MANAGEMENT OF SPLENIC INJURY AFTER BLUNT INJURY TO ABDOMEN

J. Bharath Prakash Reddy[1], K. Jyothirmayi[2], A. Ravitheja[3], C. Ananda Reddy[4], Dushyanth[5]

[1]Assistant Professor, Department of General Surgery, Santhiram Medical College & General Hospital.
[2]Assistant Professor, Department of General Surgery, Santhiram Medical College & General Hospital.
[3]Assistant Professor, Department of General Surgery, Santhiram Medical College & General Hospital.
[4]Professor, Department of General Surgery, Santhiram Medical College & General Hospital.
[5]3rd Year Post Graduate, Department of General Surgery, Santhiram Medical College & General Hospital.

ABSTRACT

BACKGROUND

The spleen is an important organ in the body's immune system. It is the most frequently injured organ in blunt abdominal trauma.[1] Over the past several decades, diagnosis and management of splenic trauma has been evolved. The conservative, operative approach has been challenged by several reports of successful non-operative management aided by the power of modern diagnostic imaging. The aim of our prospective study was to compare non-operative management with surgery for cases of splenic injury.

METHODS

We conducted a prospective study of patients admitted with blunt splenic injury to our regional hospital over a three-year period (2012-2015). Haemodynamic status upon admission, FAST examination, computed tomography[2] grade of splenic tear, presence and severity of associated injuries have been taken into account to determine the treatment of choice. Therapeutic options were classified into non-operative and splenectomy.

RESULTS

Over a 3-year period, 24 patients were admitted with blunt splenic injury. Sixteen patients were managed operatively and eight patients non-operatively.[3,4] Non-operative management failed in one patient due to continued bleeding. The majority of grades I, II, and III splenic injuries were managed non-operatively and grades IV and V were managed operatively. Blood transfusion requirement was significantly higher among the operative group, but the operative group had a significantly longer hospital stay. Among those managed non-operatively (median age 24.5 years), a number of patients were followed up with CT scans with significant radiation exposure and unknown longterm consequences.

CONCLUSION

In our experience, NOM is the treatment of choice for grade I, II and III blunt splenic injuries. Splenectomy was the chosen technique in patients who met exclusion criteria for NOM, as well as for patients with grade IV and V injury.

KEYWORDS

Blunt Trauma, Splenic Injury, Non-operative Management, Splenectomy.

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INTRODUCTION: Blunt abdominal trauma is a significant cause of morbidity and mortality with Road Traffic Accidents (RTA) and falls constituting the most frequent causes. The second most commonly injured organ after blunt trauma of the abdomen in all age groups is the spleen.[5] According to the American Association for the Surgery of Trauma (AAST), there are five types of splenic injury (Table 1). As seen in the table the injury can be severe, and sometimes lead to haemorrhagic shock since the spleen receives 5% of the total cardiac output, but there are also lower grade splenic injuries that do not cause haemodynamic instability. The treatment of these injuries has undergone significant evolution over the past few decades, but optimal management remains a subject of controversy. There has been a change in trends from splenectomy for all traumatic injuries, including minor ones, to splenic preservation which includes splenic salvage and conservative management. This transpired after the risk of lifelong susceptibility to overwhelming post splenectomy infection[6] (OPSI) was identified, a rare but highly fatal syndrome caused by encapsulated organisms that can result in death within 24 hours. Non-operative management (NOM) in adults has achieved success rates ranging from 68% to 83% and is considered to be the cornerstone of treatment in haemodynamically stable patients. An additional benefit to this approach is the avoidance of potentially unnecessary surgery and the complications of laparotomy. However, in cases that demand surgery due to haemodynamic instability or evidence of ongoing blood loss, splenic repair is attempted with splenorrhaphy being the most prevalent

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Corresponding Author:
Dr. J. Bharath Prakash Reddy,
Assistant Professor, Department of General Surgery,
Santhiram Medical College & General Hospital,
N.H.-18, Nandyal.
E-mail: bharath.prakash143@gmail.com
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method of splenic conservation. It is important for surgeons to carefully select patients eligible for NOM in order to avoid failures in treatment and complications, especially a potentially life-threatening haemorrhage from delayed splenic rupture. The increasing availability of imaging methods, such as ultrasound, CT scanning and MRI, help to identify patients suitable for NOM. The aim of this study is to establish the parameters that determine the choice of treatment when a blunt splenic trauma is evaluated and to compare NOM with surgery.

Grade	Haematoma	Laceration
I.	Subcapsular, < 10% surface area	Capsular tear, < 1 cm parenchymal depth
II.	Subcapsular, 10%–50% surface area; intraparenchymal, < 5 cm in diameter	Capsular tear, 1–3 cm parenchymal depth that does not involve a trabecular vessel
III.	Subcapsular, > 50% surface area or expanding; ruptured subcapsular or parenchymal haematoma; intraparenchymal haematoma > 5 cm or expanding	> 3 cm parenchymal depth or involving trabecular vessels
IV.		Laceration involving segmental or hilar vessels producing major devascularisation (> 25% of spleen)
V.		Completely shattered spleen. Hilar vascular injury with devascularised spleen

Table 1: American Association for the Surgery of Trauma (AAST) Guidelines for Organ Injury Scaling for the Spleen

MATERIALS AND METHODS: All patients (24) with blunt splenic trauma, resulting from falls or vehicle collisions, who were admitted to the Department of General Surgery of the Santhiram General Hospital, Nandyal, from March 2012 to May 2015, were prospectively evaluated. Data review included patient demographics, trauma mechanism, haemodynamic parameters upon admission, laboratory and imaging data and concomitant injuries. The patients underwent a FAST scan, which detects abdominal free fluid with a high degree of accuracy and has good sensitivity for liver and spleen injuries. All haemodynamically unstable patients were immediately taken to the operating room to undergo an emergency laparotomy, while those who were stable were evaluated by focused abdominal sonogram and computed tomographic (CT) scanning of the abdomen and pelvis. Splenic injuries were graded I to V according to the American Association for the Surgery of Trauma (AAST) organ injury scale (Table 1), based on the findings of the CT or laparotomy. The criteria for non-operative management were:

1. The haemodynamic stability of the patient on admission or after initial resuscitation with up to 2 L of crystalloid fluid.
2. The absence of concomitant intra-abdominal solid organ injuries requiring surgical intervention.
3. Splenic-related blood transfusion requirements of 2 units or less.
4. Haemoperitoneum only if it extended to less than three abdominal quadrants.

These criteria were described by North American high volume trauma centres. Patients treated conservatively were placed in a monitored setting for 5 days. The standard of treatment included infusion of crystalloid fluids or packed red blood cells in order to maintain systolic blood pressure >90 mmHg and haemoglobin concentration > 8 g/L. Follow-up scans were performed a week and a month after injury to evaluate the degree of splenic healing or if there were clinical indications. In haemodynamically unstable patients, the decision of whether to perform splenectomy or attempt splenic salvage was made according to the presence and severity of associated injuries, the haemodynamic stability of the patient during surgery and the grade of splenic injury. Haemodynamic instability was defined as systolic blood pressure <90 mmHg despite adequate fluid replacement. Patients with penetrating injury, major head injury, thorax injury, bone injury leading to haemodynamic instability, age group <14 years are excluded from the study. All subjects included in this study gave their informed consent.

	Non-operative	Operative
Systolic blood pressure (mmHg)	132(120-145)	96(85-106)
Heart rate/min	90(80-100)	110(90-130)
Hb on admission (mg/dL)	11(9.5-12.5)	9.75(8.5-11)
Grade of splenic injury	≤3	≥3

Table 2: Clinical Characteristics of Patients with Blunt Abdominal Trauma

RESULTS: The median patient age was 32 years (range, 15–60 years) (Tab 3). The median age of the operative and non-operative groups was not significantly different. As expected, the male to female ratio was 2:1. All injuries resulted from blunt trauma. Eighteen patients sustained injury due to road-traffic accidents, three due to falls and three due to assault and sports (Tab 4). All patients were under the care of a consultant surgeon and evaluated by an on-call team clinically and a decision regarding management was taken. Fifteen patients were managed operatively and

ten were managed non-operatively. Out of the 9 non-operative patients, one became unstable with increasing abdominal pain, tachycardia, hypotension and a drop in haemoglobin on the third day of admission. He underwent an urgent laparotomy and splenectomy. At laparotomy, there was a large posterior splenic tear with a haemoperitoneum.

Age in Years	No. of Patients
15-25	5
26-35	13
36-45	3
46-55	2
>56	1

Table 3: Age Distribution

Mode of Injury	No. of Patients
RTA	18
Fall from height	3
Assault and others	3

Table 4: Mechanism of Injury

Grade	Conservative management	Operative Management
I	2(8%)	-
II	4(16%)	-
III	2(8%)	2(8%)
IV	-	8(33%)
V	-	6(25%)
Total	8(33%)	16(66%)

Table 5: Distribution and Management of Cases according to CT scan Grading of Injury

All patients had ultrasound abdomen and CT scans at admission (16 from the operative group and 8 from the non-operative group). Out of these 24 patients who had CT scan, 2 patients had a grade I injury, 4 had grade II injury, 4 had grade III injury and 8 patients had grade IV injury and 6 patients had grade V injury according to American Association for the Surgery of Trauma (AAST) guidelines for organ injury scaling for the spleen (Table 1). Both grade IV and grade V patients and two out of four grade III patients underwent operative management. All grade I patients and grade II patients and two out of four grade III patients were successfully managed non-operatively (Table 5). Patients were transfused overall an average of 1.9 units of whole blood. Transfusion requirement in the operative group (3 units) was significantly higher (P = 0.004) than the non-operative group (0.3 units). The overall mean hospital stay was 11.1 days. Mean hospital stay in the non-operative group (13.9 days) was significantly longer (P = 0.29) than the operated group (8.4 days). Of the 8 patients managed non-operatively, six patients were followed up with serial ultrasonograms and four patients with repeat CT scans. Among these four patients, two had one CT, one had two CT and one had three CT scans. At followup, all patients were successfully discharged in the operative group. Among 8 patients in the non-operative group, one patient died 6 months after discharge due to a myocardial infarction. The remaining seven patients are alive.

DISCUSSION: With the rise of RTAs, there has also been an increase in blunt abdominal injuries. Second only to the liver, the spleen is the most frequently solid organ injured, occurring in 32% of cases. Traditionally, operative management was performed for all patients with splenic injury. However, over the past two decades, treatment of blunt splenic injuries has undergone major changes. The concept of these changes was that splenectomy leads to impaired immunologic defence and patients are susceptible to infections and the highly fatal syndrome of overwhelming post-splenectomy infection (OPSI). A rare development, especially in adults (0.5%), OPSI is very severe with dramatic clinical features leading to cardiovascular collapse. Antibiotics, even when administered early, may fail to halt the progression of this syndrome and most patients die within 24 hours from onset. Presently, non-operative management of splenic injury is considered the treatment of choice for all haemodynamically stable patients. The current study highlights the parameters essential to deciding the appropriate treatment for patients suffering from blunt splenic trauma. Systolic blood pressure on admission, when normal, is clearly a sign of haemodynamic stability and a strong indicator for splenic preservation. It is also considered a predictor for the success of conservative management. Likewise, haemoglobin concentration and the requirement for blood transfusion of up to 2 units within the first 24 hours is a strong predictor of the need for splenectomy.

Associated injuries are also a significant parameter when selecting the treatment provided. Patients with severe concomitant intra-abdominal injuries are also more likely to undergo splenectomy. Recent reports consider the presence of head injury of little importance in determining the need for splenectomy. However, in our study, subjects with impaired consciousness were treated operatively. This probably stems from the fact that when mental functions are compromised, diagnosis of unidentified bowel injury and intervention may delay, rendering non-operative management for these patients less feasible. Grade of splenic injury was an important determinant for the success of conservative treatment. Subjects with grade I and II needed a shorter hospital stay and had fewer complications compared to those with grade III injuries. Conservative treatment was initially performed in children with successful results. During the last two decades, there has been a rise in the number of patients with blunt splenic trauma managed non-operatively. The original rigid criteria for this treatment have been expanded to include patients who in the past would otherwise have been excluded. Success rates in adults currently range from 60% to 98%. In our study, one of the 9 patients in the non-operative group required surgical intervention or blood transfusion of >2 units and no

mortality was recorded among these patients. Pneumonia and prolonged ileus due to intra-abdominal haemorrhage are two important complications of non-operative treatment, but significantly less common compared to the other method. The operative splenic salvage procedure has been used for several years. Besides splenic suture, other options include mesh splenorrhaphy, partial resection, electrocautery and the application of haemostatic agents. Preserving as much splenic tissue as possible is correlated to maintaining resistance against infection. Patients who have operative intervention have significantly high complication during hospital stay in form of wound infection, fever and cough.

In the past decade, the use of splenic artery embolisation[7,8] (SAE) has contributed to the non-operative management[9,10] of blunt splenic trauma. This technique is performed by interventional radiologists and was first described by Sclafani in 1981. There are two methods of SAE: proximal splenic artery embolisation (PSAE) and super selective distal embolisation. It has proved to be a safe and useful intervention. The indications for performing angiography and transcatheter arterial embolisation in splenic injuries, yet to be universally determined, have undergone several changes. However, more recent studies recommend the use of this method in the presence of the following CT findings: active contrast extravasation, splenic vascular injuries, AAST grade III-V injury and large haemoperitoneum. SAE has been successfully performed in institutions with both surgical and angiographic services. Good cooperation between the surgeon and the radiologist is essential. The first needs to supervise the embolisation and be prepared for surgical intervention should SAE fail or rapid clinical deterioration of the patient occur. The availability of these settings and the level of experience of surgeons and radiologists are mostly responsible for the different success rates of SAE among various hospitals. These settings are not available in regional hospitals. Therefore, it is significant to point out the need for well-organised trauma centres[11], with increased availability of ICU facilities and an experienced interventional radiology team in order to provide the best possible treatment to patients with blunt abdominal injuries.

CONCLUSION: The spleen remains one of the most commonly injured organs after trauma and its management has considerably evolved over the last few decades from mandatory operative intervention to the current standard practice of selective non-operative management. In managing splenic trauma, an assessment of the overall clinical picture is clearly more important than any specific aspect of evaluation. From our prospective study, it is concluded that young age group and male patients of rural population are commonly involved in splenic injury in blunt injury to abdomen. Common modes of injuries are RTA and patients usually present with pain in abdomen. On initial clinical examination, if patients have tachycardia, hypotension, tachypnoea, guarding, rigidity and respiratory distress, then it indicates severe splenic injury and high probability for operative intervention, and associated injury on x-ray (chest and FPA) also indicates underlying severe splenic injury.[12] USG abdomen is initial investigation of choice, then CT scan abdomen is best investigation to grade the injury. Higher grades (III, IV, V) on CT scan increase probability for operative intervention and associated morbidity and hospital stay in comparison to lower grade (I, II).

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