



Review Article

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An Overview on Splenic Trauma Management Approach: Literature Review

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ABSTRACT

Of all organ injuries, the two most commonly encountered blunt abdominal injuries to organs are the spleen and liver. Splenic injury is historically managed by urgent laparotomy and subsequent removal of the spleen. This puts patients at lifelong postoperative risk of infections, and prophylactic vaccinations. To review the literature on recent updates on splenic injury diagnosis and management. PubMed database was used for article selection, papers on organ blunt trauma were obtained on the topic of splenic injury, and reviewed. An updated outlook on splenic injuries shows that not all patients require an urgent splenectomy. In fact, many patients today could be managed conservatively under the supervision of the surgical team. Only patients who deteriorated and become hemodynamically unstable would fit the criteria for surgical intervention. In conclusion, splenic trauma used to be historically managed through emergency splenectomy. With the advancement of radiological technology, especially the CT scan, this blunt abdominal injury can now be staged and treated accordingly. Generally, hemodynamically stable patients can be managed conservatively, while those who are hemodynamically unstable are referred for operative management or interventional radiology.

Key words: *Splenic injury, Blunt trauma, Trauma investigation, Splenectomy*

INTRODUCTION

The most commonly damaged organ in blunt abdominal injury is the spleen [1]. This fact remains solid across different ages, as although the spleen is protected by a ribcage it remains vulnerable to injury [2]. Splenic injuries may form 25% of all blunt abdominal traumas according to recent data [3]. Splenic and liver injuries following blunt trauma are extremely common, especially with vehicular accidents [4]. A surgeon should always be alert to the possibility of a splenic or liver trauma or both in a patient of a road traffic accident or any other form of blunt injuries such as direct trauma from a fight, fall from a height, or non-accidental injury. Moreover, due to various complications that may even be fatal in some cases, clinicians shall be familiar with the clinical features and

presentation of such patients. In this paper, we will review the literature regarding splenic injury, its etiology, risk factors, diagnosis, and management.

MATERIALS AND METHODS

Through PubMed database, the selection process took place in order to identify the relevant articles, and the following keywords were used in the mesh (“Splenic Injury”[Mesh] AND (“Diagnosis”[Mesh] OR “Management”[Mesh] OR “Risk factors”[Mesh])). The inclusion criteria were based on including one of the following phrases: splenic injury, evaluation, diagnosis, and management. Exclusion criteria were all other articles that did not meet the inclusion criteria; and/or not having any of the inclusion criteria topics.

Review

The spleen is an intra-peritoneal organ resting in the left upper part of the abdominal cavity, having access to the peritoneal cavity through its hila, hence during extravasation the peritoneum fills with fluid and can be detected by imaging modalities. This is because the splenic hila contain the major vessels of the spleen, the splenic artery and vein, but there are also collateral supplies from nearby organs and attached ligaments. This is surgically relevant, as collateral supplies attach at both poles of the spleen making splenectomy difficult and splenorrhaphy a preferred option.

The peritoneum engulfs the spleen, and in combination with the rib cage, offer it protection against blunt but not penetrating traumatic injury. When the injury occurs, the patient may complain of left shoulder pain, this is clinically known as the ‘Kehr sign’, which results from diaphragmatic irritation from the splenic extravasation. Intraoperatively, the pancreatic tail is closely related to the spleen and is, therefore, at risk of injury intraoperatively.

Certain risk factors could be responsible for decreasing the capsules' protection of the spleen. These include bacterial infection causing spontaneous splenic rupture and patients on current antiplatelet therapy [5]. Other risk factors include other infective states such as infectious mononucleosis or malaria [6, 7].

Clinical awareness

Surgeons, especially those involved with trauma care, should have a low threshold for diagnosing the splenic injury and proceeding with management accordingly. When the surgeon examines the patient with abdominal trauma, they should pay particular attention to the various signs of blunt organ injury. These signs include visible erythema on the flanks and periumbilical area, or signs of diaphragmatic irritation such as left upper shoulder referred pain. While the presentation of splenic injury is similar to liver injury, it would usually appear on the left upper abdomen with tenderness rather than right upper pain.

If the splenic vessels extravasate with trauma, then they would fill the peritoneum causing inevitable pain and irritation of the peritoneal layers. This manifests as rigidity and rebounds tenderness of the abdominal wall. In brisk bleeding, the patient's vital would disrupt and shock protocol should be started and the patient resuscitated, sometimes necessitating urgent laparotomy. If the patient develops hypotension, then emergency surgery should be done. In certain cases where the patient is successfully resuscitated interventional radiology can be instigated instead of surgery. Interventional radiology using the splenic embolization method, when available, is preferable to total splenectomy in patients who are hypotensive with splenic injury [8].

Not all splenic injuries require surgical intervention, and most often they are treated conservatively. However, as with any injury that is managed nonoperatively, the surgeon must have meticulous monitoring of the condition, as complications may occur and operative intervention may then become necessary.

Updates on diagnostic methods

Before the current advancement and widespread availability of computerized tomography, the methods used had lower overall accuracy in detecting splenic injury, which meant that the definitive diagnostic modality was intraoperative detection by laparotomy. The first step in diagnosis remains screening during the abdominal trauma survey for any signs of retroperitoneal hemorrhage or flank tenderness, with disrupted vital signs. In hemodynamically unstable patients the surgeon should perform a diagnostic peritoneal lavage (DPL) to rule out intra-abdominal bleeding, this modality has been superseded by focused-abdominal sonography test (FAST) and CT.

DPL has the advantage of more sensitivity to bleeding detection over FAST scans, however, it would require around 15 minutes to be useful. FAST is faster, but it is operator-dependent and in experienced surgical hands it might reach sensitivity equivocal to DPL. Both DPL and FAST detect intraperitoneal bleeding and not splenic injury per se, and neither is equivalent to the value a CT scan brings to the organ injury situation.

Indications for nonoperative treatment

As CT is the current standard many splenic injuries, for hemodynamically stable patients, can now be managed conservatively under supervision, and only those showing major avulsion would necessitate immediate surgical intervention. This is also because modern CT imaging can detect splenic extravasation, hence providing answers to whether the patients need operative splenectomy or otherwise.

A hemodynamically stable patient has normal vital signs, and would best be investigated using CT imaging. A Helical or spiral CT scan is preferred to exploratory laparotomy as it is overall accurate and non-invasive [9]. In addition to diagnosis, the CT imaging would also aid in staging the splenic injury, and suitable candidates could be prepared for surgery. Another important factor that would relatively contraindicate a non-operative approach is the presence of co-morbid conditions.

Non-operative management is not prioritized in a patient who is hemodynamically unstable, this includes not waiting for a CT scan in these patients as they may die in the radiology department. It is, therefore, that the surgeon prioritizes faster diagnostic modalities such as FAST or DPL, and maintains a low threshold for operative laparotomy in unstable patients. CT scan is therefore reserved for hemodynamically stable patients.

Indications for operative intervention

If the patient is hemodynamically unstable with suspected splenic injury, with physical examination or imaging modality, then this is an indication for operative investigation by exploratory laparotomy. The surgeon then, in an event of confirmed injury, should attempt to repair the laceration or, if not feasible, perform a splenectomy. Stabilized patients would benefit from CT staging (**Table 1**) of their injury [10]. However, staging is not always a determinant of surgery, instead, it is hemodynamic status and peri-operative intra-peritoneal bleeding that are the main indications for surgical intervention [11]. Other factors include the presence of comorbid conditions or other traumatic injuries.

Table 1. American Association for the Surgery of Trauma (AAST) classification system for splenic injury

Grade	Description
I	<ul style="list-style-type: none"> • Hematoma: subcapsular <10% surface area. • Laceration: capsular tear <1 cm parenchymal depth.
II	<ul style="list-style-type: none"> • Hematoma: subcapsular 10 to 50% surface area. • Laceration: capsular tear 1 to 3 cm parenchymal depth, <10 cm in length
III	<ul style="list-style-type: none"> • Hematoma: subcapsular >50 percent of surface area or ruptured subcapsular or parenchymal hematoma; • Laceration >3 cm in depth
IV	<ul style="list-style-type: none"> • Devascularisation >25% of spleen • Segmental or hilar vascular injury
V	<ul style="list-style-type: none"> • Shattered spleen

Patients who are hemodynamically unstable should be offered intravenous fluid bolus, those who do not respond well to fluids or transiently respond before deteriorating are considered as high-risk for underlying organ laceration, including splenic and liver trauma [11]. Research has reported a risk of splenic rupture in patients infected with the coronavirus-19 disease, this is best managed with emergency surgery. In such infected patients with sudden severe abdominal pain, a low threshold for entering the operating theatre is practiced [12]. As this group of patients is commonly hemodynamically unstable, a preferable choice of management is transcatheter arterial embolization [13].

Not all patients who are hemodynamically unstable require splenectomy, certain patients may be able to compensate and achieve vital stability, in these cases an angioembolisation would be a preferable alternative to surgical involvement. In children, splenic trauma should follow the same approach as adults with regards to

surgical intervention after a trial of conservative therapy if vitally stable, this is not always instigated in clinical practice [14].

Splenorrhaphy is preferred over splenectomy because of the difficulty in ligating splenic collateral arteries and, more importantly, due to the splenic role in the immune defense of the body and recycling of aging red blood cells [15].

Complications of operative management and splenic trauma

Certain risk factors are associated with complications following splenectomy for splenic trauma. These include blood transfusion within the first hours of injury and a splenic injury with a high grade on the scale [16]. Splenosis, a benign non-consequential mass, may occur in patients after splenic injury or splenectomy and should be added to the differential diagnosis of patients with trauma history, as to avoid unnecessary surgical intervention [17]. Other rare complications post-splenic injury include splenic arterial aneurysmal development, which requires coiling and embolization [18]. Embolization in these patients does appear to be associated with venous thromboembolism development [19].

CONCLUSION

In summary, splenic trauma used to be historically managed through emergency splenectomy. With the advancement of radiological technology, especially the CT-scan, this injury can now be staged and treated accordingly. Generally, hemodynamically stable patients can be managed conservatively and show a great prognosis. However, those who are hemodynamically unstable are referred for operative management or interventional radiology.

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REFERENCES

1. Abdulla RK, Mohammed NA, Abdelghani S, Eltayeb LB, Waggiallah HA. Efficacy of Plasmodium Falciparum on Hematological Parameters and Coagulation Profile in Children under Five Years Old. *Entomol Appl Sci Let.* 2020;7(3):91-7.
2. Reshetnikova TI, Zenkin AS, Georgievna T. The Histological Structure of Pig Organs and Tissues during the Experimental Use of the Triazavirin Antiviral Drug. *J Biochem Tech.* 2020;11(4):1-7.
3. El-Matbouly M, Jabbour G, El-Menyar A, Peralta R, Abdelrahman H, Zarour A, et al. Blunt splenic trauma: assessment, management and outcomes. *Surgeon.* 2016;14(1):52-8.
4. Sargazi M, Taghian F. The Effect of Royal Jelly and Exercise on Liver Enzymes in Addicts. *Arch Pharm Pract.* 2020;11(2):96-101.
5. Perez CA, Bastidas A, Rajasekar S, Nasser N, Garcia-Rodriguez VO. Spontaneous splenic rupture associated with Escherichia coli bacteremia and dual antiplatelet therapy. *Proc (Bayl Univ Med Cent).* 2020;33(2):241-2.
6. Kinderknecht JJ. Infectious mononucleosis and the spleen. *Curr Sports Med Rep.* 2002;1(2):116-20.
7. Kassam N, Michael S, Hameed K, Ali A, Surani S. Case Report: Sudden Splenic Rupture in a Plasmodium falciparum-Infected Patient. *Int J Gen Med.* 2020;13:595-8.
8. Guinto R, Greenberg P, Ahmed N. Emergency Management of Blunt Splenic Injury in Hypotensive Patients: Total Splenectomy Versus Splenic Angioembolization. *Am Surg.* 2020;86(6):690-4.
9. Hamid S, Nicolaou S, Khosa F, Andrews G, Murray N, Abdellatif W, Qamar SR. Dual-Energy CT: A Paradigm Shift in Acute Traumatic Abdomen. *Can Assoc Radiol J.* 2020:0846537120905301.
10. Moore EE, Cogbill TH, Jurkovich GJ, Shackford SR, Malangoni MA, Champion HR. Organ injury scaling: spleen and liver (1994 revision). *J Trauma.* 1995;38(3):323-4.

11. Nijdam TMP, Spijkerman R, Hesselink L, Leenen LPH, Hietbrink F. Predictors of surgical management of high grade blunt splenic injuries in adult trauma patients: a 5-year retrospective cohort study from an academic level I trauma center. *Patient Saf Surg.* 2020;14(1):1-9.
12. Mobayen M, Yousefi S, Mousavi M, Shafighi Anbaran A. The presentation of spontaneous splenic rupture in a COVID-19 patient: a case report. *BMC Surg.* 2020;20(1):220.
13. Nishiura A, Takakuwa T, Miura A, Otomaru I, Araki T, Fujitani Y, et al. Spontaneous Splenic Rupture with Angioimmunoblastic T-Cell Lymphoma Successfully Treated Using Transcatheter Arterial Embolization. Gan to Kagaku ryoho. *Cancer Chemother.* 2020;47(7):1097-9.
14. Yung N, Solomon D, Schuster K, Christison-Lagay E. Closing the gap in care of blunt solid organ injury in children. *J Trauma Acute Care Surg.* 2020;89(5):894-9.
15. Ali SS, Mahassni SH, Alnefaie RM. The effects of hypervitaminosis D in rats on histology and weights of some immune system organs and organs prone to calcification. *Int J Pharm Phytopharmacol Res.* 2018;8(6):59-71.
16. Knight M, Kuo YH, Ahmed N. Risk factors associated with splenectomy following a blunt splenic injury in pediatric patients. *Pediatr Surg Int.* 2020;36(12):1459-64.
17. Chorbińska J, Krajewski W, Sroczynski M, Guziński M, Zdrojowy R. Splenosis mimicking lymphadenopathy. *J Surg Case Rep.* 2020;2020(10):rjaa425.
18. Selim M, Awad Albayomy A, Almuhaish LA, Alraddadi SA, Alharbi WM. Multiple Incidental Unruptured Splenic Artery Aneurysms Following Severe Trauma. *Cureus.* 2020;12(10):e11136.
19. Lewis M, Piccinini A, Benjamin E, Demetriades D. Splenic Artery Angioembolization is Associated with Increased Venous Thromboembolism. *World J Surg.* 2021;45(2):638-44.