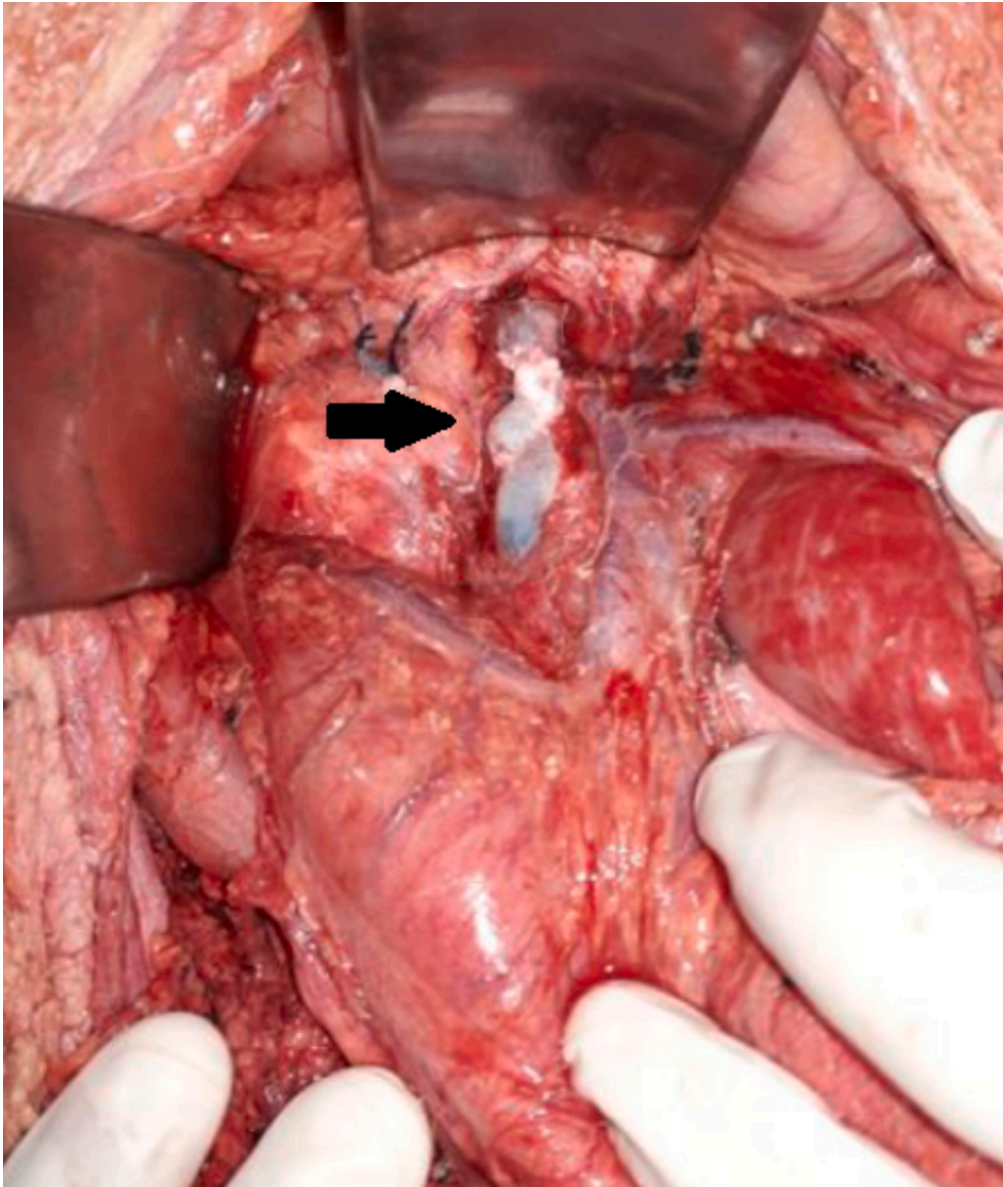
Fig. 2. Laceration of the superior mesenteric vein after vascular control, indicated by the arrow.

without any new findings, then evolving to abdominal closure. Three days after the correction of the pseudoaneurysm, the patient was with spontaneous ventilation and the day after he started oral feeding. He was discharged from the ICU on the third postoperative day of the last approach and hospital discharge fifteen days after the admission. The postoperative control with angiotomography was realized thirty days after the trauma without any evidence of pseudoaneurysm or arteriovenous fistula. After six months of the event, the patient remains under follow-up in good conditions without complaints. This case report was approved by an Ethics Committee for Research Involving Human Beings (CAAE: 37422820.5.0000.5231) and the informed consent form was signed by the patient.

## Discussion

SMV injuries are rare, being more common in penetrating trauma, with a prevalence of 80 to 93 % of these cases. These have a negative prognosis, not only because of the presence of the vascular lesion itself, but also because of its rarity, which prevents surgeons from developing significant experience with their management [2] [3]. These injuries are associated with massive bleeding due to the absence of valves in the portal venous system, leading to anterograde and retrograde bleeding [4]. The hemorrhagic shock is the main cause of death and the severity of venous injury is related to the increase in mortality rates [3]. Asensio reported in thirteen years 51 cases of SMV injury, with 24 patients surviving. Of these cases, 19 had an isolated SMV lesion with a 52 % survival rate, and 4 cases had an lesion associated with the aorta with a 25 % survival rate [5]. Surgical exposure of the SMV can be performed directly at the root of the mesentery after reflection of the transverse colon in a cranial direction to locate Rogie's quadrilateral [6]. After identification of the hematoma or active bleeding, obtaining proximal and distal control of the vessel can be a very laborious task. The Pringle maneuver is often used to help control hemorrhage associated with digital compression. Right-sided visceral medial rotation, including an extensive Kocher maneuver, allows the surgeon to control the superior mesenteric vessels [7]. Maneuvers used to expose the infrarenal aorta and retroperitoneal zone I include cranial reflection of the transverse colon, evisceration of the small intestine to the right, and

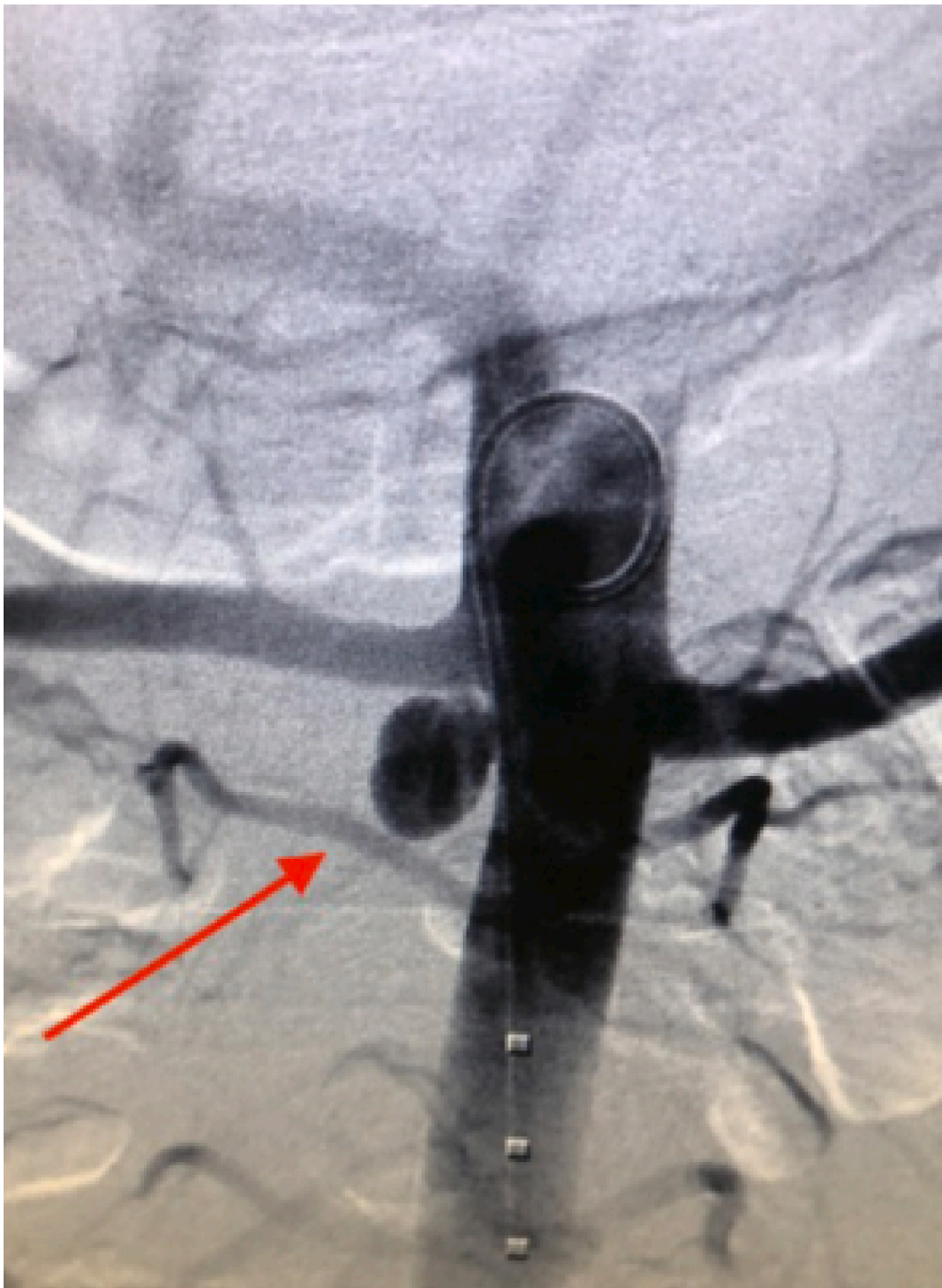




**Fig. 3.** Lesion repair with great saphenous vein patch, appearance in second-look surgery. The black arrow indicates the lesion.

section of the ligament of Treitz along the connective tissue to the left of the abdominal aorta until the left renal vein is located [7]. Recently, in a retrospective study, the results of primary repair and SMV ligation were compared, concluding that ligation should be selected for hemodynamically unstable patients [5]. Ligation can result in significant intestinal edema and venous engorgement. Compromised venous flow through the portal system can result in arterial hypotension and splanchnic hypertension that can lead to venous thrombosis, intestinal ischemia and necrosis [8]. According to the Phillips, despite concerns about intestinal viability, ligation is generally well tolerated due to the collateral flow in the portal venous system through the inferior mesenteric vein (IMV) and portosystemic branches [9]. In a damage control situation, stopping the bleeding and returning the patient to the ICU for physiological stabilization is essential [4]. Within this context, despite little available evidence, vascular shunt has also become a treatment option.

Due to the lack of evidence, no recommendation exists for standardizing the correction of these injuries. These must be individualized and taken intraoperatively based on the presence of the severity of the vascular injury, the presence of other associated injuries and the hemodynamic stability at the time of surgery. However, it is highly unlikely that rescue techniques will succeed if the first attempt fails [9]. Thus, injuries to the superior mesenteric vessels represent a major challenge for surgeons. Although its incidence is rare, mortality is high and requires knowledge of anatomical exposures and subsequent treatment options.



**Fig. 4.** Aortography performed by digital subtraction with a centimeter pigtail catheter and identification of a pseudoaneurysm of the right renal aorta on the right. The red arrow indicates the lesion. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

#### **CRedit authorship contribution statement**

**D.M. MAURO:** Writing – review & editing, Writing – original draft, Supervision, Project administration, Formal analysis, Conceptualization. **B. MIYAZAWA:** Writing – review & editing, Visualization, Investigation, Formal analysis, Data curation. **S.J.**

**NASCIMENTO:** Writing – review & editing, Validation, Investigation. **T.S. ALVES:** Writing – review & editing, Validation, Investigation. **J.G.N. SCORPIONE:** Writing – original draft, Visualization, Methodology, Data curation.

### Declaration of competing interest

The authors Daniel Miguel Mauro and João Gabriel Nogueira Scorpione have employment conflicts of interest with the institution. The other authors have none.

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