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Management of Isolated Traumatic Splenic Injuries: A Review Article

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Abstract

Background: Splenic injury is one of the most common intra-abdominal injuries following abdominal trauma, especially blunt abdominal trauma and road traffic accidents. Isolated traumatic splenic injury may present with abdominal pain, left upper quadrant tenderness, shock, or delayed splenic rupture. Accurate diagnosis and grading are essential for choosing the proper management strategy.

Aim: This review aims to discuss the important scientific points related to isolated traumatic splenic injuries, including etiology, clinical presentation, grading, evaluation, ultrasonographic findings, computed tomography findings, and management principles.

Conclusion: Management of isolated traumatic splenic injuries depends mainly on the patient's hemodynamic status, clinical presentation, imaging findings, and grade of splenic injury. Ultrasonography is useful for rapid detection of intra-abdominal blood, while contrast-enhanced CT is the preferred diagnostic modality in hemodynamically stable patients. Non-operative management, including splenic angioembolization, is preferred in selected stable patients to preserve splenic function and reduce the risks related to splenectomy.

Keywords: Splenic injury; traumatic splenic injury; isolated splenic trauma; AAST scale; ultrasonography; computed tomography; non-operative management; splenic angioembolization.

Introduction

Ruptured spleen is the most common intra-abdominal injury following abdominal trauma, especially to the left hypochondrium. The commonest cause is road traffic accidents. The spleen may be injured either separately or with other nearby organs such as kidney, bowel and ribs. Ruptured spleen is suspected in poly-traumatized patients and is usually associated with decreased blood pressure and increased heart rate **(Habeeb et al., 2021).**

Management of traumatic splenic injury depends primarily on the patient's hemodynamic status and the severity of splenic damage. In hemodynamically stable patients, non-operative management remains the standard approach and includes close observation, serial clinical assessment, and radiological follow-up. However, patients with failed observation-only management or those requiring further intervention may be treated with splenic artery embolization, which preserves splenic function while controlling hemorrhage **(Coccolini et al., 2019).**

Operative management can lead to overwhelming post-splenectomy infections, so non-operative management, including splenic angioembolization, is preferred over splenectomy to preserve splenic function, which decreases lifelong risks of septic complications and overwhelming post-splenectomy infection. The non-operative approach also avoids other potential fatal complications of operative management, including complications associated with laparotomy, and has also been associated with shorter hospital stay, shorter ICU stay, lower blood transfusion requirements, and lower mortality compared with operative management **(Spittle et al., 2023).**

Therefore, isolated traumatic splenic injury should be evaluated according to mechanism of injury, clinical presentation, hemodynamic condition, grade of splenic injury, and imaging findings. The American Association for the Surgery of Trauma scale and contrast-enhanced CT are important tools for grading splenic injury and guiding management decisions **(Zarzaur et al., 2015; Stylianos et al., 2021).**

Etiology

The primary cause of splenic injury is most frequently attributed to motor vehicle accidents. Direct blunt trauma and falls are also significant contributors to spleen-related trauma cases. Additionally, penetrating trauma, such as abdominal gunshot wounds, accounts for 7% to 9% of total penetrating trauma cases. Other mechanisms of injury include indirect trauma, such as a tear in the splenic capsule during colonoscopy or excessive traction on the splenocolic ligament during surgical procedures **(Yang et al., 2017).**

Splenic rupture can be divided into two major categories: traumatic rupture and non-traumatic rupture. The most prevalent major mechanism in traumatic injury, 50% to 75%, is the result of motor vehicle injury. Direct abdominal blows and falls are the remaining major causes of traumatic rupture. Additionally, traumatic rupture can present immediately after an injury or may present in a delayed fashion **(Akoury & Whetstone, 2018).**

Non-traumatic splenic rupture is very uncommon, though it can be related to underlying pathological conditions or may be idiopathic. However, non-traumatic rupture, when it does happen, carries a mortality of around 12%. One often-cited example of spontaneous splenic rupture, which occurs in only 0.1% of patients with this condition, is related to infection with mononucleosis **(Akoury & Whetstone, 2018).**

Diagnosis

Clinical Presentation

Splenic injury is the most common visceral injury from violence. Splenic injury is commonly associated with left hemothorax, fracture of the left lower ribs, and injuries to the tail of the pancreas, left lobe of the liver, left kidney, or left colon. Direct compression of the spleen causes parenchymal injury **(Mehanathan et al., 2021).**

Hilar injury may lead to rapid development of shock and rapid deterioration, and even death can occur. Other injuries may present with features of shock such as pallor, tachycardia, restlessness, tachypnea, anxiety, hypotension, decreased capillary refill, and decreased pulse pressure **(Perrotta et al., 2021).**

Patients may present with abdominal pain, abdominal distension, tenderness, and abdominal rigidity in the left upper quadrant. Positive Kehr's sign may occur when a clot or blood collected under the left diaphragm irritates the diaphragm and the phrenic nerve, causing referred pain in the left shoulder **(Mehanathan et al., 2021).**

Delayed splenic rupture may occur after a latent period of Baudet, in which the patient has no signs or symptoms for hours to days and presents later. Delayed splenic rupture tends to occur 4–8 days after trauma. This may be due to expanding subcapsular hematoma, clot disruption, pseudocyst rupture, or pseudoaneurysm/arteriovenous fistula rupture **(Jahromi et al., 2016).**

Table 1. American Association for the Surgery of Trauma (AAST) Splenic Injury Scale

Grade	Type of injury	Description
I	**Laceration**	Capsular tear, 1 cm depth
I	**Hematoma**	Involving less than 10% of total surface area of spleen
II	**Laceration**	1–3 cm parenchymal depth which does not involve a trabecular vessel
II	**Hematoma**	Subcapsular, involving 10–50% of total surface area of spleen; intraparenchymal, less than 5 cm in depth
III	**Laceration**	More than 3 cm parenchymal depth or involving trabecular vessels
III	**Hematoma**	Subcapsular involving more than 50% of total surface area of spleen or expanding; ruptured subcapsular or parenchymal hematoma
IV	**Laceration**	Segmental or hilar injury with more than 25% devascularization
V	**Laceration**	Shattered spleen
V	**Vascular**	Hilar vascular injury which devascularizes the spleen

Source: American Association for the Surgery of Trauma splenic injury scale **(Zarzaur et al., 2015).**

Evaluation

Ultrasonography is a quick and noninvasive technique for detecting intra-abdominal blood. When hemoperitoneum is present, especially when it is perisplenic, it highly suggests spleen trauma. However, a high number of significant abdominal organ injuries occur without associated hemoperitoneum **(Stylianos et al., 2021).**

CT scans serve as the preferred diagnostic modality for detecting solid organ injuries, including those affecting the spleen. These scans can reveal disruptions in normal splenic parenchyma, surrounding hematomas, and free intra-abdominal blood. A contrast-enhanced CT scan is particularly valuable for assessing differences in splenic parenchyma and hematoma density, which aids in identifying associated injuries. High-quality imaging is crucial, as suboptimal scans may result in missed diagnoses of subtle splenic injuries **(Stylianos et al., 2021).**

Radiographic Features

Ultrasound

FAST scanning may be performed to determine the presence of free fluid, particularly in the upper abdomen. Fresh blood is usually characterized as echo-free. Absence of free fluid does not rule out splenic injury. Disruption to the splenic echotexture indicating laceration or hypoechoic regions representing hematoma may be present **(Stylianos et al., 2021).**

Diagnosis and evaluation of splenic injury can be done by FAST, CT scan, and less frequently diagnostic peritoneal aspiration. Findings in the FAST scan suggesting splenic injury include a hypoechoic rim around the spleen and/or free fluids in the abdomen. Grading of splenic injuries can be done using the American Association for the Surgery of Trauma scale based on the injuries identified in the CT scan or during exploration **(Coccolini et al., 2019).**

Computed Tomography (CT):

CT is the modality of choice for assessing splenic trauma. Contrast-enhanced CT is the imaging modality of choice for evaluating splenic injuries. Splenic parenchyma should be assessed mainly during the portal venous phase, as the heterogeneous enhancement seen during the arterial phase may mimic splenic injury **(Sun et al., 2021).**

CT can demonstrate splenic laceration, subcapsular hematoma, intraparenchymal hematoma, perisplenic fluid, hemoperitoneum, active contrast extravasation, pseudoaneurysm, and vascular injury. These findings help in grading splenic injury and determining whether observation, angioembolization, or operative management is required **(Djordjevic et al., 2021).**

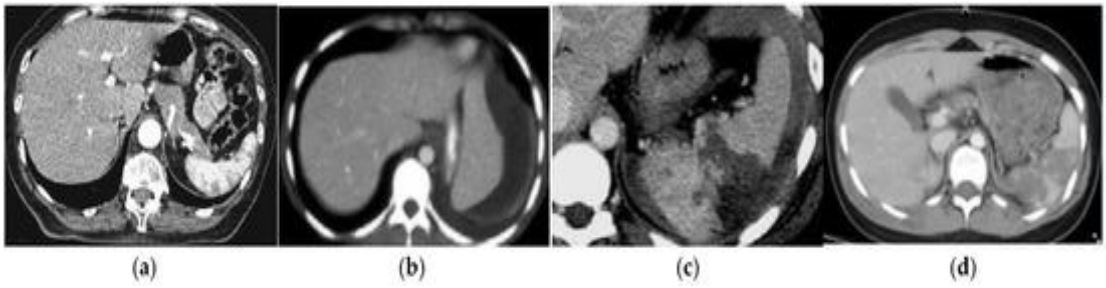

Figure (1): (a) Grade I spleen injury, small lacerations as a result of sport injury; (b) grade II splenic injury (hematoma) developed after fall from a standing height; (c) grade III injury as a consequence of a car accident (splenic lacerations); (d) grade IV splenic injury, result of fall from a bicycle **(Djordjevic et al., 2021).**

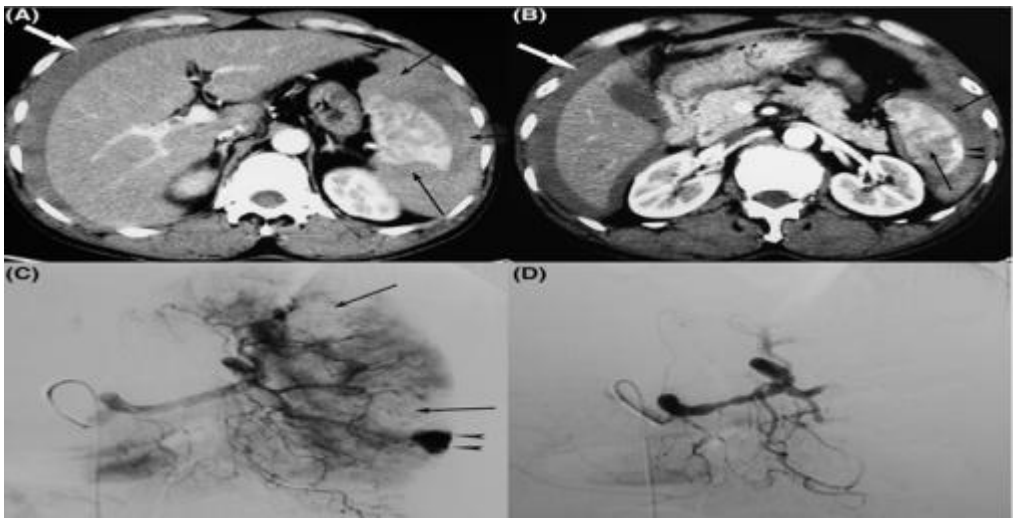

Figure (2): Images in a 56-year-old patient with grade IV splenic injury. (A) and (B) Contrast-enhanced CT shows splenic laceration and extensive subcapsular hematoma (black arrows) with contrast material extravasation (arrowheads). Free intraperitoneal fluid is seen around the liver (white arrows).(C) Splenic artery angiography shows intraparenchymal bleeding (arrowheads) and splenic contusion (arrows). (D) Splenic artery embolization arrested the bleeding **(Ren et al., 2021).**

Management Considerations

The management of traumatic splenic injury depends primarily on the patient's hemodynamic status and the severity of splenic damage. In hemodynamically stable patients, non-operative management remains the standard approach and includes close observation, serial clinical assessment, and radiological follow-up **(Coccolini et al., 2019).**

Patients with failed observation-only management or those requiring further intervention may be treated with splenic artery embolization, which preserves splenic function while controlling hemorrhage. Alternatively, operative management in the form of splenectomy, either open or laparoscopic, may be indicated when definitive treatment is required **(Coccolini et al., 2019).**

Non-operative management, including splenic angioembolization, is preferred over splenectomy to preserve splenic function, which decreases lifelong risks of septic complications and overwhelming post-splenectomy infection. The non-operative approach also avoids other potential fatal complications of operative management, including complications associated with laparotomy **(Spittle et al., 2023).**

The non-operative approach has also been associated with shorter hospital stay, shorter ICU stay, lower blood transfusion requirements, and lower mortality compared with operative management. Therefore, preservation of the spleen should be considered whenever it is safe and feasible in selected hemodynamically stable patients **(Spittle et al., 2023).**

Conclusion

Isolated traumatic splenic injury is a common and important consequence of abdominal trauma, especially following motor vehicle accidents, direct blunt trauma, falls, and penetrating trauma. Clinical presentation may include shock, abdominal pain, left upper quadrant tenderness, Kehr's sign, or delayed splenic rupture. Accurate diagnosis depends on clinical assessment and imaging, with ultrasonography useful for detecting intra-abdominal blood and CT being the preferred modality for evaluating splenic parenchymal injury and associated findings.

The AAST splenic injury scale is important for classifying the severity of injury and guiding management. Non-operative management, including observation and splenic angioembolization, is preferred in selected hemodynamically stable patients to preserve splenic function and reduce complications related to splenectomy. Operative management remains necessary in unstable patients, failed non-operative management, or cases requiring definitive hemorrhage control**.**

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