



Contents lists available at ScienceDirect

International Journal of Surgery Case Reports

journal homepage: www.casereports.com

Minimally invasive splenectomy in grade IV splenic trauma: A case report associated with high-grade renal trauma

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ARTICLE INFO

Article history:

Received 5 December 2020

Received in revised form

29 December 2020

Accepted 29 December 2020

Available online 2 January 2021

Keywords:

Abdominal trauma

Splenic injury

Laparoscopy

Splenectomy

Splenic rupture

ABSTRACT

INTRODUCTION AND IMPORTANCE: In closed abdominal trauma, the spleen is the most frequently injured organ (30–45%). Splenic lesions grades IV–V have higher failure rates with nonoperative management (NOM). The minimally invasive approach is an alternative when NOM fails. This is the first reported case of a patient with splenic and left renal trauma, both grade IV, with combined management, which consisted of a minimally invasive surgical resolution of the splenic trauma and a conservative management of the renal trauma, with a satisfactory recovery of the patient. This contributes to understanding the benefits of minimally invasive surgery in moderate splenic trauma associated with other high-grade injuries.

CASE PRESENTATION: We present a 45-year-old woman with a multiple trauma after a motorbike vs car traffic accident. On physical examination, she was hemodynamically stable, with abdominal guarding and generalized rebound tenderness associated with multiple upper and lower limb fractures. An abdominal CT scan revealed grade IV splenic and left renal trauma, with moderate hemoperitoneum. A minimally invasive laparoscopic approach for hemoperitoneum drainage and splenectomy was performed.

CLINICAL DISCUSSION: There is currently no consensus to define the indications for minimally invasive treatment on splenic trauma. While laparotomy is the standard treatment, it is not without potential severe complications, while laparoscopy providing a treatment option in selected cases with hemodynamic stability.

CONCLUSION: The role of the minimally invasive approach is safe and feasible in selected patients with high-grade splenic lesions and hemodynamic stability, including the association with other organic lesions such as kidney trauma.

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1. Introduction

The spleen is the most frequently affected organ in blunt abdominal trauma (35–45%) [1]. In the US, more than 39,000 adult patients with blunt splenic trauma are treated annually, of which only 10% require urgent surgical intervention, and the rest is managed with non-operative management strategies (NOM) [2]. However, laparotomic splenectomy is still the standard treatment of those patients who are not candidates for NOM, or for whom this strategy has failed, with a morbidity of 20–25% and mortality of 2–10% [3]. Currently, these results can only be compared with laparoscopic splenectomy performed as a treatment of hematological diseases, since there are no large case series of laparoscopy for splenic trauma [4].

We aim to present the first case report of a patient with splenic and renal trauma, both grade IV, with a successful combined man-

agement, consisting of a minimally invasive surgical resolution of the splenic trauma and a conservative management of the renal trauma. This case report is reported in line with the SCARE Guidelines [5].

2. Case presentation

A 45-year-old woman, with no clinical, surgical, or allergy history, drug use, tobacco, or alcoholism was referred by the emergency medical service after a multiple trauma motor-vehicle accident, specifically motorcycle (with helmet) vs car. In the emergency room, the patient presented a patent airway, SpO₂ 88%, with oxygen requirement, pulse 100 beats/min, blood pressure 120/70 mmHg, body temperature 36 °C and a Glasgow score of 15/15. The physical examination revealed a distended abdomen, with palpation-induced pain on the left hemiabdomen and rebound tenderness. EFAST (Extended Focused assessment with sonography for trauma) was performed, showing free fluid in three abdominal windows; no pericardial and pleural effusion; without pneumothorax. In the analysis, an hemoglobin of 10.9 mg/dL, hematocrit 32.8%,

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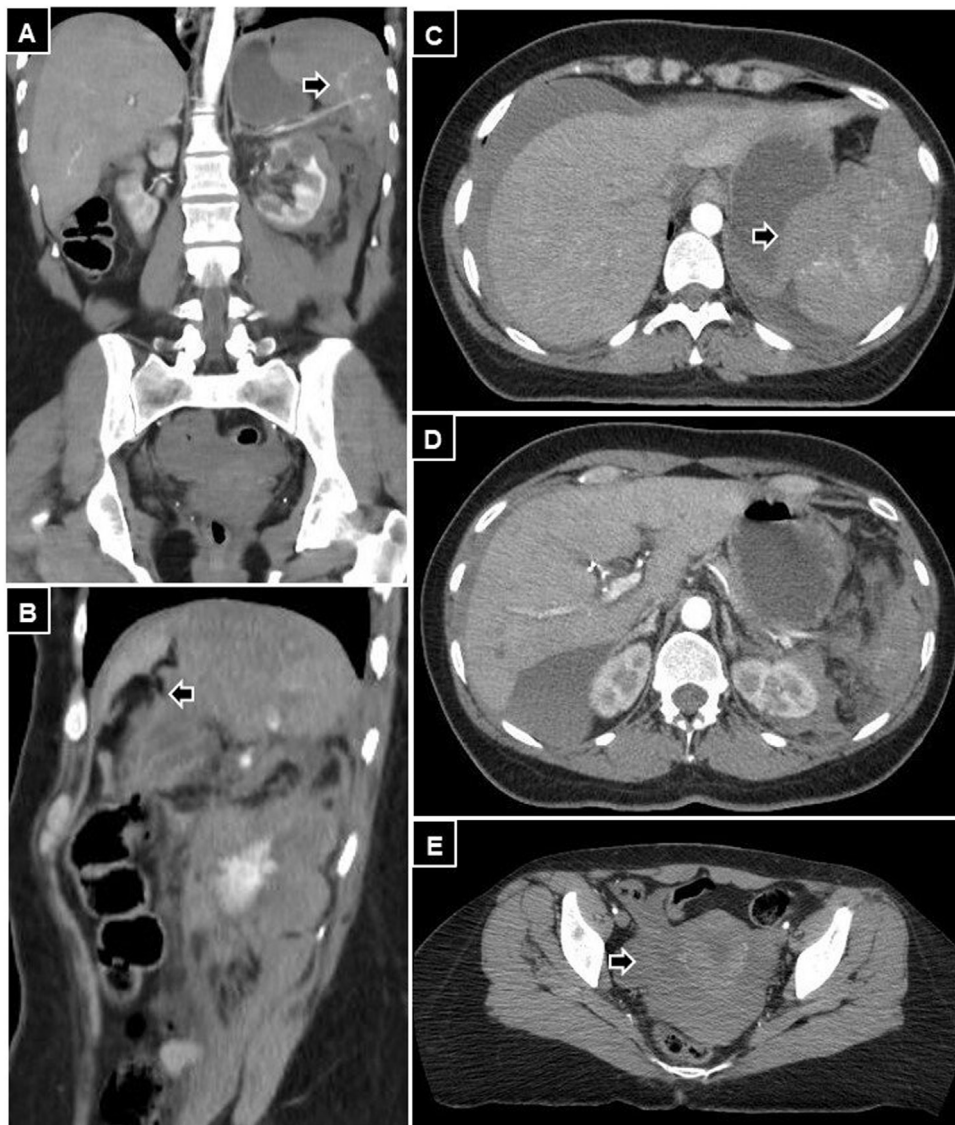


Fig. 1. Computed tomography of the abdomen and pelvis. **A:** Contrast extravasation (arrow). **B:** Parenchymal laceration (arrow). **C:** Hypodense subcapsular mass (arrow). **D:** Perihepatic and perisplenic free fluid. **E:** Hemoperitoneum in the pouch of Douglas (arrow).

leukocytes 12.000 mm³, KPTT 26 s, and platelets 191.000 mCL, were reported. Given the hemodynamic stability, an abdominal computed tomography (CT) scan was performed, identifying deep lacerations in the spleen and the presence of intraparenchymal hematoma, perisplenic fluid, and areas of active bleeding compatible with a grade IV splenic trauma (AAST) / grade III (WSES) (Fig. 1). The left kidney showed lacerations in the collecting system, with a ruptured subcapsular hematoma (Grade IV) and moderate hemoperitoneum (Fig. 2). Complementary radiographs were also requested where exposed fractures of the left elbow, knee, and right ankle were observed. Given these clinical and tomographic findings, along with the hemodynamic stability of the patient, surgery with a minimally invasive approach was decided. The surgical procedure was performed by a senior staff surgeon specialized in HPB surgery and with vast experience in laparoscopic and minimally invasive emergency surgery.

The patient was positioned in a right lateral decubitus at an angle of approximately 45° (hemilateral position). An open pneumoperitoneum was performed and four trocars were placed: two 12 mm in the umbilical region and left hypochondrium and two 5 mm in the right flank and epigastrium. The laparoscopic exploration revealed

hemoperitoneum in four quadrants and a block in the left upper quadrant due to multiple clots and adhesions, without active bleeding. Drainage of the hemoperitoneum with the release of adhesions was performed. After taking down the gastrocolic ligament and mobilizing the splenic flexure, the spleen surface and extent of the lesion were identified (Fig. 3). The splenic vessels were identified and clipped individually along the superior border of the pancreatic tail with a Polymer Locking Ligation System. The spleen was then fully mobilized by the division of all short gastric vessels and posterior attachments with special care in not injuring the pancreatic tail. Once the spleen was released, it was removed morcellated in a strong plastic bag and two cavitory drains were placed (Fig. 4). The retroperitoneum was inspected, ruling out expansive or pulsatile perirenal hematoma, and therefore renal NOM was decided. The operative time was 3 h, with an estimated blood loss of 150 cc and a requirement of 2 units of red blood cells.

Immediate postoperative recovery was performed at the intensive care unit for 24 h. Later the patient recovered uneventfully in the general ward, where she spent 14 days for the management of other traumatic injuries, bone fractures and control of kidney trauma. Before discharge, she was given vaccinations for

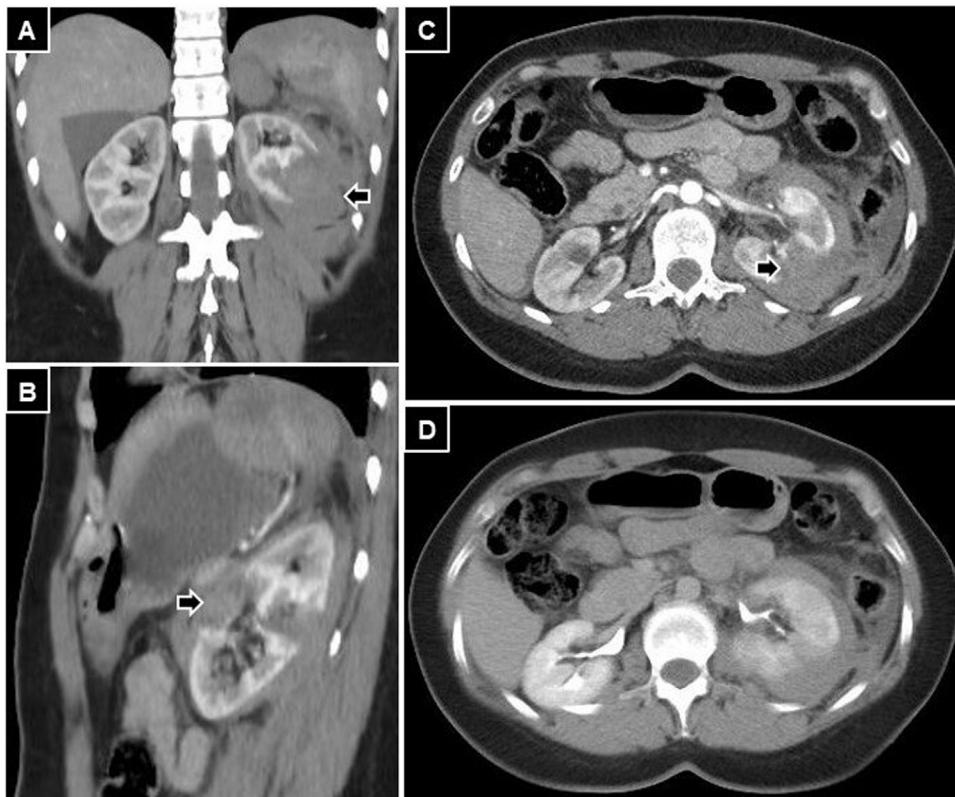


Fig. 2. Grade IV renal trauma, which resolved with conservative treatment. **A and B:** Injure in the lower pole and left collecting system (arrow). **C:** Retroperitoneal hematoma (arrow). **D:** Excretory phase, without contrast filtration.



Fig. 3. **A:** Left hypochondrium with clots and perisplenic adhesions. **B:** Perihepatic hemoperitoneum drainage. **C:** Spleen lacerations.

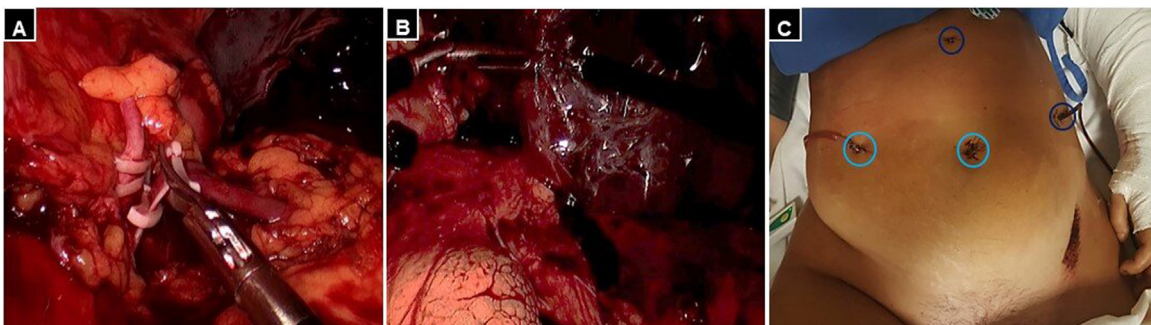


Fig. 4. **A:** Splenic pedicle dissection. **B:** spleen removal in a plastic bag. **C:** Abdominal scars after laparoscopic surgery, ports of 12 mm (light blue circles) and 10 mm (dark blue circles).

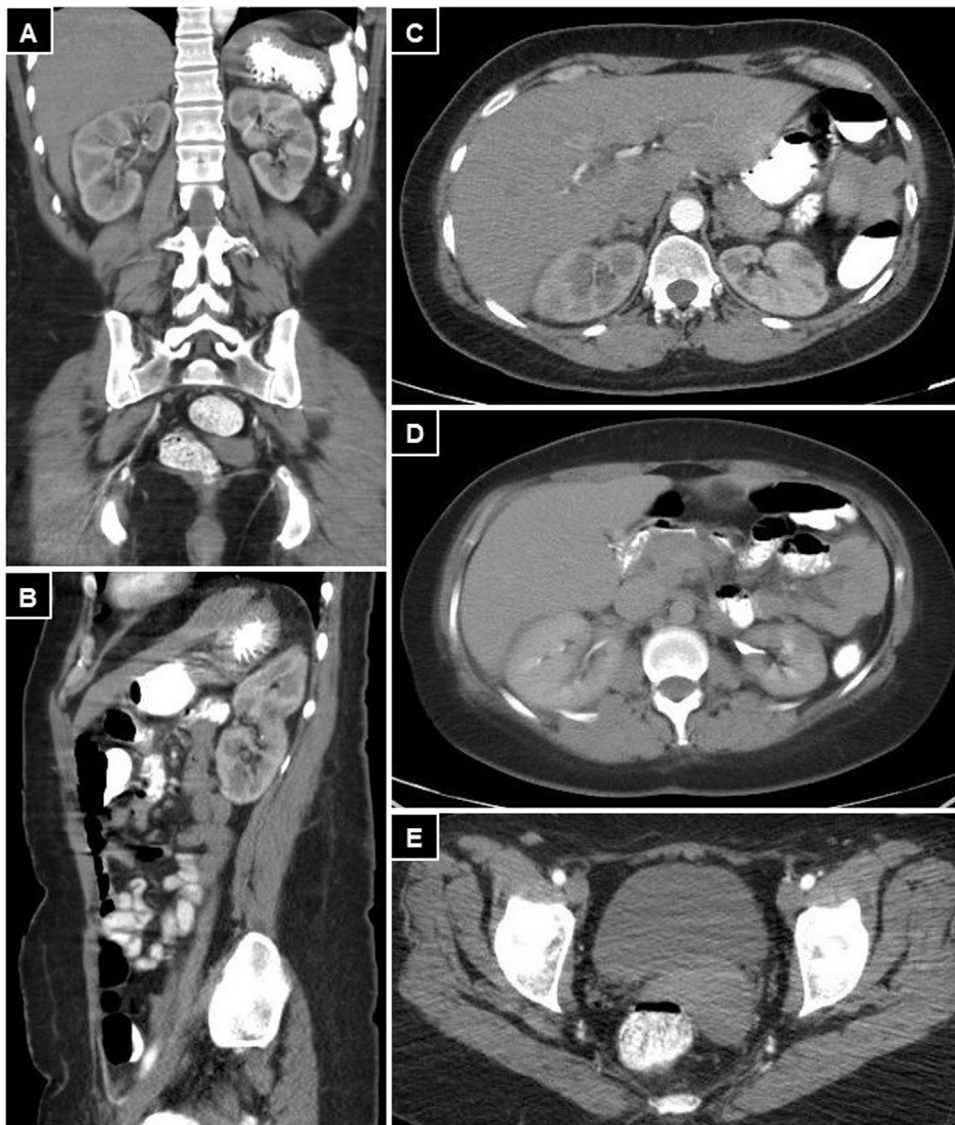


Fig. 5. Postoperative control at 3 months. **A–C:** ad integrum recovery from renal trauma, ruling out oral contrast filtration and absence of perihepatic and perirenal fluid. **D:** excretory phase, without contrast filtration. **E:** absence of free fluid in the pouch of douglas.

capsulated microorganisms (pneumococcus, meningococcus, and *Haemophilus influenzae*). Scheduled clinical controls and a CT scan 3-month after surgery were performed, showing no abdominal complications and a successful NOM of the renal trauma (Fig. 5).

3. Discussion

Currently, the preservation of the spleen using NOM is the most accepted therapy [1]. This therapeutic approach evolved thanks to what has been observed in pediatric patients, where the preservation of immune function makes it possible to combat infections by encapsulated microorganisms, responsible for post-splenectomy sepsis, which has a high mortality rate (50–70%) [6]. However, the failure rate of NOM varies widely in the literature. In a study of nearly 15,000 patients, the NOM failure rate increased with the grade of injury from 4.8% for patients with AAST [7] grade I injury, to 33.3% and 75% for grades IV and V, respectively [8]. Currently, an overall failure rate of 10% is estimated [9]. The predictive factors of failure are related to grade IV and V lesions, contrast extravasation and moderate or severe hemoperitoneum (≥ 3 spaces). Late

rebleeding or delayed rupture have also been associated, along with the presence of a pathological spleen [9].

With regards to decision making, it has been shown that the pathophysiological status of the patient is more relevant than the anatomy of the splenic lesion, which can help with therapeutic decisions in splenic trauma [10]. In 2017, during the world congress of the World Society for Emergency Surgery (WSES), the final version of the WSES guidelines on splenic trauma included a new classification system that used both the degree of anatomical injury (AAST) and the clinical condition of the patient. This serves as a more detailed tool to determine the management of splenic trauma [1,10]. In this case, the patient presented hemodynamic stability and a grade IV injury (AAST) classified as a WSES III, equivalent to moderate splenic trauma with a risk of NOM failure of 72.2%. Taking into account the tomographic findings of a splenic lesion (AAST IV/WSES III) without associated visceral injuries and a moderate hemoperitoneum, the indication for angioembolization could have been feasible, since none of the factors above mentioned are considered an absolute contraindication to starting NOM. However, abdominal peritonism was categorical, for which surgical treatment with a minimally invasive approach was offered.

Laparoscopic splenectomy has been widely accepted since 1991 as a feasible and safe technique for most hematological disorders [11]. However, the role of laparoscopy in abdominal trauma is still controversial and there is only a very limited number of reports including a minimal invasive approach for splenectomy in trauma patients [12]. The Society of American Gastrointestinal and Endoscopy Surgeons (SAGES) accepts diagnostic laparoscopy as a feasible and safe method in trauma if applied to selected patients, including those with hemodynamic stability, with an injury in the left thoracoabdominal region or with suspected intra-abdominal injuries undiagnosed using accepted imaging techniques [13]. It has been shown that minimally invasive techniques could reduce the rate of negative laparotomies. Laparoscopies identify diaphragmatic lesions better than other modalities, providing potential treatment according to the specific requirements of each patient, such as an small intestine or stomach suture, liver and splenic cauterization, the application of clips to control mesenteric bleeding and allows for the performance of sigmoid colostomies [14,15]. Laparoscopy has been shown to have a sensitivity of 90% and a 70–100% specificity for the detection of intra-abdominal lesions [16]. The first reports of laparoscopic splenectomy in trauma were described as isolated cases starting in 1995 [17]. The largest series has 11 patients with blunt abdominal trauma, who underwent minimally invasive treatment, with a mean grade III splenic injury (AAST) [18]. In this series, they reported that laparoscopic splenectomy is useful in patients with blunt trauma in whom conservative management produced no improvement and who do not have other injuries that preclude laparoscopy. Unlike other reports, our patient had a concomitant grade IV renal trauma (AAST), which was managed conservatively after ruling out an expansive or pulsatile perirenal hematoma during laparoscopic exploration for minimally invasive splenectomy, leading to a favorable and uneventful recovery of the patient. This unique scenario contributes to understanding the benefits of minimally invasive surgery in moderate splenic trauma associated with other high-grade abdominal injuries. Ultimately, the role of laparoscopy in trauma depends on the experience of the surgeon and the selection of the patient [4]. These factors play an important role in determining the best treatment modality applied.

4. Conclusion

The presented technique of laparoscopic splenectomy in grade IV splenic trauma associated with high-grade renal trauma was feasible and safe, with hemorrhagic control comparable to that of the open technique, offering the benefits of the minimally invasive approach. Further progress in laparoscopic techniques and devices may, in the near future, show laparoscopy as a safe approach in high-grade splenic trauma in hemodynamically stable patients for whom NOM fails.

Conflicts of interest

The authors declare that there is no conflict of interest.

Funding

No source to be stated.

Ethical approval

This is a case report study and ethical approval not required.

Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Author contribution

Dr. Diana Alejandra, Pantoja Pachajoa (literature review, data analysis and interpretation, drafting of manuscript and approved the final version).

Dr. René Manuel, Palacios Huatuco (literature review, data analysis and drafting of manuscript).

Dr. Nicolás, Bruera (literature review and data analysis).

Dr. Florencia, Llahi (literature review and data analysis).

Dr. Alejandro Marcelo, Doniquian (study concept and approved the final version).

Dr. Fernando Andrés, Alvarez (study concept, drafting of manuscript, critical revision and approved the final version).

Registration of research studies

Not applicable.

Guarantor

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Provenance and peer review

Not commissioned, externally peer-reviewed.

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